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Міністерство освіти і науки України
Одеський державний екологічний університет

МЕТОДИЧНІ ВКАЗІВКИ З АНГЛІЙСЬКОЇ МОВИ

ДЛЯ СТУДЕНТІВ IV ТА V КУРСУ

Рівень підготовки – Магістр
Напрям підготовки – "Комп'ютерні Науки"
(VIII - IX СЕМЕСТР)

Одеса - 2006

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Методичні вказівки призначені для підготовки студентів магістерського рівня навчання за напрямом підготовки "Комп'ютерні Науки" у VIII та IX семестрах.

В результаті вивчення дисципліни "Іноземна мова професійного спілкування", яке у VIII та IX семестрах розраховано на 124 години; з них 62 годин аудиторних занять, 62 години - самостійна робота, майбутній магістр повинен:

знати:

- не менше 400 відібраних лексичних одиниць необхідних для ділового спілкування;
- граматичні явища в об'ємі навчального мінімуму для вміння вести ділову бесіду, для читання, перекладу фахової літератури;
- відібраний мінімум засобів формування потенційного словникового запасу (афіксація, конверсія, словоскладення, інтернаціональна лексика);

вміти:

- читати та перекладати з словником оригінальну літературу за фахом з метою отримання потрібної інформації;
- брати участь в усному спілкуванні іноземною мовою в ділової та професійній сферах.

Module 1

Text 1.1 Audit of Computer Systems

Ever since the earliest commercial punched card systems the *audit trail* has been in danger and auditors, both internal and external, have come to feel that much of their job lies in defending the trail from the possible ravages of *systems, analysts* and *programmers*. The difficulty arises in ensuring that good intention about liaison do not deteriorate into the sudden realization that *source document* can no longer be traced through to its final home in the company's financial statement.

The first step is usually to ensure that no *systems definition* may be passed for *programming* or implementation until it has been formally approved by both internal and external auditors. (Systems definitions usually have to be signed off by other authorities such as the user departments, operating authority etc., and the formal addition of the auditors to this cycle presents no problems.) Approval must also, of course, be given to any amendments to the system that are made later, and although it can be a tedious business getting approval for every small amendment to a new system, anarchy will prevail if this is not made a firm rule

Even the regular approval of new systems is not the whole answer to ensuring that oversight or over-sophistication do not destroy the audit trail: anyone, who has been given a three-inch thick systems definition and asked to approve it will appreciate that a prior knowledge of the design and workings of the system is invaluable in checking a definition for flaws. Auditors can acquire this by being present regularly at the design stage of a new system, and many companies now make it a rule that representatives of the auditors discuss new systems with analysts on a once-a-week basis. This ensures at least that the completed definition is not entirely new ground, and also allows the auditor to suggest amendments to the system before such amendments involve a laborious rewriting and re-drawing of a large part of the definition.

Having made sure that a new system has adequate controls and that the audit trail is satisfactory, the auditor now needs to consider methods of ensuring that the systems he has approved are the systems which are in fact operating. The main check here will be on the *programs*, and it is usual for auditors to maintain a secure copy of each program (perhaps in a fire-proof locked cabinet) and to compare, these programs on a regular basis with those which are actually being used. The auditor must also constantly satisfy himself that adequate disciplines are being maintained in all the data, processing areas - programming, *data preparation, work assembly*, operating and control - and his best chance of making sure that the disciplines he watches are indeed adequate is to ask for written standards of procedure against which he can check actual procedure.

So far we have outlined only an extra burden for the auditor, but computer systems can also be of great benefit to him and the more familiar an auditor is with computers the more readily he will call for special audit programs. Such programs might select particular transactions for a manual audit, either on a random basis or on an exception rating, i.e., all transactions which exceed a certain norm; or information obtained by audit staff at remote centres can be processed and compared with *master record*, saving audit time and increasing its breadth of operation. Again, details of transactions can be refrained and analysed in ways designed by, the auditor, perhaps as part of the regular system so that special audit runs are made at the end of each job.

The computer can be a great help to an auditor, but it is clear that this is possible only

when the auditor is to some extent familiar with the abilities - and requirements - of a computer. Regular discussion with the data processing personnel should, give him this familiarity, and a once-a-week check on the design of new systems is perhaps the most satisfactory way of achieving this.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 1.2 Budgetary Control

Budgetary control is a system used by management in which targets (budgets) are set and actual performance compared with them. The purpose is to establish where, how and why actual results are diverging from the budget and what action is needed to achieve the budget. Computers are often used for recording and reporting the information required in a budgetary control system (for example, on *spreadsheets* on personal computers), and a brief summary is therefore given here.

The main steps in operating a budgetary control system are: (i) The objectives of the organization and their relative importance are determined. For example, the importance of volume of orders as against profit from orders might be decided. In a normal trading business the key budgets are, orders, revenue, production, manpower, capital expenditure, cash flow, profit and return on capital employed (ii) A total budget is drawn up which would result in the achievement of the objectives. Certain of the resources available may be insufficient to attain the budget. Perhaps skilled labour is limited; or money. It is then clear that some definite action is needed to make the budget achievable. Perhaps a training programme needs to be set up; or financing arrangements made. This stage stimulates forward planning. (iii) The detailed budgets are set and each manager should be involved so that he fully accepts his own budget. Budgets should only include those items for which a manager has been given authority. (iv) Many of the individual budgets are interdependent and therefore have to be compatible so that the total budget is a realistic whole. For example, the sales manager's budget for revenue is dependent upon the production manager producing enough goods and at the right times. (v) There should now be a reliable total budget built up from the individual budgets to which each manager is committed. (vi) The actual results are recorded in the same form as the budget, compared with it and variances from the budget established. (vii) The causes of variances are analysed and reported to the appropriate levels of management. Each manager has to explain his variance and either to justify it or take action to remedy it.

The frequency of reporting will differ according to need and to the ability to take immediate action; e.g., cash may be reported daily whereas manpower may be monthly.

Attention is concentrated on the exceptions from the required results.

Budgets may be set for any length of time but if taken too far ahead become less reliable. They are often set annually, and should not be revised too frequently because there is then a danger of their becoming forecasts of expectations rather than targets for achievement.

Budgets may be fixed amount or flexible according to level of activity; e.g., a salesman's budget for entertainment may be a fixed sum or a percentage on orders taken, i.e., flexible. Flexible budgets are more complex but often give more useful information than fixed budgets.

The advantages of the system are that it provides: (i) definition of objectives, (ii)

anticipation and planning; (iii) personal involvement of all levels of management; (iv) delegation of controllable items; (v) coordination of activities; (vi) concentration on exceptions; (vii) a basis for corrective action.

Budgetary control encourages management to anticipate as well as concentrating attention on those results which are deviating from the budget. Both of these effects are vital pillars in the structure of management control.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 1.3 Character Recognition

Human beings axe taught to recognize patterns from an early age. In the first year of life baby can be induced to make more or less consistent vocal responses to pictures, for example saying 'dog' whenever it is shown a picture of one. Later, children are taught to identify letters and number and subsequently to read and perform arithmetic. When children grow up some of them may spend their lives manipulating letters and numbers, recognizing patterns quite automatically. The ideal *data* processing system is one in which data is captured at source and processed as soon as possible, and it would therefore be very desirable for machines to recognize symbols and numbers directly in the same formats as those used by human beings in their everyday social and commercial activities.

At present the patterns that most computers can recognize are not conveniently read by human beings. Similarly, data originating from people is not usually input directly into the compute. Data handling, therefore, is typified by a conversion process from •human* format to computer format.

The objective here is to enable the computer to read source documents directly. The problem of converting a pattern on an input document into electronic signal suitable for processing by a computer is one of pattern recognition. It is necessary to strike a balance between a pattern convenient for people to read and one that is convenient for the computer. There are two main systems for automatically recognizing printed characters: optical character recognition *(OCR)* and magnetic ink character *recognition (MICR).* In the former, characters are printed in conventional type formats or *as bar codes,* usually in black ink on a white surface, and the characters scanned by measuring their optical reflectivity when subject to illumination. In MICR systems however, characters are printed in a stylized format using an ink impregnated with magnatizable particles. When MICR documents are the ink is magnetized before the characters are presented to a read hear. The output signal generated are governed by the magnetized particles

passing the head and for any character are propotional to the vertical projection of the character. Mark reading is also a form of character recognition and it is common to find mark reading and optical character recognition used within the, subsystem. Despite the fundamental differences in these systems, the equipment utilized in each case contains similar types of unit. There is always a scanner, which reads characters and converts them into electronic signals, and this unit is associated with a normalizing unit, which examines each signal to improve its quality without changing its basic characteristics. The signal thus generated is then examined to determine the bask properties of the character and a decision mechanism is

used to analyse these properties and identify the character concerned. If the decision mechanism is unable to identify the character unambiguously then the character, is rejected.

The ability of machines to recognize characters printed in a format easily recognizable to human beings has great advantages in reducing the task of ***data collection*** and thereby speeding up the flow of data in a system. Costs *for data preparation* can be considerably reduced and improvements in accuracy can other be achieved as compared with more conventional, methods.

The development of character recognition systems has taken place in many different organizations and led to a wide number of special type founts being developed. As improvements have been made in techniques of character recognition some degree of standardization has been evident but there are still many differing founts in use. In the field of MICR there has tended to be less variation and two founts, known as E13B and CMC7, are more or less accepted as standard on an international basis. In OCR systems there are more variations although the International Standards Organization has proposed two standard founts known as OCR'A' and OCR'B'.

In some respects there appears to be less flexibility in MICR founts than in OCR. The MICR system requires that characters should be printed in a highly stylized format and with a high degree of accuracy, but this system of recognition relies on the magnetized particles forming each character and is not therefore so vulnerable as OCR systems are when handling damaged and folded documents, or with documents that have been soiled or have overwritten characters. OCR systems require less stylized formats and the characters can often be printed by the use of conventional machines such as typewriters; this aspect allows for cheapness and flexibility in establishing data collection points. In both systems characters to be read must be printed in certain specified areas of the documents with a fairly high standard of print registration.

MICR has been used for cheques in banking throughout the world. MICR sorter/readers are used to sort automatically the cheques in clearing houses for distribution to various branches, the cheques being preprinted with a branch code. The cheque number and customer's account number are also preprinted, and at a later stage the amount of the transaction can be added using an MICR *encoder*. Details from such cheques can be read automatically into a computer *memory* to update subscribers' accounts.

OCR documents have been used as *turn-around documents* in hire-purchase accounting and similar applications, each customer being issued with a book of vouchers preprinted with the amount due for each payment in the hire contract. In some credit card *applications* customers are given a plastic ticket which is embossed with their own account number; this card has to be presented at point of sale to act as a plate in printing a record of the transaction. The record is then used to provide automatic input to OCR equipment.

OCR equipment is often used in gas and electricity accounting; a common system is to combine mark reading and character recognition techniques to enable meter reading staff to input details of consumption from turn-around documents, the actual consumption figures being entered as marks on preprinted areas of the forms. Bar codes are, of course, familiar on most packages of consumable items.

Character recognition techniques are used with great advantage where large numbers of transactions in a fairly regular format are involved. They are best suited to applications where only a limited number of variable characters have to be entered, and in this context provide a speedy and accurate method for recording data.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 1.4 Communication Devices

The collection of data from remote locations for centralized processing has long been necessary in both business and scientific organizations. This need has increased as more powerful and expensive computer systems have been installed and as applications based on centralized *on-line* files have been developed. This process has led to the development of many types of communications device to suit the varying needs of users in terms of the volume and speed of transmission required.

In the earlier stages of the development of data transmission there was a tendency to use existing forms of equipment to transmit data, for example, the teleprinter and associated *paper tape* machines were used to transmit data over conventional telegraph circuits. Such a system usually required that data was prepared and input as paper tape at one terminal, and was transmitted to a central location where a duplicate tape was punched automatically to be taken by hand to a *paper tape reader* for loading into the computer. This type of system had many disadvantages: the speed of transmission was only about 50 *bits* per second, the handling of paper tape at the sending and receiving terminals limited the system to *batch processing* applications and introduced time delays which were unacceptable for many systems, and the lack of inbuilt error detection and correction facilities was a severe restraint - a single bit transposed could generate very significant errors in subsequent processing.

To deal with these problems equipment was developed to meet the following needs: (i) to allow for the capture of original data by automatic *data collection* techniques to distant stations; (ii) to transmit the data automatically at high speed to a central computer; (iii) to check all transmissions to detect and automatically reject or correct transmission errors; (iv) to accept data at the central location and to present it directly to the computer for processing, e.g., against *files* maintained there, if necessary using a *multiplexor* to enable the central computer to control perhaps a hundred or more *communication channels*; (v) to enable the central computer to prepare data for transmission back to the terminal; and (vi) to enable data to be displayed or recorded at the distant terminal.

Of course not every system requires all these needs to be satisfied: some systems may control only a few communication channels, some or all of which may be required to operate in batch processing mode only; and again volumes may be such that a fairly low speed of transmission may be suitable in some off-peak period.

In straightforward data collection systems terminals such as *badge readers, keyboard* machines, *direct data entry* terminals and videotex terminals may be available at distant locations. These units can be connected to a communication channel by special transmission units designed to *interface* the appropriate data collection device to the particular channel used.

In remote inquiry systems the remote stations will also include output devices such as page *printers, visual display units, intelligent terminals*, videotex terminals, etc. Thus an inquiry transmitted to the central computer can be processed and a reply is automatically transferred back to the terminal. (Airline reservation systems provide an example of this.) In inquiry systems the distant terminals are connected to their communication channels by

transmit/receive data terminal units.

In large organizations a data processing capability may be required at several decentralized locations, even though a large degree of centralized data processing is maintained. Depending upon the volume of traffic and the type of application, such a situation could give rise to high speed links directly from one computer to another, or more conventional transmission techniques, e.g., from *magnetic tape* at one terminal to magnetic tape at another.

At the centralized location the computer can simply accept input in the form of some input medium such as magnetic tape or paper tape, but this type of input would not be suitable for *real time* inquiry applications, and instead some form of high speed link might be required. Here a special transmission control unit, perhaps incorporating a *multiplexing* facility, is used to connect the computer to the various communication circuits. Such systems often require very complex *software/hardware* facilities to accept and transmit data to and from a large number of channels on a *time-sharing* basis.

In order to achieve the advances listed above there has been a considerable development in data transmission techniques, improving both the speed of transmission and the facilities for error detection and correction.

The limitations of distortion and attenuation in circuits, particularly over long distances, make for slow transmission speeds by conventional telegraph methods. However by transmitting a modulated carrier wave much higher speeds can be obtained depending upon the quality (e.g., band width) of the transmission circuit used.

Error detection and correction techniques rely for the most part upon the use of a *redundancy code*. For example, *parity* checks may be applied to each *character* at the receiving terminal. Another method, known sometimes as a *loop check*, requires data to be transmitted in blocks, which when received are sent back to the transmitting terminal via a special return circuit for comparison with the data originally transmitted. If a transfer is incorrect the block is then retransmitted until a 'correct' transfer is signalled. Using re-transmission techniques an error rate better than a single error in 10^7 characters can be achieved.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Exercises

Exercise 1.1

Complete the sentences below with one of the following verbs plus a preposition. Remember to use the correct form of the verb.

apologize arrive belong complain correspond die distinguish experiment fill ~~hear~~ knock lose pray rhyme suffer vote

1 Did you *hear about* Tom and Sally? They've decided to emigrate to New Zealand.
2 It was almost midnight when we_____ the station.
3 Do you know who this book_____?
4 I taking so long to reply to your letter.

5 Could you_____this form, please?
6 If you don't agree with the proposal, you can always_____ it at the meeting.
7 Some people find it difficult to_____an American accent and a Canadian accent.
8 He_____the manager about the poor service at the restaurant.
9 Would you say that the British House of Lords_____the American Senate?
10 I think there's someone_____the door.
11 Can you think of a word that_____'sing'? Yes, 'bring'.
12 Do you think scientists should be allowed to_____animals?
13 The priest said he would_____us.
14 For years, her husband had_____migraines.
15 I don't know why, but I really hate_____cards. It puts me in a bad mood all day.
16 Although he had survived the battle, the soldier later_____

Exercise 1.2

A Put the adjectives in the correct places and in the right order in the following sentences. There is an example at the beginning (0).

0 She bought a handbag in the sale. (leather, brown)
She brought a brown leather handbag in the sale.

1 He bought a bunch of roses. (yellow, sweet-smelling)
2 The nextdoor neighbour's cat has soft fur. (grey, lovely)
3 The hotel was owned by a businessman. (tall, German, middle-aged)
4 They lived in a house. (three-bedroomed, semi-detached, brand new)
5 My brother loves sports cars. (red, Italian, fast)
6 In the middle of the room was a coffee table. (oval, superb, oak)
7 Where did you get this vase from? (old, magnificent, Japanese)
8 I love meals. (tasty, hot, Indian)
9 He was wearing a jacket. (shabby, cream, old, linen)
10 Outside the Town Hall was a statue. (marble, huge, triangular, black)

B Put the adverbs in the best places in the following sentences. There is an example at the beginning

0 We have a lie-in on Sunday morning. (usually)
We usually have a lie-in on Sunday morning.

1 The children go riding on Saturdays. (sometimes)
2 I was pretending. I wouldn't have chopped your finger off! (only, really)
3 Carol's daughter plays the violin. (beautifully)
4 My brother finishes work on Fridays. (nearly always, early)
5 I don't go to the theatre. My sister, on the other hand, goes. (often, regularly)
6 I don't understand why Joanna didn't want to come to my party. (still)
7 George hasn't done much work so he'll fail the exam. (probably)
8 I disagree with you! Watching football live is better than watching it on TV. (completely, definitely)
9 'Where's Rose?' 'She's gone home.' (just)
10 'Is my omelette ready? (yet) 'No, dear, I'm waiting for the hen to lay the eggs!' (still)

Exercse 1.3

Complete the interview questions with words from the list.

achievement approach get good know learn
like look for motivates offer plan sort
strengths ~~tell~~ weaknesses work

1 _____*Tell*_____ me about yourself.
2 Why should we_____you the job?
3 What is your major_____?
4 What are you_____at?
5 What_____of person are you?
6 What are your_____and_____?
7 What do you_____about our organization?
8 How would you_____this job?
9 How do you_____things done?
10 What do you_____in a manager?
11 What_____you?
12 Do you like to_____in a team or on your own?
13 What do you_____best about your current job?
14 What did you_____in your last job?
15 How long would you_____to stay with this company?

Module 2

Text 2.1 Critical Path Method (CPM)

This is a technique used in planning, scheduling and controlling major industrial, technical or commercial projects. An alternative term for CPM is PERT *(Project Evaluation and Review Technique)*. Originally slightly different in concept, the two terms are now interchangeable, and both are referred to as *network planning*. CPM is useful in conjunction with projects which require the combination of varying amounts of different resources at different times and which involve a large number of interrelated events and activities.

The first stage in planning a project using CPM techniques is the drawing up of a network, a special type of chart made up of circles and arrows. Each circle represents an *event*, i.e., something that happens at a particular point in time. The circles are joined up by arrows which represent *activities*, i.e., jobs of work that are spread over a period of time. An event cannot occur until all the activities leading up to it have taken place.

A network will always start with an event, for example 'Authorization of Project', and will always end with one, for example 'Product Launched'. In between the first and last events there will be a number of intermediate events, each preceded and followed by one or more activities. Thus any intermediate event will be dependent on the completion of certain activities and will itself control the start date of later activities.

Each activity on a network is given a time estimate which represents the time that activity is expected to take. A common convention for networks is that time flows from left to right. Each event is given a number, later events having a higher number than earlier events. It is not necessary to number events in sequence however, and gaps in sequence are often left to facilitate later insertions on a network.

Sometimes it is not possible to give an accurate estimate of the likely duration of

activities. In these circumstances it is usual to specify three time estimates; optimistic, pessimistic and most likely. Another peculiarity of activities is that no actual work need be done in the time allotted to them. Awaiting delivery of a component is an example of this sort of activity. It is also possible for an activity to take up no time at all. Although this appears to be a negation of common sense, activities of zero duration are a convention used to simplify the drawing of networks. Activities which require no resources and/or no time are known as dummy activities.

The drawing up of a network is a useful discipline because it causes the designer to consider the interrelationship between the various activities. The real value of a network, however, lies in the use that can be made of it in scheduling and controlling projects. First of all it is possible to process a network in order to establish how long the project is likely to take from start to finish. This is known as isolating the critical path.

The critical path of a network is determined by considering each event in turn and calculating the earliest possible time at which the event can occur. If an event depends on several activities the earliest time is determined by the activity which takes longest to finish. Thus the critical path is the sequence of interconnected events and activities which will require the longest time to accomplish. The sum of all the time estimates of the activities on the critical path will be the shortest time in which a project can be completed.

The characteristic of events and activities on a critical path is that if any of the time estimates are not met, the completion date of the project will be affected. Conversely time estimates not on the critical path can change (within limits) without affecting the overall completion date. The degree to which a time estimate is free to change is known as the degree *of float*. The total float of any activity is the maximum time that can possibly be made available for its completion minus the duration of the activity. Any expansion or movement in an activity in excess of its total float will change the critical path and increase the overall project time. Deliberate use can be made of knowledge of float times in order to divert resources from non-critical activities and concentrate them on activities on the critical path. It should be stressed that the critical path in a network can never possess float.

Critical path techniques enable a project to be controlled as well as scheduled. Control will obviously need to be tightest for events which lie on the critical path. The technique used is to insert actual performance times on the network, which is then re-analysed to see the effects of the work done. This will enable management to take action on anything which is likely to jeopardize the future progress of the project. It is evident that any slipping on a critical activity will delay completion of the project. To correct this, it may be possible to transfer resources from non-critical activities.

Critical path analysis is usually thought to be a technique associated with electronic computers. This need not necessarily be the case, but when a project involves more than a few hundred activities, or any additional operation apart from simple scheduling is required, it is probably essential to use a computer in order to cope with the volume of calculation. Most computer manufacturers offer CPM or PERT packages as part of their standard *software*, and these programs can be run either on the user's own computer or by computer bureaux which sell computer time. As well as the analysis of the critical path, the computer can also handle problems associated with re-allocation of resources, and the effect of resource *allocation* can be immediately tested by *simulation*.

The main features of a computer CPM or PERT system may be summarized as follows:

(a) The handling of events and activities and their changing values.

(b) The ability to interrelate networks of different levels.

(c) The ability to accept progress data and to produce progress reports.

(d) The ability to determine the critical path through a network.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 2.2 Data Preparation

Computers can process information with virtually unerring accuracy, but if a computer is presented with inaccurate information to process, the result produced will be useless. Great care must be given to the systems and procedures concerned with the preparation of data, and the way in which this data is loaded into a computer.

The data to be processed may be generated in a number of different forms- it could, in an order processing system for example, arise from a telephone conversation in which a customer identifies himself giving name, address, items ordered, quantities, credit card number and delivery address. It is easy to imagine the difficulty and confusion which could arise if errors were made in the transcription of this data: for example, goods could be delivered to the wrong address; the wrong goods could be sent to the right address; or the charge could be made to the wrong customer's account. Instead of increasing efficiency, the computer could simply be creating confusion at a very fast rate. Data preparation systems are therefore designed to: avoid errors in transcription of data from one medium to another; verify that data items are consistent with information stored in existing computer files; and then check the consistency of information within *data elements* and the relationship between data elements in the input data itself.

In the early days of computing, data was prepared for input to the computer on *punched cards* or *paper tape*. This often meant that transactions recorded on forms or documents had to be read, *field* by field, by a *key punch* operator who punched relevant items on a keypad which caused a mechanical punching unit to be activated to punch holes into a card or a paper tape. This process had several potential sources of error: the original document might be illegible: the punch unit itself might fail or create errors; or the operator might depress incorrect keys on occasions. To overcome these problems the whole process was usually carried out twice - once by the original key punch operator, and secondly by another operator using a *verifier*. A verifier was a machine purposely designed to compare the position and significance of holes in a card or tape with key depressions made by the verifying operator. When there was a discrepancy, the verifying machine was halted and the verifying operator was obliged to re-examine the original document and decide on the correct character. Very high degrees of accuracy could be obtained by such methods, but it required an extensive degree of manual labour to create such input, and significant delays, sometimes days or weeks, could arise before data could be organized and entered into a central computer.

To speed up this process, data entry and verification machines were designed to record data directly on to a medium such as *magnetic tape* or *magnetic disks*. These machines were known as *key-to-disk* or *key-to-tape* systems. The basic operation was still the same: an initial input operation, and a second verification stage. Magnetic media could be handled more quickly and efficiently than cards or paper tape, but systems were still essentially delayed by the need to batch data and go through the basic stages: collection and batching of source documents; initial keying of input; second stage verification and correction of input; and loading into the computer. Great benefits were to be obtained by cutting down this cycle and, if possible, by capturing transactions at the point and time of their occurrence.

Today many computers operate *on-line*, with the Users inputting directly into the computer using a *terminal*. This greatly speeds up the efficiency and avoids the delays inherent in the batch preparation process described above. However, it will be appreciated that errors can be created in this on-line process. To avoid getting rubbish into the system, a combination of manual as well as automatic computer procedures can be applied. When data is entered, checks are imposed upon all fields which are keys and which control the entry of data on to files, e.g., customer numbers, item numbers, personnel numbers.

A name and address file is never maintained simply by name. Names can easily be confused even if qualifying initials are used. Each customer is given an account number in which some part of the number consists of a self-checking code. When the entire number is entered, the computer automatically performs a calculation to determine whether the number is a valid one. If the number is invalid, the user is prevented from entering further details of the transaction.

The system known as Modulo 11 provides an example of a self-checking system: a unique code is obtained by performing a calculation upon a number to derive a remainder, which is then appended to the number for use in data processing operations. For example, the number 14710 has a remainder of 3 attached to become 147103. To check the validity of this number, the computer detaches the remainder and multiplies each digit by a statistically selected weighting factor as follows:

Digit		Weight		Result
1	X	1	=	1
4	X	2	=	8
7	X	5	=	35
1	X	3	=	3
0	X	6	=	0
				47

The total is divided by 11 to give a remainder of 3. Such check-sums will expose transcription errors in keys, but other checks are needed: for example, numeric fields must not contain non-numeric codes; numeric fields may have to fill in a defined range of values; and comparisons of descriptive data already stored in computer files can be made against details given by the user. A series of such checks will, when combined, greatly reduce the probability of errors in data preparation.

Other methods are in use to reduce data preparation costs and input errors. Some of these methods are intended to capture data automatically by greatly reducing or even eliminating the use of keystrokes to capture data. For example, in retail operations, transactions can be captured by having magnetic recording devices attached to cash registers so that data can be transmitted on-line to a central computer at frequent intervals. Point-of-sale machines also exist which can read bar codes imprinted on goods so that movements to or from stock are captured automatically. These techniques capture data as a by-product of an everyday operation using methods which entail little special consideration by the person performing the operation.

The development of techniques for the automatic recognition of preprinted characters by machines has led to some improved concepts in data collection. These techniques are described in more detail under the heading *character recognition*, but some details are given here. The essential principle involved is that the original transaction document is used as input to the computer system. Machines are available which can read documents bearing either magnetized-ink characters or special characters for *optical recognition*; these machines can be connected directly to a *central processor* to facilitate the automatic transcription of the data

from the documents on to a storage medium such as a *magnetic disk*. These techniques are suitable for many applications involving large volumes of data to a fairly standard format; for example the use of magnetized-ink characters on bank cheques. They are particularly suitable where *turn-around documents* can be used and where the details to be entered for each transaction involve relatively few items of data. Gas, electricity and hire purchase accounting are examples.

The development of *real time* data processing applications requires data collection devices to be held permanently *on line* to the central processor via some form of data transmission or *in-plant* communications network. Here *interrogating typewriters, cathode ray tube visual display units, key-to-disk* units and other keyboard input devices come to prominence. The data preparation limitations can be virtually eliminated as far as the recording of transactions is concerned, and the system can be designed to respond immediately to each transaction as it arises.

In all forms of data preparation it is usually preferable to allow the computer to perform a range of validity checks on every item of data as it is transcribed from the input medium. In this way it is possible to ensure that each record entering the system conforms to a prescribed pattern in the number and type of characters in specified fields, and in the logical relationship between fields for certain transaction types. These types of check are even more important in real time applications.

In *batch-processing* applications it is also necessary to maintain *control totals* throughout the stages of preparation and transcription to ensure that individual transactions or complete batches are not lost.

Generally, all data preparation is concerned with accuracy of transcription or transmission, and the eventual integrity of data depends very largely on this initial accuracy.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 2.3 Data Processing Standards

There are probably no data processing managers who do not readily accept the need for standard procedures in their departments, but there are far too many who will ruefully admit that many of their present difficulties are directly attributable to the fact that, in the early stages, getting on with the job seemed more important than writing Out standards and since that time they have been too busy extricating themselves from the troubles this caused to do anything about it. It cannot be stressed too strongly that the most important thing about any data processing standard is that it shall exist; so long as there *is* a standard it doesn't matter too much if it is the best or not. Standards should embrace the activities of systems analysis, programming, operating and clerical procedures, and in general serve the following functions. (i) Communication: a successful data processing installation depends so much on successful communication (from systems analyst to programmer and to operating staff, for example, and between data processing staff and user departments) that a standard form of presentation and terminology helps to prevent ambiguity. Standard forms *of documentation* will also help to ensure that documents are complete and that necessary steps in, for example, *systems design* have been taken. Later, when modification of the system becomes necessary, standard

documentation will allow easy access to the relevant section. (ii)Control: performance of specialist functions such as systems analysis and programming requires to be carefully controlled, and standards of work and method ensure that work reaches a prescribed quality and allows management to assess progress against timetables. It is also helpful to be able to assign clear responsibilities to staff. (iii) Continuity: if all work is prepared to a given standard, prepared by a standard method and documented in a standard way, then the bugbear of complete dependence on individuals is avoided. Sometimes complete systems have been thrown overboard because, when the time came to amend them, it was found that the original designer had left and no one could make head or tail of the notes be had left behind. Further notes are given in the general articles on *Documentation.*

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 2.4 Debugging

Debugging is the technique of detecting, diagnosing and correcting errors (also known as bugs) which may occur in *programs* or systems (both *hardware* and *software).*

The two main types of program error that can occur are logic errors and syntax errors. The former are the result of incorrect appreciation of the problem, and the latter the result of incorrect *coding* of the program. An example of an error in logic would be the attempt to calculate average speed by dividing fuel consumption by time taken, instead of distance travelled by time taken. The calculation would be performed correctly by program, but the result would be incorrect. An example of a syntax error would be writing the *instruction* DO V TIME, DI ST where DIV, referring to the operation 'divide', should have been written instead of DOV, which is meaningless and would not be operated on by the computer.

Errors are detected by observing that programs do not produce the results expected from them, or by the failure of a program written in a *symbolic language* to *compile* correctly. Detecting errors by means of observing results involves testing programs with samples of data which the program would expect to be presented with in normal running. The nature of this data would be predetermined and the results expected from the program calculated by the programmer or systems analyst concerned, and compared with the actual results obtained. Test data of this sort is presented to the program either directly in the form expected in normal running, or by means of simulated input conditions, for example, by storing data with the program and altering the data input instructions to *access* the data directly from *store* rather than from an *input device.* As well as testing programs by means of *test data,* testing of all conditions expected in normal running must also be carried out, for example, all conditions causing a program to print messages requiring operator action, such as loading paper on a *printer,* must be simulated. Any failure of a program to achieve expected results, or any unexpected halt occurring within a program, will require error diagnosis, as described below.

Programs written in a symbolic language require *compilation,* or translation into the *machine language* understood by the processor. The process of compilation enables syntax errors involving incorrect handling of the symbolic language to be detected. Most compilers reject incorrectly used statements, and print some indication of the type of error. However, errors in logic cannot usually be detected by compilers: any correctly formed statement will

be translated, even if the instruction will cause the program to carry out an illogical function or perform a calculation incorrectly.

Once an error has been detected, either through incorrect results from test data or simulated operating conditions, or through an unexpected halt, or through compilation errors, the cause of the error must be diagnosed. Various methods of error diagnosis may be used. A *dry run* may be performed on the program *flowchart* or compilation listing. This involves the programmer in performing each step of the program as if he were the computer, checking and recording the action of each instruction or flowchart step. Instead of performing the computer's actions himself, the programmer may use a trace or diagnostic routine which performs the program on the computer in the normal way, but at the same time provides a printed record of the action taken by each instruction. Simpler versions of such a routine provide printed information about selected types of instruction. Other aids to diagnosing the causes of errors include prints of portions of internal store at various stages during the operation of a program, enabling the programmer to check the progress of the program. Prints may also be obtained of the contents of *backing store*, e.g., *magnetic disks*.

Errors of syntax detected by compilers are usually recorded by the compiler, and the type of error identified. Normally programs which have caused compilation errors cannot be run, and the errors must be corrected before the program can be tested.

Once the cause of an error has been detected, a correction must be applied to the program. Correcting source codes may be done directly by removing incorrect *statements* and substituting correct ones by using source code maintenance routines. Another technique for correcting programs is to apply a *patch*. This consists of deleting the incorrect instruction and substituting a *branch* to a section of coding correcting the error. Corrections may also be applied to a program at *run* time by directly altering the program after it has been loaded into store. However in most cases the best method of correcting errors is by amending incorrect coding at source, at the same time ensuring that all documentation supporting the program is kept up to date.

Debugging is not confined solely to programs. The term is also applied to the process of testing the performance of hardware systems, and also to the testing of a complete data processing system. In the latter case the system may be tested for flaws by means *of pilot systems* or *parallel runs*.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Exercises

Exercise 2.1

Complete the sentences below with one of the following verbs plus a preposition. Remember to use the correct form of the verb.

account accuse book count deal grumble insist refrain surround specialize taste ~~translate~~

1 The Hotel's fire regulations have been ***translated into*** eighteen languages.
2 As it was getting late, we decided to _____ the nearest hotel.

3 'My coffee_____garlic!' 'You're lucky, mine has no taste at all.'
4 I was_____cheating in the examination, just because I had made a few notes on the back of my hand.
5 If there are any personnel problems in the factory, the boss always asks her deputy to _____them.
6 The English_____the weather, but secretly they don't mind their climate because they love complaining.
7 'Why am I_____idiots?' 'We don't know, Dad.'
8 The teacher_____calling me 'Ghengis', even though my real name is 'Attila'.
9 Michael trained as a psychiatrist and he now_____mental disorders of the very rich.
10 Sylvia is always ready to help people: you can_____her to help out in a crisis.
11 Scientists are unable to_____the hole in the ozone layer, although some people believe that aerosols are to blame.
12 'Passengers are kindly requested to_____smoking.' (airline announcement)

Exercise 2.2

A There is a wrong word in each of the following sentences. Replace with the correct word. There is an example at the beginning (0).

0 George and (me) would like to invite you to our going-away party. ___I___
1 Anybody knows what happened to the Marie Celeste. It's a complete mystery._____
2 I have few time to spare before my flight leaves; let's go and have a coffee._____
3 My three cousins passed the entrance examination. Both of them are at university now._____
4 As a child, I used to being on my own a lot._____
5 There are less birds about than there were when I was young.
6 The twins passed the entrance examination. All of them are at university now._____
7 My parents played the piano, but none of them could read music.
8 You won't find many money in my purse!_____
9 After picking a bunch of grapes, I ate few and put the rest in a basket._____
10 The birthday card was signed 'With love from George and I'._____
11 As a child, I was used to be on my own a lot._____
12 All of us played the piano, but neither of us could read music.
13 You won't find much pound coins in my purse!_____
14 I have any time to spare for such nonsense; I am far too busy.
15 Nobody can tell you where Big Ben is. It's easy to find._____

B The underlined word(s) are wrong. Replace with the correct word or words. There is an example at the beginning (0).
0 The relationship between a dog and it's owner can be very close. *its*
16 I won't tell you my problems; you've got enough problems of yours._____
17 I wonder whose playing this weekend?_____
18 I've got enough problems, I don't need to listen to your own.
19 I wonder who's pen this is._____
20 Go to the shop and get me a matchbox; I want to set fire to the Town Hall._____
21 A fox would not make a good pet because its wild and difficult to control._____

Exercise 2.3

Marcia Garcia tells us about her educational background. Complete each sentence with one of the words or phrases from the box below. You will need to put the verbs into the right tense. (You can then make similar sentences about your own education and qualifications - academic and professional.)

apply degree graduate (verb) grant higher degree
job option PhD place ~~primary school~~ thesis secondary school stay on
study subject

1 I started at ***primary school*** in London when I was five.
2 At the age of 11, I went on to _____, also in London.
3 At 17, I _____ to university.
4 I got a _____ at Manchester to _____ Engineering.
5 But at the end of the first year I changed to another _____.
6 I _____ from university in 1997.
7 I have a first-class _____ in Economics.
8 I decided to _____ at university.
9 So I did a _____ in Business Administration at the University of California.
10 During the course, I did an _____ on small business development.
11 I found the topic so interesting that I applied for a _____ to do a doctorate on the same subject.
12 Once I had got the money, I had to write a 50,000-word _____.
13 So now I have a BA, an MBA and a _____.
14 All I need now is a _____!

Module 3

Text 3.1 Discounted Cash Flow

Discounted cash flow (DCF) is a method for the financial analysis of capital projects. This name for the technique tends to be particularly applied to capital projects but the principle is essentially the same as underlies the calculation of redemption yields on gilt-edged stocks and the actuarial valuation of pension and life assurance funds.

The data required for DCF calculations are estimates of the amount and timing of all the various cash inflows and outflows associated with the project throughout its estimated life (not forgetting investment grants, tax charges and tax reliefs which the project will generate). No differentiation is made between capital and revenue items and no attention is paid to accounting artifices such as book depreciation or book profit. There are two main ways of applying DCF techniques to such data. In one version the operator, at a standard predetermined rate of interest, discounts each item of inflow and outflow to produce the equivalent flow at a convenient standard datum point of time such as the date at which the first sum of money is to be spent. From the sum of the total discounted values of the inflows, the operator subtracts the sum of the discounted values of the outflows, to obtain the 'net present value' (NPV) of the project. Only if the NPV turns out to be positive will the project earn its keep in the sense that the (varying) amount of cash tied up in it from time to time will be earning more than the rate of interest used for the discounting process.

In the other common version of DCF analysis, the above process is carried out at several rates of interest until, by trial and error and finally interpolating between two adjacent rates, a

rate of interest is found at which the NPV is zero. This rate, known as the DCF yield, is the effective rate being earned on the varying amounts of money invested in the project throughout its life. In general, projects with high yields will be preferred to those with low yields but special considerations apply if one project is more risky than another or if the commission of one project excludes the possibility of carrying out another. In the latter case, the amounts of money invested and the time in which the money is invested at the DCF yield may be more important than that yield itself. It would be foolish to embark on a project yielding 15% for one year on £1,000 if by so doing one were prevented from carrying out another project which would yield 14% per annum for 10 years on £10,000, if alternative uses of money were only expected to earn 10%.

Subject to such special features, one may stipulate, a cut-off rate of DCF yield, and accept or reject projects according to whether or not the DCF yield exceeds this rate. If the rate chosen were the same as the standard rate of interest used in the NPV version, the two variants would produce the same criterion. This assumes, as is generally the case, that the DCF yield is unique; an objection to DCF yield is that if the cash outflows interleave in time with the inflows, instead of falling exclusively after them, it may be possible for there to be either two DCF yield solutions or none. This phenomenon, which rarely occurs in practice, can be avoided by an extension of the method known as the 'extended yield' method.

The cut-off rate of yield, or standard rate of interest for discounting in the NPV version, should be chosen as representing the effective after-tax cost of capital. Ideally this should have regard to how far an individual project can be financed from debt, i.e., relatively cheaply, and how far it must rely on equity capital, either in the form of plough-back earnings or a new equity issue, which is more expensive since equity money has to be obtained in competition with the equity market in general, from which investors expect to receive over the years (by way of dividend and capital appreciation) considerably greater net-of-tax returns than fixed interest investors, to compensate for their added risk. Rates of the order of 8-12% are typically considered appropriate, but the particular company's balance between debt and equity finance and special risk features of the industry or of the project should be taken into account.

With the aid of interest tables, which give the present value of £1 receivable or payable at any future year, for discounting the future cash flows back to the starting date, the various NPVs required for DCF analysis can be easily calculated by hand; alternatively they lend themselves well to computer operation, and this will be preferred where a large number of analyses are required. There has been considerable controversy on the respective merits of the DCF yield and the NPV at a standard rate of interest; if the former is calculated, the production of the latter involves little extra effort (or programming) and there is much to be said for producing both figures as a matter of routine.

A frequent objection to DCF analysis is that it demands forecasts of cash inflows and outflows many years ahead and that these may be in serious error. However, these uncertainties with regard to the future *are* inevitably reflected in the yield which will be obtained in the event, and it is indeed a virtue of the method, rather than a vice, that it focuses attention on the forecasting problem instead of pushing it under the carpet. By contrast, more commonly used methods such as the 'payback period' (under which the amount of profit expected after the investment has been recouped is completely ignored) or the 'accountants' return on capital' (the ratio of average book profit after depreciation to the initial or average capital invested) can give seriously misleading results, in particular because they ignore the increasingly important effect of different types of tax allowance and their timing.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 3.2 Dump and Restart

When a computer run has been terminated at a point earlier than its completion (because of a machine failure, for example) dump and restart techniques ensure that the run can be restarted without the need to go back to the beginning. Various techniques can be used to achieve this, but all conform to a basic pattern: at various points within the programs staking up the run dump points will be present; when the program reaches a dump point, the State of the *memory* and the state of all *peripheral units* is *dumped.* This will involve writing memory onto a suitable peripheral, *e.g., magnetic disk or magnetic tape,* and printing or punching details of the point reached by all peripheral units. Normally the program will continue to run after recording the dump details until it reaches the next dump point, when the new state of the program is dumped. If a program is terminated for any reason - because of machine failure or because the machine is required for other jobs- the operator records the last dump point reached and preserves the dump information reduced at that point. When it is required to restart the program, the memory dump is read into store, returning it to the state it was in when the dump took place. The operator resets the peripheral units to the condition needed by the dump point (for example, replaces magnetic media that must be read again) and the program can be restarted at the point immediately after the test dump point occurring before the stoppage.

Manufacturers or users usually write special dump and restart routines which automatically record and restore the ~~peripheral~~ and ore information. The technique is particularly useful for inclusion in long or complex jobs where much time might be wasted if the whole job ad to be run from the beginning. The selection of suitable dump points at the discretion of *the programmer or systems analyst: these* points may occur at fixed time intervals or at recognized points within a ran, e.g., when it is necessary to change *reels in milti-reel file* working.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 3.3 Dynamic Allocation

A method adopted on *multiprogramming com*puters for assigning *main store and peripheral units* to a *program.* Usually performed under control of an *executive program, and* designed to permit complete flexibility in the *hading* of programs dependent upon the peripherals and storage available at any one time. As each program is compiled a series of statements, sometimes known as the *request slip,* is generated indicating the requirements of the particular program. Before the program is loaded the *executive program* reads the request

slip and ascertains whether the program can be accepted. If it can, the executive program allocates the appropriate peripherals and main storage to the program. The essence of the system is that the *programmer* need not specify the particular peripherals he requires, but only the type of peripheral and thereafter he uses *symbolic names* to address the units in the program. At *run time* the executive program allocates specific units of the desired type to the program. 2. An extension of the allocation system described in 1 above, concerns the assigning of *magnetic tape files* to a program. Here, the programmer specifies, by means of the *header label*, the particular tape files processed by his program. The operator can then load these files on to any of the available *tape decks* at run time. When a program requiem to open a particular file the executive program searches all unallocated decks to find a tape with the appropriate label. When it does so, the deck is allocated to the program.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 3.4 Evaluating a New System

The last step in the design of any new system should always be an attempt to evaluate' it in comparison, with the system it will be replacing, and management should ensure that no new system is implemented until such an evaluation has, been made:, too many systems have been introduced on a wave of enthusiasm and followed closely by a trough of depression as expense and effort rise to keep the system operating. The two systems should be compared under two main headings, cost and information availability. In order to evaluate a system's cost it will be necessary to establish a breakdown, for each area affected by the system, of the wage and salaries, equipment, supplies and overheads. It should always be possible to do this fairly accurately both for the new system and the old one, and a comparison of the respective costs can then be made. Since likely savings in the future will be a key, point, (the introduction of new equipment probably being a heavy initial expense),it is often useful to indicate a date when the installation-costs of the new system will have been covered by savings. It is also important to realize that the replacement of several low-paid staff by fewer but better-paid staff is not necessarily a saving.

In considering information availability and quality it is essential to relate it to the need for readily available and better quality information. An inexperienced systems analyst will always try to justify an expensive system on the grounds that it provides information that was never obtainable before and that this may result in a saving of thousands, but such claims should always be very carefully examined; above all it must be clear that a system which, results in the handling of mountains of irrelevant data by highly-paid executives will probably result in a loss rather than a saving. Evaluation of a new system may well result in the eradication of unnecessary information rather than its proliferation. In any event it will have involved a careful assessment of the disadvantages of the system which will have been salutary for all concerned.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 3.5 Systems Analysis

Systems analysis as an activity existed long before computers were invented: the art of analysing methods of doing things and designing and implementing new and better methods has been applied ever since mankind organized itself into social groups. Out of this organizing activity have developed the modern sciences of organization and methods (O & M), work study, systems engineering and other associated techniques.

The advent of computers produced a very powerful tool, capable of handling huge amounts of information at enormous speed/Systems analysis is the name given to the technique of determining bow best to put this powerful tool to work.

This article gives a brief description of some of the aspects of systems analysis. The range of activities which come under this concept, however, is not clearly defined. Some of the activities described may be performed by an individual employed as a systems analyst: others may be considered to be more appropriate to *a programmer* or to an O & M expert Nevertheless, the activities described are all concerned with using a computer efficiently and profitably: this, is the ultimate aim of systems analysis.

The work of a systems analyst can be likened to that of an architect. In designing a building the architect must first of all. determine in consultation with his client what the building is for: teaching, nursing, family living, etc. He must analyse the activities to be performed in the building: eating, sleeping, cooking, etc. He must then determine the physical limitations within which his design must come: costs, materials, dates. He then designs a solution to the problem: this solution must be communicated to the user, to the builder, to the contractor, to his clients. Once the design is approved, he must monitor progress on the building and alter designs if requirements change (although he will hope to have to do as little of this as possible). Finally, when the building is complete, he must satisfy himself that it conforms to his design and to the client's requirements. He can then have the satisfaction of seeing his design realized, and performing the function for which it was created.

This is only a rough analogy: but it illustrates the main functions of systems analysis: (i) definition of the problem; (ii) investigation of the working of existing systems; (iii) analysis of the results of the investigation so as to help determine the requirements of a new system; (iv) design of a new system that is practical and efficient and makes the best use of available *hardware and software;* (v) communication of the new system to all parties concerned; (vi) assistance in implementation of the new system and its maintenance thereafter.

Each of these functions will form part of the analysis of any particular system: however, the relative importance of each step and the responsibility for undertaking it may vary considerably from system to system. The following remarks outline briefly the methods,adopted at each stage. (i) Definition of the problem: Before embarking on a systems project a clear statement and understanding of the problem must be made: otherwise, the answer produced will not meet the needs that it is supposed to and the whole project may well prove to be abortive. Thus the first important task of a systems analyst is to obtain a definition c the problem. The subject of the project, and its boundaries, as well as the objectives and hoped-for benefits must be specified as precisely a possible in a written systems project

assignment. This will be the result of cooperation between the 'clients' or users of the proposed new system and the staff to be involved in the design of the new system.

(ii) Investigation of the working of existing systems: This stage can be divided into an interim survey followed by a full scale system investigation.

The purpose of an interim survey is to provide a guide from which to estimate the time needed for a full scale investigation and the resource required to carry the investigation out. The interim survey will normally cover the following points: volume of work; staff involved; time involved; costs of present system. The interim survey will not propose solutions but obtain facts highlighting areas for further investigation and defining the extent of the problem.

A full scale systems investigation can continue indefinitely: it is thus essential to plan such an investigation carefully, breaking it down into a series of separate projects. One approach to the problem is the systems project team. The investigation is planned as a series of tasks each of which is given to a team to solve. The team is given precise terms of reference and a limit is set on the time for completion. Team members are taken from those closely involved in the subject under investigation, as well as systems specialists. In assigning tasks and breaking down a detailed investigation into separate projects it is essential to determine what facts are to be looked for, so that unnecessary detail is not included. *Documentation* of the results of the investigation is essential, and several techniques are available, such as *systems flowcharting, horizontal flowcharts* and *decision tables*. In carrying out a systems investigation it is not sufficient merely to record what is formally laid down in company rules or other documents as being the situation: neither is the correct picture necessarily obtained from what any individual says the situation is. The real situation must be discovered by patient observation and discussion. From the results of the investigation can be determined the best way of meeting the real needs of the system.

(iii) Analysis of results: Once the detailed systems investigation described above has been completed, the results obtained must be analysed so as to determine the weak points of the system investigated and the relation between the existing situation and the overall objectives of the new system. This stage attempts to produce answers to the following questions: Is the present system doing what it is supposed to do, in the time allowed, with the required accuracy and at reasonable cost? Is the organization of the system adequate to its task, and is the staff adequate? Are the documents used and produced necessary and are they efficiently designed? On the basis of answers to questions of this type the new system can be designed more effectively.

(iv) Design of new system: The designing of a new system is a creative function and, as such, difficult to define in detail. However, in designing a new system some of the following activities normally take place: (*a*) Re-appraise the original terms of reference of the investigation in the light of results so far obtained. (*b*) Reflect again on the results of the analysis of the existing system, particularly any weak points and any unexpected discoveries. (*c*) Determine precisely what output will be required from the new system and how it will be used. (*d*) Determine the *data items* required in order to produce the required output. (*e*) Decide on the medium and format of all *input* and *output files*, taking into account hardware and software availability and timing requirements. (*f*) Devise efficient methods for processing input to obtain output, making use of software available and defining any special programs required. *(g)* Devise an efficient method of *data collection*. This is particularly important, since the results produced by the system depend on how accurate, complete and up-to-date the raw data input to the system is. *(h)* Define in detail all the clerical procedures and documentation (e.g., *turn around documents, source documents)* required at the data capture stage. (*i*) Decide how the system is to cope with changes and modifications. No systems design is perfect, nor can an analyst predict completely the requirements of any system in the future. Thus as much flexibility as possible must be incorporated into all parts of the system.

This can be done using general purpose software (e.g., applications software, file processing programs) or by specifying programs which can be modified by means of variables input from *parameters*.

(v) Documentation: The general articles on *Documentation* describe the documentation which must accompany any new system. Such documentation is essential: *a.* As a record of agreement on all decisions. *b.* As a method of communication between the analyst and the programmers responsible for preparing all programs required. *c.* As a method of communication between the analyst and those responsible for operating the system, both the user and the specialist data processing personnel. The documentation should be signed as agreed by the users, the programming staff and also representatives of company auditors and accountants.

(vi) Implementation: Before a new system is finally operational, several stages of testing must take place. The first step is the detailed testing of individual programs, for which the systems analyst will provide *test data* and schedules of expected results.

Once the individual programs of the system have been proved correct against test data, the system as a whole must be tested, to ensure that all procedures, manual, off-line and' on-line are working as planned. This form of test requires some simulation of the 'real life' situation. This can be achieved on a limited basis by means of a pilot scheme, where one small but representative area of the system is used to test the new procedures before these are extended to other areas. This may be sufficient test of procedures: but in some cases, full *parallel running* will be required. This means that the new procedures are operated at the same time as the procedures they are designed to replace. The results obtained by the two systems are compared and the old system dispensed with when the new one is operating successfully.

The pilot scheme and parallel run steps are also used to try out the provisions made for auditing and controlling the operations of the new system, so that control is established over the full implementation of the system.

A major function of implementing a new system is ensuring that all documentation is accurate and up to date. And modifications made to a system in the light of testing or operational experience must pass through the same acceptance and audit procedures as the original system. The analyst must ensure that this documentation is maintained accurately and is always up to date.

(vii) Conclusions: This article has discussed in general terms some of the activities involved in systems analysis. Great emphasis is laid on the necessity for the analysis of a system to be complete and thorough. However, too great a rigidity in a system can prove fatal to its ultimate effectiveness. Any worthwhile system must be capable of being changed without involving a complete revision of all that has gone before. With the increasing availability of general purpose application-oriented software the task of the analyst is considerably eased. By definition, general purpose software is designed to be used in a large number of related applications which differ in detail. Thus a system making use of such software will be more flexible titan one using specially devised routines. Software *is* designed to be modified, whereas single-purpose routines generally win do one job only, and cannot easily be modified. Thus the task of a systems analyst is as much to forecast how the system and its requirements will change, as it is to define the specific requirements of the system at a fixed point in time. *Telecommunications* systems by which the user is able to interrogate a computer, and control the input and output from it directly, mean that the systems analyst is less an intermediary between a user and the mysterious world of the computer, and more a teacher, explaining how to use and control a powerful tool in the simplest and most efficient manner.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Exercises

Exercise 3.1

Rewrite the following sentences using the verb in capital letters with a suitable preposition to replace the underlined words. Make each new sentence as similar in meaning as possible to the original. You may need to change the tense or the form of the verb. Choose from the following prepositions.

~~about~~ across against at by for in into on over round through to towards with after

1 Everyone is full of praise for the new play at the Globe Theatre.
Everyone is *raving about* the new play at the Globe Theatre. RAVE
2 Who's taking care of the children?
Who's _____ the children? LOOK
3 Some people are opposed to women with small children going out to work.
Some people don't _____ women with small children going out to work. AGREE
4 My dog really likes you.
My dog has really _____ you. TAKE
5 Would you like to explain in more detail what you proposed when we last spoke?
Would you like to _____ what you proposed when we last spoke?ELABORATE
6 Rachael did not hesitate to take advantage of the chance to go to Australia.
Rachael _____ the chance to go to Australia. JUMP
7 Will I be at a disadvantage because of my age?
Will my age _____ me? COUNT
8 Little children know how to behave in such a way that their parents will give them what they want.
Little children know how to _____ their parents. GET
9 The repairs we had to do on the car have really used up a lot of our savings. The repairs have _____ *our* savings. EAT
10 Tedious as it was, I had to examine a large number of documents before I found what I was looking for.
I had to _____ a large number of documents before I found what I was looking for. PLOUGH
11 She happened to find the missing necklace while she was looking for something else.
She _____ the missing necklace while she was looking for something else. STUMBLE
12 Any money I have to spare is added to the money I am saving for my holiday.
Any money I have to spare is _____ my holiday. PUT
13 Everybody deserted John after he was arrested, but his wife told him: 'I will not abandon you, John, whatever happens.' His wife promised to _____ him. TICK
14 She decided to treat herself to a large box of chocolates. She decided to _____ chocolates. INDULGE

15 During the interview, the Prime Minister tried to avoid going into detail about an embarrassing story.
She tried to_____an embarrassing story. GLOSS
16 I am happy to confirm that he is a man of integrity. I can_____him. VOUCH

Exercise 3.2

Read the text below and use the word given in capitals at the end of each line to form a word that fits in the space in the same line.

HOW MUCH ARE YOU WORTH?

A important factor to take into (1)_____in trying to answer this question is how socially useful a person's work is, (2)_____of the talents he or she may bring to it. It is (3)_____accepted that looking after the sick or taking (4)_____for the education of the young is a more (5)_____occupation than, say, selling second-hand cars. Yet used-car (6)_____undoubtedly earn more than the nurses or teachers. But what about job (7)_____? People who enjoy their jobs, the (8)_____goes, get their reward in the form of a 'psychic wage', and that it is the people with the (9)_____jobs who need more money. Whatever the (10)_____, jobs which are traditionally thought of as 'vocations' continue to be (11)_____badly paid, while other jobs, such as those in the world of entertainment, carry (12)_____ rewards out of all proportion to their social worth.

CONSIDER
REGARD
GENERAL
RESPONSIBLE
VALUE
SELL
SATISFY
ARGUE
REPEAT
TRUE
RELATE
FINANCE

Exercise 3.3

Charlie Kim tells us about his professional history up to now. Complete the sentences with verbs from the box. Make sure the verbs are in the right tense.
buy drop out join look after move promote run sell set up spend take off write

1 I went to college in the States but got bored so I ***dropped out*** after two years without a degree.
2 I_____a company making computer games.
3 After six months I was_____to the post of chief games designer.
4 I_____two years there learning the business.
5 Then I_____to a bigger games company for more money but I hated it.
6 So I decided to_____my own company.
7 With my partner, Mario Carter, I co-_____the software for a game called *Sudden Death*.
8 It_____a million copies in its first year.
9 We_____another games company in Japan with the money we made.
10 Now I_____the company in the States.
11. And Mario_____the company in Japan.
12 Now I'd like to_____a year_____to learn about website design.

Module 4

Text 4.1 Feasibility Studies

A feasibility study is research into the possibility of developing a solution to a problem. In computer terms this may mean placing an order for the appropriate *configuration* and the research may be primarily an appraisal of the current situation of *hardware* and *software*, leading to the choice- of equipment. It may also be an assessment of whether a particular area of a company's activities should utilize a computer already used by the company. Some comments on this type of study are given at the end of this article.

The *raison d'etre* of the feasibility study should be that there is reasonable doubt whether the problem is capable of solution within an acceptable time-scale and budget, or at the very least Whether solution A or B is the better one. Any study which begins on firmer ground Is not a feasibility study, it is phase one of an actual project Probably over ninety per cent of systems design is imitative and the feasibility of the proposals is self-evident; however, the economic benefits may be more apparent than real; the originator of a real feasibility study should be moved by a vision of Utopia, on the other hand he should place a limit on the time and resources that may be expended before a return on the investment must be achieved.

Nowadays it is customary for some form of feasibility study to be carried out for every large project which affects the national interest for example a conversion to the metric system. Even though the estimates of cost and benefits are sometimes wide of the mark such studies are an essential feature of the democratic process, providing an opportunity for debate and allowing priorities to establish themselves. The computer has become an essential tool in conducting these feasibility studies, both through the analysis of survey data and through *simulation* techniques.

As indicated earlier, feasibility studies are also made to establish whether a computer should be used in solving some particular problem. It is very important that such a study be made as crisply and tidily as possible, and it often helps if the study is carried out within a formal framework. For example, a representative of the problem area should be formally appointed to work with the man (often a systems analyst) conducting the study, and terms of reference should include a statement of the nature and type of application to be studied, the objectives and expected duration of the study, and a clear identification of the areas to be investigated. Those conducting the study will generally examine permanent records within the problem area; interview staff handling the work; observe and measure the work; summarize the facts to provide a broad statement of requirements of a new system; consider possible solutions; and provide an estimate of the cost of completing a full systems investigation. This information should provide those who called for the study with enough information to decide whether or not the project is feasible.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 4.2 File Structure

This term relates to the way that information is organized into *fields, records, blocks* and *files,* and to the way in which they are organized into the available *backing storage* medium, including structures created to assist in access to required units of information.

In early computers, records held on *magnetic tape* were stored *serially* one record after another. The records were sequenced according to the significance of data appearing in a key field; e.g., account number or name. Such a file is known as a *serial file,* and examples can be found in many computer installations. Indeed, *applications* which use magnetic tape or *cassette tape* as their principal backing storage medium are very often organized using serial files. The disadvantage with such files is that to find a particular record it is necessary to search the medium from start to finish, a process which can take from 1 to 60 minutes, depending upon file size and medium and position of the record in the file.

The use of *magnetic disk* files gives the *system* designer the opportunity to use more convenient file structures which give rapid access to specific records in milliseconds. Such structures are essential for *on-line* or *real time* systems, where it is common to require record retrieval and display in 1 or 2 seconds from entry of a request for a specific key.

Commercial systems, such as order processing systems or reservations systems, usually employ file structures suited to such retrieval, using either *random* file structures or *indexed sequential* file structures.

In random files, records may be stored anywhere on the storage disk. The location is determined by computing a disk address from the key number of the record. The computation is performed in exactly the same way each time it is required to *read* or *write* to a record, so the same disk address is always generated for a specific key. This system is efficient where the structure of the key is such that a unique disk address is always created, but sometimes different keys will create the same disk address, and then some records have to be stored in an *overflow area,* and only a *pointer* to this record is stored in the original generated address. Random file structures may therefore be inefficient in the time taken to retrieve records and in the utilization of disk space, but they are effective where the system designer has control over the keys in use and can create a suitable *algorithm* (known as a *hashing algorithm)* to compute a *track* and *sector* address from the key number in such a way that an efficient distribution of the records arises over the disk surface.

Indexed sequential files are usually created in such a way that areas of the disk are reserved for storing records from a particular key sequence (e.g., Account Nos. 150-200 are assigned to a specific block/track/sector address) known as a *bucket.* An index is set up to relate key numbers to bucket addresses. Records in a file are accessed by looking up the index, retrieving the bucket indicated, and searching for the record required within the bucket. Since records may arise randomly throughout the life of the system, it is not usual for the records in the bucket to be in strict sequence, but in general the records are stored sequentially, although the file may be stored over non-contiguous areas of the disk. It is also usual to assign an area of the disk sufficient to cope with the present file size plus an amount for expansion; the file is then reorganized periodically to cope with file growth. Some buckets will get filled before others and therefore overflow areas are used.

Both random and index sequential files are useful where an *application* requires access to structured records through a simple key choice, but whole classes of computer application require responses to be constructed to user requests which are based upon logical relationships; e.g., 'present all the records which relate to persons between the ages of 25 and 35, who have a degree in engineering, and have served in overseas locations, are not married and have not risen above the rank of branch manager'.

File structures designed for this type of inquiry often use *inverted* files, or *relational*

files, and there is not a conventional record structure in which all fields related by specific keys are stored in one place. Instead, any data *element* classed as an attribute or characteristic (e.g., marital status, age range, job title) is stored as a list of all the items which have that characteristic. Records can then be constructed during processing by comparing lists to create sub-files of records which fulfil a particular set of attributes.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 4.3 Flag-Status Register

In many central processors, a special register exists in which individual bit positions are used as flags to indicate to the programmer the status of various activities within the system. For example, the following tags are set or unset according to events occurring in previous instruction execution *cycles*. (i) If the result is positive or negative. (ii) If there has been a carry or not. (iii) If there has been automatic overflow or not. (iv) If the result is equal to zero or not.

Flags may also be associated with other events such *interrupts* arising external to the processor. The instruction sat provided in the particular machine language or *assembly* system usually includes instructions which test these flags, and in some cases these instructions may deliberately set or unset the flags. They are frequently used in association with *branch instructions* to determine the logical sequence in which parts of a program are performed.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 4.4 Flowcharting

Flowcharting is a technique for representing a succession of events in symbolic form. The 'events' recorded in a flowchart may represent a variety of activities, but in general a particular flowchart will record the interconnexion between events of the same type. In *data processing*, flowcharts may be divided broadly into *systems flowcharts* and *program flowcharts*. Systems Flowcharts: The object of systems flowcharts is to show diagrammatically the logical relationship between successive events in a data processing system. The main types of 'event' in a systems flowchart will be the clerical and manual procedures involved, *data collection* and *data preparation*, and the computer *runs* involved. The flowcharts will identify the various procedures involved, showing their interconnexion and the overall design of the system.

Program Flowcharts: The object of a program flowchart is to show diagrammatically the logical relationship between successive steps in a computer program. Flowcharting a computer program may involve a number of different levels of complexity, but at least two

levels are usually prepared, outline flowcharts and detail flowcharts.

The purpose of an outline flowchart is: (i) to help the conversion of a program specification into a sequential statement of operations; (ii) to guide the further development of the program; (iii) to ensure that no *input* or *output* record is overlooked, and that all requirements of the program specification are met. In order to achieve this an outline flowchart must show: (i) all input and output functions; (ii) how each type of record will be processed; (iii) how the program will be divided into *segments* and *routines;* (iv) all *entry points* and *halts.*

The purpose of a detail flowchart is: (i) to interpret the detailed program specification; (ii) to define the programming techniques to be used; (iii) to provide clear directions for *coding;* (iv) to make the coded program more intelligible. A detailed flowchart will be used as the basis for coding the program, either in a *high level language* or in *machine code.* Thus the level of detail must be sufficient for unambiguous coding. This will vary according to the language to be used and the complexity of the program: the most detailed level of flowcharting will have a symbol representing each individually coded *instruction.* However, it is usually sufficient to represent a sequence of instructions forming a logical unit of the program by means of a single symbol.

Symbols: flowcharting symbols usually conform to some standard set in which each symbol has a specific meaning. Internationally and nationally accepted standards have been designed, such as the European Computer Manufacturers' Association standard and the American Standards Association standard, but local peculiarities prevail in almost any installation. For this reason great care (and often great resourcefulness) is needed in reading the flowcharts of anyone whose personal whims are not publicly accepted: considering that the flowchart is a major tool in the science of communication, it can sometimes be strangely uncommunicative. Among the symbols defined will be symbols representing the following functions:

Flowlines Flowlines show the *transfer of control* from one operation to another

Process A symbol to represent any kind of processing function.

Decision A symbol which represents a decision or switching type of operation that determines which of a number of alternative paths is to be followed.

Connector A symbol to represent an entry to or exit from another part of the flowchart. It is used to indicate a transfer of control that cannot be conveniently shown by a flowline (e.g., because the flowchart continues on another page).

Terminal A symbol representing a terminal point in a flowchart (e.g., start, stop, halt or *interrupt).*

Other special symbols are used to represent subroutines, input/output functions and different types *at peripheral unit* and sources of input and types of output.

The techniques of flowcharting are often complementary to those of using *decision tables,* on which there is a general article.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Exercises

Exercise 4.1

For each of the sentences below, use the verb in capital letters and a suitable preposition to write a new sentence. The new sentence should be as similar as possible in meaning to the original. You may need to change the tense or form of the verb.

1 We laughed very loudly when we saw the clown. ROAR
We ***roared with*** laughter when we saw the clown.

2 Do you want a drink? CARE
Would you_____a drink?

3 What do the letters EU mean? STAND
What do the letters EU_____?

4 We ran into a barn to get out of the rain. SHELTER
We_____the rain in a barn.

5 I lent my cousin £5. BORROW
My cousin_____£5_____me.

6 The group leader asked students if they would volunteer CALL
to help with the campaign to help earthquake victims.
The group leader_____volunteers to help with the campaign.

7 A car crashed into a bus this morning. COLLIDE
A car_____a bus this morning.

8 Charlie has just inherited a fortune! COME
Charlie has just_____a fortune!

9 I have the same first name as my grandmother. NAME
I was_____my grandmother.

10 Farmers' dogs will often attack people they don't recognize. GO
Farmers' dogs often_____people they don't recognize.

11 I like the idea of a universal language. APPEAL
The idea of a universal language_____me.

12 I was really deceived by his story about seeing an FELL
ostrich in his back garden! I really_____his story!

13 There is a fence round the pond to stop children falling in. PREVENT
The fence is to_____children_____falling in the pond.

14 I'm not sure what you are trying to say. DRIVE
What are you_____?

Exercise 4.2

Read the text below and use the word given in capitals at the end of each line to form a word that fits in the space in the same line.

THE ELEPHANT MAN

John Merrick was one of the most (1)_____human beings who ORDINARY
ever lived. He suffered from a rare bone disease which (2)_____him FORM
grotesquely: his right leg was twice normal size and his head was (3)_____ LARGE
and misshapen. When young he had a 9-inch (4)_____protruding from GROW
his mouth, hence the (5)_____nickname 'The Elephant Man'. FORTUNE
He was (6)_____seen by an eminent surgeon, Frederick Treeves, while EVENT
working in a circus. Treeves secured his (7)_____to the London ADMIT
Hospital and gave him a mask to wear so as not to (8)_____others. TERROR

Treeves discovered that Merrick was a man of (9)_____intelligence.	STAND
Treeves' friends began to visit Merrick, and his (10)_____soon spread.	FAMOUS
Members of the Royal Family, (11)_____Princess Alexandra, were among those who repeatedly visited him. The (12)_____of his soul had finally escaped the prison of his body.	NOTE BEAUTIFUL

Exercise 4.3

Sidney Carton is talking about his job responsibilities but is having problems with his prepositions. Complete the following sentences with a preposition from the box, where necessary. You need some of the prepositions more than once. Some of the sentences do not need an extra word. You can then make similar sentences about your own job responsibilities.

after in on out to with

1 I head _____ the marketing department at Power Enterprises.
2 I report directly_____Mr Power himself.
3 I look_____a department of about 30 people.
4 I deal_____all the major aspects of the company's marketing strategy.
5 I liaise_____the other members of the management committee.
6 I listen carefully_____what our customers say.
7 I handle_____one or two of the major accounts myself.
8 I'm working_____a very important account at the moment.
9 I also monitor_____the general situation in the market place.
10 We carry_____market surveys regularly.
11 We test_____new products on groups of consumers.
12 I am also involved_____one or two of Mr Power's takeover projects.

Exercise 4.4

Match each form of payment (1-11) with the right person (a-k).

1	grant	h	a author
2	salary	_____	b senior manager
3	wage	_____	c laid-off employee
4	commission	_____	d government
5	fees	_____	e blue-collar worker
6	dividend	_____	f retired employee
7	royalty	_____	g sales representative
8	stock option	_____	h student
9	pension	_____	i consultant
10	tax	_____	j shareholder
11	redundancy pay	_____	k white-collar worker

Module 5

Text 5.1 Information Retrieval Techniques

Information Retrieval is the phrase used generally to describe the problems of recovering, from collections of data, those particular items of information which are required at a particular time for a particular purpose. Information retrieval is basically a problem of communication: communication between the originator of information and the individual requiring to use the information. What is required is a method for providing the closest possible coincidence between the description of the subject by the user and the description of the information produced by the originator. Thus a third element appears in the line of communication between these two: the process of classifying or indexing the information. A common information retrieval system is a library. The user *accesses* the individual books he requires via a catalogue organized in such a way that he can formulate a request, find a reference to the book and then locate the book on the library shelves.

Information retrieval involves basically the following sequence of events: (i) Information coming into the system is analysed and given some form of classification. (ii) The information is stored in an ordered manner (not necessarily corresponding to the classification made at stage (i)). (iii) The user translates his requirement for information into a classification by a process analogous to that made for original information. (iv) A search of the store is made for an item with a classification corresponding to that made by the user. This step may be divided into two, the first stage being a search through an index to the classifications, which will give a reference to the location of the item in the store. (v) When a match or *hit* is obtained, the item of information is extracted from the store.

It can be seen from this general outline that the events correspond generally to normal experience of searching for information, for example in libraries, catalogues of merchandise, office filing systems, trade directories, reference book indexes. These techniques have been adopted and extended, utilizing the great speeds and storage facilities of computers to provide rapid access to increasingly large and diverse collections of information. There are an almost infinite number of possible approaches to the problems of information retrieval: this article can only attempt to describe in general terms some of the approaches made to solving the problems posed by each of the steps described above.

The problem of information retrieval starts, in fact, with that of storing information. Two possibilities are open: either the information entering the system can be stored separately from the index used to reference it (as happens in a library) or the index and the information can be stored together (as happens in an office filing system). In computer applications, the choice depends on the amount and type of computer *storage devices* available and the type of information being dealt with. A computer system used, for example, to provide an information retrieval system for accessing technical literature would normally be of the first type, the actual information items being stored apart from the index. A system of personnel records, however, might be of the second type, a complete computer record being created and stored for each individual together with identifying and classifying information. The development of storage devices with differing capacities and *access time* means that in some systems the information may be held on one type of device while the index to be searched is on another. Other developments, particularly in the field of miniaturization of original documents through microfilming, enable physical copies of the documents to be stored with some form of coded representation of reference information. *Punched card* systems were developed by which microfilmed documents could be inserted within a card on which reference information was punched. By using mechanical devices, selected cards could be

retrieved and the associated document obtained. Extensions of this principle to computers involve associating microfilms with magnetic recording surfaces - either tape or cards - which can he coded and read by computers. Other developments are the recording of televised images of original documents on video tape or video disk, and associating the video image with identifying information which can be read by the computer. A different approach is the development of devices which can read printed documents automatically, and convert them into computer format.

Indexing information within a system makes possible the correlation of requests for information with relevant items of information stored by the system. There are many possible indexing schemes, but basically there are two types of approach to the problem. Each item of information may be given an identifying *key,* which in the case of systems separating the information from the index will act as the cross-reference from the index to the item. As well as this key, selected attributes possessed by the information will be coded in some form and associated with the identifying key. For example, in a system of personnel records, the identifying information may be a staff number, followed by a series of codes isolating such attributes as experience, qualifications, marital status, occupation code. In addition, if the system is one which incorporates information together with reference tables, there may be non-coded details such as the individual's name and address, job title, etc. An alternative approach is that of inverse filing. In this system each individual item is again given an identification code. Selected attributes are chosen, and a list of all possible combinations of attributes is made. Against each combination of attributes is placed the identifying key of all items of information having that combination. This system is used, for example, in assisting police forces to identify criminals from fingerprints. Any fingerprint may have several different attributes. Lists are made of all combinations of these attributes, and any known criminal having any combination of attributes is listed against the combination. Thus by studying any fingerprint, identifying its attributes and comparing them with the files, the police can find a list of all criminals whose prints have the same combination of attributes. The more precise this classification can be the smaller will be the shortlist obtained; ideally, the coding of attributes should be sufficiently detailed to identify a single individual.

The choice of which system to adopt depends again on the type of information being considered, and also on the sort of questions expected. Inverse filing can only be used if die type of inquiry will always be limited precisely to a given combination of attributes, since adding new attributes or revising the codes used is a difficult and complex activity. The alternative system is more generally used when flexibility of approach is required, since any combination of different attributes can be specified, and extension of attributes merely involves adding another code to each item of information without necessarily altering any of the codes already used.

Most storage devices are used in information retrieval systems, both for storing of indexes and for storing information. The type of device chosen will depend on the type of file organization adopted *(inverted files* or *serial files)* and on the amount of data to be stored. *Magnetic tape* is usually used for serial files, which require each record to be examined in turn when any search for information is made. If, however, the description of required attributes can be used to generate an *address* where the corresponding information is required, as for example in an inverted file, then *direct access* storage devices may be chosen. The great capacities of direct access devices may also be utilized for files which contain large quantities of information. These files may be held serially, and individual items located by first searching a magnetic tape containing index information only, the relevant items being accessed directly from the storage device by means of an address found on the index tape. Another factor relevant to the choice between types of storage device is the expected usage of the system. The time taken to read through a long magnetic tape file may not be justified if

the normal expected 'hit rate' (the ratio of items satisfying the given inquiry to the total of items examined) is low.

Performance characteristics of an information retrieval system can be measured in terms of completeness, relevance, specificity and response time. 'Completeness' refers to the number of items which could be relevant to the user's inquiry that are in fact retrieved by the system. This will normally depend on the accuracy and efficiency of die coding and indexing system adopted. 'Relevance' is the inverse of completeness: it is a measure of the number of items retrieved by die system which do in fact conform to the needs of the user. 'Specificity' is a term which refers to the degree of generality of the information retrieved. These first three characteristics depend on the system design. The fourth item, 'response time', is a measure of the time taken to retrieve an item of information from store, and depends also on the *hardware* involved.

One of the major items of applications *software* provided by most manufacturers is software concerned with aspects of information retrieval. This software can assist a user at all the stages of setting up and using such a system. Indexing can be assisted by means of such routines as KWIC (key word in context) indexes, which provide lists of items of information sequenced by specific words or codes, each word or code appearing in the sequence in its appropriate location. Files of information can be subjected to statistical analysis to determine the frequency of occurrence of attributes, thus isolating factors for further identification. Routines can assist in setting up and maintaining files on tape and direct access devices. On the problem of specifying requests to a computer file, software exists which enables a user to relate different combinations of attributes by means of Boolean operators (AND, OR) and logical relations (equal to, greater than, less than, etc.). More specialized software may be provided for specific information retrieval problems, such as library cataloguing, indexing of technical literature and full text retrieval systems.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 5.2 Instruction Classification

Most computers can perform a wide range of *instructions* and these are defined by the processor used. The instructions can generally be classed as belonging to one of five major groups as follows: (i) *Data transfer instructions:* These are concerned with operations which entail the movement of data between *registers* in the processor, and between registers and *main memory locations.* (ii) *Data Manipulation Instructions:* These instructions result in the data contained in locations being altered, by arithmetic or logical processes. For example. ADD A. B creates a sum of the operands in registers A and B. A logical operation such as an *exclusive – or operation* falls within this classification but may sometimes be referred to by the sub-classification logic instruction or logical instruction. (iii) *Transfer of Control instructions:* Any one of the instructions which causes an *unconditional* or *conditional branch* to take place in a program, e.g., a *branch, jump, call,* or *return* instruction. (iv) *Input/Output instructions:* These result in the transfer of data between external *peripheral units* and registers or main memory locations within the computer. Such instructions cause data to be passed via the *input/output ports,* e.g., OUT 03 causes the contents of the A register to be

transferred to a peripheral unit attached to Input/Output port 3. (v) *Machine Control Instructions:* These instructions affect the operation of the processor itself and include, for example, instructions concerned with enabling and disabling *interrupts* and resolving priorities.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 5.3 Updating and File Maintenance

In ordinary office procedure a file is a receptacle for holding documents, usually partitioned into sections which are indexed in some way to help both the filing and retrieval of documents. Computer files are like this in that they are used to store information and they are indexed, but their outward form is different and information is coded, not stored as pieces of paper. Even so, they need to be updated and maintained, updating being the reflection of actual events changing the information and maintenance being the adding, deleting or correcting of material to ensure that the information properly reflects the real situation. For example, consider a computer file containing customer accounts, showing, for each customer, the account number, name and address, outstanding balance and credit limit. The customer may order items from the firm holding the file, in which case his account must be debited with the price, and he will make payments in which case his account will be credited: the original statement is updated to take account of these transactions. The maintenance of the file described might involve correcting an account that was showing a false balance, adding new customers or removing records of customers who are no longer doing business with the firm.

The file described above consisted of a number of accounts. Files might also contain quantities and descriptions of a number of stock items, or a list of the firm's employees with personnel details. The items different files might contain are commonly known as *records and* files are said to be composed of a number of records each of which breaks down into a number of *fields*. One of the fields within a record is known as the *key:* this is different for each record and will be used to identify it during computer processing. Examples of record keys are account numbers, works numbers and part numbers. Each file in a computer installation is given a name which enables the computer to identify it, such as 'Customer File', 'Personnel File' and so on.

To understand how computer files are updated and maintained it is necessary to appreciate the characteristics of the storage media used for files. Files are typically held on *magnetic tape, magnetic disks, magnetic drums* or *magnetic cards;* this type of medium is collectively known as *backing store,* as distinct from *main store,* which is the working *memory* of the computer and not used for storing permanent data. All data, on backing store is recorded as a series of flux changes in a magnetic recording surface. Each flux change is regarded as a change of state from 0 to 1 or vice versa, i.e., a *binary* code is used to represent numbers or letters of the alphabet. Data is written to backing store by an output from main store, and subsequently read by an input to main store.

Magnetic tape is a *serial* recording medium, differing from magnetic disks, drums and cards which are *direct access* media. Serial files can only be updated serially, by copying from one file to another. Direct access files can be updated serially, but also randomly and

selective sequentially.

The characteristics of serial updating are as follows. Records are stored in sequential order according to the record keys. Sorted transactions and file records are each read in turn and the keys examined for a match. If a transaction does not apply the record is written unchanged to a new file. If a transaction does apply the record is updated and similarly written to the new file: Eventually a completely new updated file will have been created. The old file is usually retained for a while in case mistakes have been made during the updating, and usually several *generations* of a file are preserved, all at successive stages of updating. All these generations of a file will have the same file name, and to distinguish between them, each is given a unique number (known as a *generation number).*

The main features of serial updating are that the input transactions with which the file is to be updated are collected into a sizeable batch and sorted into record key order, and every record on the file has to be read and written to a new file whether or not it has been updated. The closer the batch size approaches the file size the fewer will be the number of unwanted records read and rewritten. Magnetic tape files, therefore, are most suitable when large volumes of data are being presented during the updating run. Magnetic tape is the most common method of storing files because of its relatively low cost; the extra flexibility of direct access processing, however, frequently justifies the higher price of the equipment.

The characteristic of direct access files is *that addresses* within the file can be specified, not necessarily in sequence. This permits selective-sequential or random updating. For selective-sequential processing the records within the file are held in key order and input transactions are sorted to this order, as with serial processing. Only those records for which there are transactions, however, are read from the file and, when updated, the records are written back to where they came from. Thus, unwanted records are not *accessed,* with a consequent saving in time, and the file is updated in situ, without copying. This increased efficiency brings with it two problems. First, updated records may not fit back into the file if they have been expanded and there may be no room for new records. Secondly, since past generations of the file are not preserved an alternative system of file security must be devised. The first problem is known as *overflow* and is catered for by having files bigger than they presently need to be. File security is dealt with by keeping copies of files, or copies of the parts that have changed.

Random updating of direct access files eliminates the need for batching and sorting the input transactions, which can be dealt with as they occur. There is no difference in principle from selective-sequential updating, but this implies an orderly progression through the file, while random access involves the need to access any part of the file at any particular instant and is most suitable for low volumes of data. Where response time is critical in file updating, however, for example in airline flight booking, random access is essential.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 5.4 Virtual Machine Environment

An environment in which several different users are able to operate their *applications* within a computer system in such a way that there is considerable sharing of *hardware* and

software facilities. However, each user application is unaware of the existence of other applications, and is developed as though it atone occupied the computer.

In a virtual machine environment each user regards his program as consisting of a series of *instructions* to solve his particular application program. When the program is *compiled,* additional instructions are added to provide an interface with standard *system software* or *middleware, e.g.,* input/output routines, or file handling routines. During the compiling process, a program is also allocated hardware *resources* including *peripheral devices.*

To the user, the various items of system software which operate in conjunction with his program are not thought of as forming his program - indeed, they will reside in a separate part of the main store and be shared by several other application programs.

The importance of a' virtual machine environment is that hardware and software resources are efficiently shared by all users without them being conscious of the fact and with full *security and privacy for* individual programs. Each user's virtual machine thus has protection from interference although it may co-exist with several other virtual machines each operating independently.

Each virtual machine contains a hardware and software mechanism to handle all requests for system software facilities and to pass control to relevant routines. The interaction of all co-existing virtual machines is governed by die kernel which is usually that central part of an operating system which interfaces directly with the hardware, and provides mutual synchronization and protection to processes active within the computer. The kernel is instrumental in mapping individual virtual machines on to the hardware, and controls the transfer of *segments* between main store and backing store. The kernel monitors virtual machines and their dependence upon events - e.g., the termination of a peripheral transfer-and controls the activation of virtual machines accordingly. It schedules processing time between active virtual machines, and manages peripheral transfers and interrupts within the system.

For the virtual machine Concept to be effective it must be supported by hardware *architecture* which offers a comprehensive system of protection to all processes active within the system. Such a system provides protection for code and data within a virtual machine from errors internal to that machine, and from the effects of errors occurring in other virtual machines.

'A virtual machine environment is one which enables each user application within a computer system to operate independently without interference with other user applications with which it must co-exist, the computer system being designed so that all user applications can efficiently share the resources of processing time, main storage, and system software.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Exercises

Exercise 5.1

Complete the sentences below with one of the following nouns plus a preposition.
basis campaign choice control cruelty excuse fall freedom genius anger knowledge objection opposite strain problem

1 What is the *opposite* of 'timid? Is it 'bold' or 'brave'?
2 The_____chewing gum is that it loses its flavour too quickly.
3 If you had a_____marrying for love or marrying for money, which would you do?
4 I know you have a cold, but that's no_____not doing your homework.
5 If you have to deal with overseas clients, a_____foreign languages is very useful.
6 Do you have any_____my parking my car in front of your house?
7 Since the salmonella scare there has been a considerable _____the consumption of eggs.
8 Perhaps the three most important human rights are _____hunger, fear and persecution.
9 _____Einstein hated school and often missed classes, but he was a real _____mathematics.
10 In the dispute between the union and the management, new proposals have been put forward which should at least provide a _____discussion.
11 In our class, we can do as we like; our teacher has no _____us at all.
12 The RSPCA is the Royal Society for the Prevention of _____Animals.
13 Overweight people should not jog because it puts a great _____their hearts.
14 _____The African elephant will be extinct within twenty years if an international_____the ivory trade is not started immediately.
15 Vandalising public property is the only way some youngsters can express their _____society.

Exercise 5.2

Read the text below and use the word given in capitals at the end of each line to form a word that fits in the space in the same line.

GESTURES	
An ancient Chinese proverb says: 'Be (0)_____of a man	SUSPECT
whose stomach does not move when he laughs.' The (1)_____	MOVE
we make with our bodies, often quite (2)_____, give us away.	CONSCIOUS
For example, fidgeting is a sure sign of (3)_____in young children.	BORE
Drumming your fingers on the table tends to indicate (4)_____.	PATIENT
A man who keeps adjusting his tie is betraying his (5)_____.	NERVOUS
These are obvious gestures, (6)_____ recognised and understood. But	WIDE
the (7)_____of a gesture can vary in different cultures. The 'thumbs up'	SIGNIFY
sign indicates (8)_____in some countries, but in others, it is obscene	APPROVE
and (9)_____. Eye contact is another important way in which we	OFFEND
signal our (10)_____: but at what point does a look become a stare?	INTEND
And when does staring rudely become gazing in (11)_____? The	ADMIRE
answer is, as usual 'It all depends'.	

Exercise 5.3

Juanita Hernandez has just joined Nice Cream Inc. She is reading about her pension in the documentation the Human Resources Manager gave her. Fill in the missing words from the list.

average earnings board bridging brokers contribution
contributory early retirement fund holiday lump sum
~~plan~~ portable retire trustees

Welcome to Nice Cream. This sheet gives you information about your Nice Cream pension (1)_____*plan*_____.

Your Nice Cream pension is fully (2)_____, so if you decide to leave the company, you can take your pension with you.

The Nice Cream scheme is a (3)_____one. This means that every month you pay a (4)_____into the company pension (5)_____and the company pays an equal amount. You can choose how much you pay and you can also pay into the scheme a (6)_____of any size at any time. If the scheme has more money than it needs, you can take a contributions (7)_____and stop paying a monthly sum for a while.

The fund is managed by a (8)_____of (9)_____who are appointed jointly by the senior management board of the company and your trade union representatives. This committee works completely independently of the company. The company cannot touch the money in the pension fund.

If you are a member of this scheme for 35 years, you can expect to (10)_____at the age of 65 with a pension equal to 80% of your final (11)_____. If you take (12)_____, you can receive a (13)_____pension until you are 65
and can receive your full pension.

We think that this scheme is one of the best available and one reason why so many people decide to stay with Nice Cream. However, if you prefer not to take part, we can give you the names of insurance and pensions (14)_____who can give you independent advice on other products on the market.

Module 6

Text 6.1 Law and Computers

Early fears of the inadmissibility of evidence based on magnetically recorded data have proved groundless. Any loss of data by *overwriting* or other electronic hazards would have no greater significance in law than the loss of documents in a fire. Also the need to print out records held on a magnetic medium may be compared with the translation of evidence gathered in a foreign country. Although a computer system may dispense with intermediate records, the validity of its *output* can be established by circumstantial evidence obtained by a re-run of the *programs* with proven *input* data. In a vital case it may also be desirable to call an expert witness to give evidence that the installation is efficiently conducted and that the information it provides can be relied on in a commercial environment.

There is, however, some danger from actions in tort. The directors of a company should ensure, when they delegate responsibility for customer relations to an unthinking computer,

that fail-safe *exception reporting* has been incorporated in the programs and procedures. Thus, in Burnett v. Westminster Bank Limited (1965) the bank was held liable for damages when its computer system (which relied on the *magnetic ink character recognition* encoding on cheques) failed to detect that the customer had altered the account details in manuscript.

A company providing computing services for others might also be liable for damages, for example, in the event of an incorrect engineering calculation resulting in the collapse of a structure. On the other hand, negligence could be held against a company which failed to employ a computer in a situation where similar enterprises had established their value in maintaining safety limits.

Whatever litigation may arise, a company's interests will be protected best when a meticulous control is maintained over its data processing operations, through the enforcement of proper *data processing standards*. All activities should be logged immediately and accurately, recording *batch* sequence numbers, the total number of items processed, *control totals* and other matters relevant to data security. *Operating systems* should be operator-proof. There should be automatic checks on the *validity* of data, e.g., correct codes, logical situations, quantitative limits. A reliable *dump and restart* procedure should be used. Output should be identified by program-generated *header* and *trailer labels* giving time and date, description, page numbers, data record count and control or *hash totals*. Environmental records should be equally thorough in respect of atmospheric conditions, maintenance schedules, this logging of *down time*, fault reports, and operators' duty rosters. There should always be two people on duty when operational jobs are being run. All these precautions will substantiate the evidence of an 'expert witness' if the need should arise.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 6.2 Linear Programming

Linear programming is a section of mathematical programming which has proved extremely valuable in many fields, particularly that of allocation problems. Linear programming problems are those in which: (i) the objective can be expressed as the maximization or minimization of a linear function of the variables, i.e., the variables have fixed costs, profits, etc., per unit of the items; and (ii) the objective function described in (i) is restricted by a set of constraints which may also be expressed as linear functions of the variables. Putting this less formally, linear programming enables us to maximize or minimize a function which is the sum of multiples of several variables subject to constraints upon these variables; these constraints can themselves be written as sums of multiples of the variables.

To illustrate the use of linear programming we shall consider a very simple example, for clarity. Suppose we wish to make a diet for pigs, and we want the diet to cost as little as possible, but to contain definite minimum quantities of various vitamins, using certain basic foods. We consider one unit by weight of this food, say one pound. We want to minimize the total cost so we need to know the cost of each food per ounce. Our constraints are that the diet must contain certain minimal quantities of various vitamins, and since the vitamin content of each food will depend on its weight this can be expressed linearly. Thus we will need to know: (i) the cost of each food per ounce; (ii) the vitamin content per ounce of each food. We

can then write:

Total cost=ax(cost of first food)+bx(cost of second food), etc.

Content of vitamin 1=ax (vitamin 1 content of first food)+bx (vitamin 1 content of second food), etc.

Content of vitamin 2=ax (vitamin 2 content of first food)+bx (vitamin 2 content of second food), etc. Total weight= 16 ounces=a+b+c, etc.

where a, b, c, etc. are the amounts of each food.

Use of linear programming will then find for us the values of a, b, c, etc., which will give us the minimum vitamin content defined and minimize the total cost.

Perhaps linear programming has become so popular because its results can be readily shown to be economically valuable and that it can be very easily used with a digital computer.

There are several techniques for the solution of linear programming problems, perhaps the most common of which is the simplex technique.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 6.3 Modular Programming

Modular programming is a technique used in *programming* which simplifies the tasks of developing and maintaining large *suites* of programs. The objective of modular programming methods is to achieve two main goals: speed and efficiency of *debugging* and ease of *maintenance* of the programs in a suite.

The basis of modular programming techniques is to divide each program at the planning stage into a number of logical parts or *modules*. Each module corresponds to a particular program function and can be treated as a separate entity. A number of different programs may in practice share certain common modules. Each individual module is relatively simple to specify, write and test. Changing requirements can be met by simply changing existing modules or adding new modules to the system.

Modular programming techniques have been powerfully extended by means of modular program testing software, sometimes known as a *testbed*. A testbed is a software system which allows the user to test individual modules independently of the overall context of the program of which they are subdivisions. *Test data* needed for the program is supplied to the testbed and fed automatically to modules being tested. Where modules require to pass data to or from other modules not yet developed, the testbed can simulate the presence of these modules for testing purposes. A testing system for program modules may also have available other programming aids such as keeping records of the progress of testing, providing detailed diagnostic information, automatic generation of test data. A further feature is the ability of the user to choose different *languages* for different modules, for example mixing *COBOL*, *FORTRAN* and possibly a *low level language* within a single program. The testbed software would co-ordinate the *object code* generated for the complete program regardless of the *source code* used for each module.

Also known as structured programming.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 6.4 Multiprogramming

There is an extreme difference in the speeds at which a computer handles its internal operations (performing calculations on data in its *central processor)* and the speeds at which even the fastest *peripheral units* used for input and output of data operate. In the time taken to print one line on a *printer* working at 1200 lines per minute, a processor could perform many thousand additions. Few *programs* would in fact perform many operations between printing successive lines of print, or performing any other peripheral operation, and this means that during the operation of a program which makes fairly frequent use of a peripheral device there will be long periods of time (long, that is, in relation to the internal speeds of the computer, something like several thousandths of a second) during which the processor is idle, waiting for a peripheral transfer to finish before it can continue by performing the next set of internal operations.

To help redress the balance, *time sharing* techniques have been developed which enable a single program using more than one peripheral unit to continue processing while several of the units under its control continue their respective actions. However, there will still be periods of time when the processor remains idle, and in any event peripheral units not used by the program during time sharing cannot be used at all, since they need a program to 'drive' them.

Multiprogramming is a technique developed in order to utilize a computer more efficiently by enabling the processor to spend a greater proportion of its time in action and by making more use of all available peripheral units. The basic principle of multiprogramming is that more than one program can be present in *memory* at the same time, and share the available processor time and peripheral units. Each program is written as a completely independent unit, as if it were being produced for a single-program machine, and each program uses peripheral units allotted to it for the duration of a *run*. With several programs sharing the computer the best use is made of the central processor time, whilst all the programs concerned also make more practical and extensive use of the available peripheral units. For example, a program to read data from magnetic disk and rewrite to *magnetic tape* will only require the use of the central processor for a very small fraction of the program running time, the remainder representing peripheral transfer time during which other programs in the system can use the central processor. Benefits to be gained from this concept of multiprogramming include the elimination of *off-line* equipment to transcribe data on to a faster medium for input since while this activity is proceeding, using limited numbers of peripheral units and little processing time, other more productive programs can use the remaining peripherals and processor time.

In order to achieve multiprogramming, several problems must be overcome. Obviously, if more than one program is present in memory at the same time, there must be no danger of one program interfering with another. Interference could involve *overwriting* another program's *area*, or attempting to use a peripheral unit at the same time as another program. In order to achieve optimum utilization of processor time and of peripheral units, some method of allotting priorities between the programs sharing the computer must be made. Further, in

order to enable programs of different sizes to be *loaded* into the computer at different times, as and when store space becomes available because of programs finishing, the method of loading programs and sharing memory between them must be as flexible as possible. These various objectives are achieved by a combination of *hardware* and *software*. Different multiprogramming systems adopt different combinations of these two methods; in a short article it is not possible to describe all types of system. One typical approach combines a system of hardware checks to prevent one program from interfering with another's area, and an *executive program* to control peripheral sharing and the operations concerned with loading and communicating with programs.

The method by which the executive program controls the sharing of processor time between programs and the operation of peripheral transfers can be described in outline as follows. When a program requires a peripheral transfer to be carried out, it obeys an instruction which transfers control to the executive program. The executive program then initiates the transfer, and returns control to the program just left. This program may proceed until it requires to use the information being read in by the transfer or the area from which data is being transferred. At this point the program will obey an instruction which suspends the program from further operation until the peripheral transfer is completed. Control is then transferred to the executive program. At this stage the order of priorities allotted to the programs present in the computer is consulted by the executive program, which looks for the program of highest priority that can now proceed because it is not held up for a peripheral unit. This program is entered to make use of processor time which would otherwise be wasted. When the transfer relating to the first program is complete an automatic *interrupt* occurs, and, assuming that the first program had higher priority, the executive program suspends the current one and re-enters the first one. As a general principle, programs that are *peripheral limited* (i.e., those which use very little processor time compared to the time they spend on peripheral transfers) will be given a higher priority than those which are *processor limited* (i.e., those which use a relatively large amount of processor time). Written at the beginning of each program is descriptive data which includes the program's priority number. This number is entered by the programmer, but to allow flexibility when several programs are being run simultaneously, it is also possible for the operator to alter the priority at any time during the run. Another technique used to achieve multiprogramming is *interleaving*. In this method, *segmented* programs are used, and segments of one program are inserted between segments of another program so that control is constantly switched from one program to another as each segment is completed. Using this technique the programmer will segment his program in such a way that processing and peripheral transfers occur in different segments; he must also know with which programs interleaving is to take place, so that as control alternates between segments, one program is performing a peripheral transfer while a processing segment of another program is being executed.

A further refinement of multiprogramming systems is the use of sophisticated *operating systems*, in which the functions of an executive program are extended to cover more comprehensive control over the scheduling of many programs and associated data files through the system.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Exercises

Exercise 6.1

Complete these sentences with the correct preposition.

1 Congratulations ___*on*___ your thirty-fifth birthday!
2 With reference_____your advertisement in today's *Guardian*, I wish to apply for the position of Sales Manager.
3 We have a good working relationship_____the local authority.
4 Do you take pride_____your appearance, or are you just vain?
5 The party's new policy document puts a strong emphasis_____ public ownership of basic utilities like electricity and water.
6 John's got very strange taste_____clothes, hasn't he?
7 There has been a considerable improvement_____the flow of traffic since they opened the extra lanes on the motorway.
8 'Have you made proper provision_____your old age?' 'No, I intend to become a burden on my children!'
9 Let Alicia work it out; she has an amazing aptitude_____figures.
10 If you put as much effort_____your schoolwork as you do _____roller-blading, you might have a chance.
11 In a surprising departure_____tradition, the Queen rode to Parliament on a bicycle.
12 Football fans showed their disapproval_____the referee's decision by booing loudly.
13 Please give my regards_____your mother when you see her.
14 Extensive research_____artificial sweeteners has shown that rats die quickly if you drop large blocks of saccharine on them!
15 Picking your nose in public is not illegal, but it is certainly an offence_____good manners.

Exercise 6.2

Read the text below and use the word given in capitals at the end of each line to form a word that fits in the space in the same line.

A YOUNG WOMAN TALKS AMBITION

Getting to the top doesn't just depend on (1)_____; it also	ABLE
means making a total (2)_____to your job. I work hard: evenings,	OMMIT
weekends, whatever it takes, I think that's why I'm (3)_____.	SUCCEED
The people I work with are (4)_____motivated. I work to weekly targets	HIGH
and I achieve them. Now, I'm looking for a major (5)_____.	PROMOTE
didn't think I was (6)_____until I came into this environment.	COMPETE
I took a drop in salary when I took this job, but it has (7)_____	CERTAIN
been (8)_____. I work hard and have a positive attitude to life.	WORTH
That's (9)_____why I'm now earning the sort of salary	DOUBT
which was once beyond my (10)_____dreams!	WILD
As to (11)_____ambitions, well, I would like one day to have my	FULFIL
own company. But that's (12) _____to happen for a long time,	LIKELY
if at all.	

Exercise 6.3

Complete each sentence with a word or phrase from the list.

allowance corporation deductible evasion exile free havens incentives inheritance inspector progressive rate relief return value added

1 The standard rate of income tax in my country is 25% but well-off people pay more.
2 Marbock has been sent to prison for tax _____. He didn't pay any tax for five years.
3 In my country, tax on income is _____: rich people pay a bigger percentage of their income than poor people.
4 I have to fill in my tax _____ before the end of the week.
5 Some of the items you can see here are tax-_____ so you don't have to pay any tax on them at all.
6 You have to pay almost 20% _____ tax on things like perfume, alcohol and petrol.
7 We have been told that we will shortly receive a visit from the tax _____ who plans to look at all our accounts for the last three years.
8 The Bahamas and the Channel Islands are two popular tax _____ because taxes are low so that foreigners who want to pay less tax invest there.
9 The government is keen for foreign businesses to come to this region and therefore gives them a lot of tax _____.
10 These businesses are given a number of other tax _____ as well.
11 The government has increased the rate of _____ tax we have to pay so the net profit for the business is likely to be down next year.
12 He could have received a lot of money after his father's death but he was badly advised and the state took nearly all of it in _____ tax.
13 He earns so much money and taxes are so high in his own country that his accountants have advised him to move abroad and become a tax _____.
14 I pay less tax than other people because I have a big family and there is a generous state tax _____ for this.
15 She has to wear special clothes for her job but she gets some of the money back from the government because they are tax-_____ items.

Module 7

Text 7.1 Network Management

The set of policies, functions and procedures used to control a *communications network* and to maintain its efficiency and integrity. The procedures and functions are usually implemented as a computerized management system under the control of human operators. The network management includes the maintenance of a directory of authorized users and their addresses within the network; the existence of various communications paths through the network and the control procedures associated with availability, obligation, testing and maintenance of these paths; the collection of data and the maintenance of files, as well as processing, billing, accounting, traffic analysis and network performance.

Fault detection and management procedures associated with avoidance and correction of

fault paths through the network are also part of the network management system. *Configuration* control - including the ability to switch circuits or *nodes* into or out of operation - is also part of this function and allows a communications network to be expanded and developed to meet the demands of an expanding user community.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 7.2 Personnel Records

The recording of data concerning personnel is a common computer application. Personnel records may be kept both in order to produce a payroll and to provide a record of information about employees which can be used by management for a variety of planning and administrative functions. The type of information recorded and the method in which it is coded and stored depends largely on the ultimate use to which the data is to be put. The Data Protection Act, which gave the right of access to individuals, ensured that companies reviewed very carefully all data held about employees.

If records are kept purely for payroll purposes then information will be confined to the financial details relevant to each employee together with data necessary for payment, such as details of hours worked, absence, rates of pay, etc. Tax calculations in payroll applications are usually performed by means of *software packages* provided for the purpose by the manufacturer or user. The medium for storing personnel records used primarily for payroll purposes will normally be one suited to regular *sequential processing* in which each *record* is processed at every *run*.

Personnel records can provide a more detailed source of information about employees. Additional data about each person can include information on qualifications and experience, administrative details such as department, address, medical details, etc. The actual data recorded will depend on the applications envisaged for the information, but in all cases some system of coding information, so that retrieval and analysis may be simplified, must be devised. Where a file of personnel records is going to be used extensively for *information retrieval*, e.g., searching for personnel satisfying given conditions, the file organization will depend on the retrieval techniques to be adopted. If frequent interrogation of the file is expected, each interrogation producing a limited number of *hits*, a *direct access* storage device would normally be used, using random storage methods. The use of *inverted file* structures is used in some applications, e.g., in the recording of fingerprint details on criminal files.

Updating methods will depend on the particular application, but the *turn-round document* technique is particularly suited to updating personnel records of employees.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 7.3 Production Control

The purpose of production control is to enable a manufacturing organization to meet all orders placed by customers within a reasonable time. Computerized production control will often increase business by means of an improvement in delivery dates. Other benefits are a reduction of capital tied up in stock, reduction in labour costs and improved utilization of plant.

The starting point for a production control cycle is a sales forecast. Typically a company will have firm orders for a short period in the future, tentative orders in the medium term and intelligent anticipation (perhaps based on *extrapolation* of past trends) will have to be used for the long term. The length of these time periods will be specific to particular industries and production problems. Given a sales forecast as *input*, a computer can break down the products demanded into their constituent main units, assemblies, sub-assemblies, etc., down to piece parts and raw materials. Processing of this information is in two stages: (a) calculation of gross requirement of each constituent element of each product; and (b) calculation of net requirements of each constituent element taking into account work-in-progress and stock levels.

Finally the net requirements must be converted into economic manufacturing batches and orders to outside suppliers.

It is obvious that an integral part of a production control system must be a system of *inventory control*, because without a knowledge of stock levels it is impossible to establish net requirements for parts and raw materials. The basic objective of inventory control is to maintain stocks at the lowest levels that are compatible with the economics of production. There are two conflicting requirements here. On the one hand the cost of stockholding increases with the quantity of stock held and, on the other, the lower the stock levels the longer the turn-round time on orders tends to be. The break-even point for each stock level is most likely to be achieved using a computer system.

Input to the computer will be details of items received into, returned to and issued from stores. These items will be used to keep up to date a master stock file which can be processed for reports and queries. The computer can also carry out automatic re-order point control on stock levels and signal unusual circumstances (for example, exceptional demand and non-moving stocks).

Breakdown and inventory control are reasonably straightforward applications to put on a computer. Having ascertained the production requirements in terms of components and raw materials reached, however, the next stage is to plan the flow of work on the factory floor. This is also amenable to computer control but is a more challenging project to design and implement.

The final output from the breakdown analysis is a list of manufacturing batches, which will be necessary to meet the required production. This information can be used to plan plant loading, showing the effect of the work load on production centres and enabling management to make decisions: for example, on the need for increased plant capacity and labour force or on the possibility of subcontracting. The role of the computer is to tabulate the load in hours for a given time period, on each production centre.

Computer analysis of plant loading can be made more sophisticated in various ways. For example, the computer can load demand against appropriate time periods, starting at the required completion date and working backwards, and printing out the potential overload/underload on each shop in each time period.

Once any imbalances between load and capacity have been smoothed, it becomes possible to plan the workload through machine and assembly shops so as to optimize use of plant. This procedure involves several operations, among them maintenance of a work-in-

progress file which reflects the current state of all jobs, the printing of works documentation (such as route lists and departmental schedules) and progress control. Progress control is achieved by analysis of the work-in-progress file and the printout of details of jobs behind schedule.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 7.4 Sizing

Sizing is concerned with the evaluation of the resources and facilities needed to perform a data processing task, to achieve a specified service at a cost commensurate with the user's requirements. The service itself will require a number of aspects to be considered. For example, the workload required by the user's system may entail a given *throughput* of *transactions* in a specific time; the system may have to handle peaks of transactions at critical times; individual users of the system may require specific *response times* to be met. There can also be a requirement for *resilience* in the system and an overall *serviceability* requirement to be met. The user's functional needs must also be understood so that the complexity of the processing can be assessed.

A study of these aspects enables a statement of the end-user's work load to be formulated, against which the sizing exercise will determine the resources needed both to develop and run the required system operationally. The end result of a sizing study would normally include: a statement of the work load and its future growth; a statement of the *hardware resources* needed both initially and to cope with future growth; an outline description of the *software* resources needed (both existing software and bespoke software which needs to be developed); a statement of manpower resources needed to develop and maintain the system; a statement of expected throughput and resource levels; the spare capacity within the system; and the planned system *up time*.

A sizing study may be initiated in a number of situations; e.g., when a company issues a tender to purchase a new computer it is to be expected that the manufacturer's staff will size the project before submitting responses to the tender; a data processing department should size every major development which it undertakes; sizing techniques can also be used to review the operational efficiency of an installation or of a specific application.

The methodology used in a sizing study will depend on the degree of precision required, and on the availability of information and time to complete the study. In principle a sizing study requires information in two basic categories - product information and work load information.

With product information we are concerned with the performance ratings of hardware devices and the performance of existing or planned software used by the system. Software performance entails measuring or evaluating *instruction* path lengths and calculating the performance to be expected in executing specific functions on specified hardware.

Compiling work load information entails collecting up-to-date data about the end-user's requirement, and this may be based partially upon an assessment of his existing procedures and workload and upon future developments planned. Sometimes programs have to be written to collect and analyse data from existing systems. In designing future systems one should also

consider developing special routines known as instrumentation to collect data in an organized way for future sizing activity.

The sizing technique used will be dependent on the quality of the information available and the resources and time available to carry out the exercise. A sizing exercise may embody the use of analytical methods applied in the construction of hand-worked models, or it may involve the use of parameter driven *simulation models*. It is important not to use techniques which cannot be supported by the quality of data, and it is also important to use methods which allow for iteration easily and inexpensively to permit variations in work load and resources to be evaluated. It is also important to be able to check results using a different method.

The most common area for sizing activity is in the evaluation of hardware and software configurations needed to perform a given task or set of tasks. This is often done at a time when the full extent of the ultimate system is not known. Thus it is important to continue to use sizing concepts throughout the development of projects from the time of their inception through to efficient and effective live running. A study conducted after completion of a *systems definition* will be based on better information than one based upon an outline design or a functional specification. The performance aspects of a system can obviously be better predicted and controlled when detailed *program specifications* have been produced.

The sizing of a project will go through a change of emphasis as the project develops. The initial sizing is done to match the work load and the resources/facilities which are to be budgeted for the project. At this stage, usually based upon a functional specification, a number of trade-offs can be made according to the findings of the sizing study; e.g., reducing systems functions in favor of performance or lower cost, increasing hardware in favor of improved system resilience or increased capacity for future growth. Obviously as one approaches the later stages of a project subsequent sizing activity provides a basis for tuning the design of the system to provide the performance and facilities originally planned.

There are a number of problems which can arise in sizing studies and, therefore, all projects must be managed with the principles, concept and limitations of sizing in mind. Some of the problems are summarized below.

The requirements of a system are often changed by users during the development of a project. These are likely to invalidate initial sizing and imply the need for continual sizing studies throughout the project. There is also a tendency in project development to aim at achieving the timescales and facilities needed at the expense of software efficiency, thus resulting in dilution of original performance objectives. This must be monitored and performance targets and budgets maintained by reappraisal of sizing assumptions at key stages. The organizational environment may change during project development, thus presenting a different balance in the workload to that initially evaluated. Assumptions about the performance of hardware or software products may not be realized in practice, and this can affect the performance of the system in a major way.

The output from a sizing exercise is able to provide information permitting changes in the design and giving management the opportunity to exercise trade-offs in the best interest of the project and the organization. It is important, therefore, to budget for on-going sizing activity in a project, and to create within the data processing organization a responsibility for promoting and developing sizing disciplines The objective of sizing is to provide a basis of decision for ma trade-offs which balance the level of service, the facilities and their within a particular computing project or installation.

Tasks

1. Make 10 questions to the text above.

2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Exercise 7.1

For each of the sentences below use the noun in capital letters and a suitable preposition to write a new sentence. The new sentence should be as similar as possible in meaning to the original.

1 Are you and Jennifer related? RELATIVE
Are you *a relative of* Jennifer's?

2 Pay no attention to what he says. NOTICE
Take no _____ what he says.

3 People are demanding lower taxes. REDUCTION
People are demanding a _____ taxes.

4 My boss seems to enjoy humiliating people. PLEASURE
My boss seems to take _____ humiliating people.

5 The interview panel thought that Sarah had a very good manner. IMPRESSION
Sarah made a good _____ the interview panel.

6 My best friend is someone I can really trust. CONFIDENCE
I really have _____ my best friend.

7 Henry really knew how to make people laugh. TALENT
Henry had a _____ making people laugh.

8 Many filmmakers were influenced by the film *Citizen Kane*. IMPACT
The film *Citizen Kane* had an _____ many filmmakers.

9 This rule is always true. EXCEPTIONS
There are no _____ this rule.

10 A lot more people are buying automatic cars these days. DEMAND
There is a greater _____ automatic cars these days.

11 Lloyds the butcher's and Lloyds Bank are two completely separate organizations. CONNECTION
There is no _____ Lloyds Bank and Lloyds the butcher's.

12 Emma knows a great deal about organic farming. EXPERT
Emma is an _____ organic farming.

Exercise 7.2

Read the text below and use the word given in capitals at the end of each line to form a word that fits in the space in the same line.

SHARING

Judging from the 'Flats to Let' column, there is an (1)_____ END
search going on for flatmates which is (2)_____ to the COMPARE
search for suitable (3)_____ partners. MARRY
Indeed, the fact that the (4)_____ often specify the type and the ADVERTISE
personality of the potential flatmate suggests that (5)_____ COMPATIBLE
is as (6)_____ in flat-sharing as it is in the person you marry. DISPENSE
People usually ask for or offer (7)_____, but these probably provide REFER
only a few (8)_____ facts. The things you really want to know SIGNIFY
about a person are (9)_____ revealed, things like whether they RARE
make a noise when they eat, and other (10)_____ habits. BEAR

Let's face it, if you are going to share your (11)_____with a complete stranger for any (12)_____of time, you need to find out at the outset whether their company will turn out to be a delight or a nightmare! LIVE LONG

Exercise 7.3

The staff of this company are having problems with their prepositions on the telephone. Put the correct preposition in the space after the sentence. Choose from the following words. Some words are used more than once.

back down off on through up

1 Just a minute while I look through his number in the company phone book.
look *up*
2 I'm sorry I can't talk to you now. Could I call you down in five minutes?
call_____
3 I'm trying to get off to Mr Schmidt. Could you give me his extension number?
get_____
4 I need to take up his name and number.
take_____
5 Could you hang back a minute while I get a pen?
hang_____
6 I was talking to Mrs Bazin when we were cut up.
cut_____
7 Please could you put me down again?
put_____
8 I've been trying to talk to her all day but every time I call she hangs down.
hangs_____
9 The phone rang and I picked off the receiver straightaway.
picked_____
10 I'm sorry, I don't have this information right now. Can I get up to you tomorrow?
get_____

Module 8

Text 8.1 Computer Virus

In computer security, a **computer virus** is a self-replicating computer program that spreads by inserting copies of itself into other executable code or documents. A computer virus behaves in a way similar to a biological virus, which spreads by inserting itself into living cells. Extending the analogy, the insertion of a virus into the program is termed as an "infection", and the infected file, or executable code that is not part of a file, is called a "host". Viruses are one of the several types of malicious software or malware. In common parlance, the term *virus* is often extended to refer to worms, Trojan horses and other sorts of malware; viruses in the narrow sense of the word are less common than they used to be, compared to other forms of malware. However, in a stricter sense, viruses, worms and Trojans are different from one another. They have different characteristics and behaviors.

While viruses can be intentionally destructive, for example, by destroying data, many

other viruses are benign or merely annoying. Some viruses have a delayed payload, which is sometimes called a *bomb*. For example, a virus might display a message on a specific day or wait until it has infected a certain number of hosts. A *time bomb* occurs during a particular date or time, and a *logic bomb* occurs when the user of a computer takes an action that triggers the bomb. The predominant negative effect of viruses is their uncontrolled self-reproduction, which wastes or overwhelms computer resources.

Today, viruses are somewhat less common than network-borne worms, due to the popularity of the Internet. Anti-virus software, originally designed to protect computers from viruses, has in turn expanded to cover worms and other threats such as spyware, identity theft and adware.

Computer Virus Classification.

Included in the many types of viruses are:

Trojan horses

A Trojan horse is not a virus in the strict sense, but a computer program. Rather than insert code into existing files, a Trojan horse appears to do one thing (install a screen saver, for example) when in fact it does something entirely different, and potentially malicious, such as erase files. Trojan horses cannot replicate automatically.

Worms

A worm is a piece of software that uses computer networks and security flaws to create copies of itself. A copy of the worm will scan the network for any other machine that has a specific security flaw. It replicates itself to the new machine using the security flaw, and then begins scanning and replicating anew.

E-mail viruses

An e-mail virus is a virus which uses e-mail messages as a mode of transport. These viruses often copy themselves by automatically mailing copies to hundreds of people in the victim's address book.

Logic Bombs

Logic bombs maliciously cause legitimate applications to fail. "An application, for example, might delete itself, along with all information and files from the disk, after a couple of runs as a copy protection scheme. The logic bombs may transfer itself to other applications and storage items, i.e. floppy disks, CD-ROM disks, and CD Disks."

A computer virus will pass from one computer to another like a real life biological virus passes from person to person. For example, it is estimated by experts that the Mydoom worm infected a quarter-million computers in a single day in January of 2004. In March of 1999, the Melissa virus spread so rapidly that it forced Microsoft and a number of other very large companies to completely turn off their e-mail systems until the virus could be dealt with. Another example is the ILOVEYOU virus, which occurred in 2000 and had a similarly disastrous effect.

A computer virus is a small program written to alter the way a computer operates, without the permission or knowledge of the user. A virus must meet two criteria:

— It must execute itself. It will often place its own code in the path of execution of another program.

— It must replicate itself. For example, it may replace other executable files with a copy of the virus-infected file. Viruses can infect desktop computers and network servers alike.

Some viruses are programmed to damage the computer by damaging programs, deleting files, or reformatting the hard disk. Others are not designed to do any damage, but simply to replicate themselves and make their presence known by presenting text, video, and audio messages. Even these benign viruses can create problems for the computer user. They

typically take up computer memory used by legitimate programs. As a result, they often cause erratic behavior and can result in system crashes. In addition, many viruses are bug-ridden, and these bugs may lead to system crashes and data loss.

Trojan Horses are imposters--files that claim to be something desirable but, in fact, are malicious. A very important distinction between Trojan horse programs and true viruses is that they do not replicate themselves. Trojans contain malicious code that when triggered cause loss, or even theft of data. For a Trojan horse to spread, you must invite these programs onto your computers--for example, by opening an email attachment or downloading and running a file from the Internet. For example, Trojan.Vundo is a Trojan.

Worms are programs that replicate themselves from system to system without the use of a host file. This is in contrast to viruses, which requires the spreading of an infected host file. Although worms generally exist inside of other files, often Word or Excel documents, there is a difference between how worms and viruses use the host file. Usually the worm will release a document that already has the "worm" macro inside the document. The entire document will travel from computer to computer, so the entire document should be considered the worm W32.Mydoom.AX@mm is an example of a worm.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 8.2 History of computer viruses

A program called "Elk Cloner" is credited with being the first computer virus to appear "in the wild" -- that is, outside the single computer or lab where it was created. Written in 1982 by Rich Skrenta, it attached itself to the Apple DOS 3.3 operating system and spread by floppy disk. This virus was originally a joke, created by the high school student and put onto a game. The game was set to play, but release the virus on the 50th time of starting the game. Only this time, instead of playing the game, it would change to a blank screen that read a poem about the virus named Elk Cloner. The computer would then be infected.

The first PC virus was a boot sector virus called (c)Brain, created in 1986 by two brothers, Basit and Amjad Farooq Alvi, operating out of Lahore, Pakistan. The brothers reportedly created the virus to deter pirated copies of software they had written. However, analysts have claimed that the Ashar virus, a variant of Brain, possibly predated it based on code within the virus.

Before computer networks became widespread, most viruses spread on removable media, particularly floppy disks. In the early days of personal computers, many users regularly exchanged information and programs on floppies. Some viruses spread by infecting programs stored on these disks, while others installed themselves into the disk boot sector, ensuring that they would be run when the user booted the computer from the disk.

Traditional computer viruses were mostly first seen at the last half of the 1980s, and they came about because of a few reasons. "The first reason was the spread of personal computers. Prior to the 1980s, home computers were nearly non-existent or they were toys. Real computers were rare, and they were locked away for use by "experts." During the 1980s, real computers started to spread to businesses and homes because of popularity. By the late 1980s, PCs were widespread in businesses, homes and college campuses.

The second reason was the use of bulletin boards on the computer. People could dial up a bulletin board with a modem and download all sorts of different programs. Most popular were games, and then simple word processors, spreadsheets, etc. Bulletin boards led to what is now known as the virus called a Trojan horse. The third reason that led to the creation of viruses was the floppy disk. At the end of the 1980s, programs were very small, and one could fit the operating system, a word processor and many documents onto a single floppy disk. Most computers didn't have hard disks, so one would turn on one's computer and it would load the operating system and everything else straight from the floppy disk. Viruses took advantage of these three facts to create the first self-replicating programs.

As bulletin board systems and online software exchange became popular in the late 1980s and early 1990s, more viruses were written to infect popularly traded software. Shareware and bootleg software were equally common vectors for viruses on BBS's. Within the "pirate scene" of hobbyists trading illicit copies of commercial software, traders in a hurry to obtain the latest applications and games were easy targets for viruses.

Since the mid-1990s, macro viruses have become common. Most of these viruses are written in the scripting languages for Microsoft programs such as Word and Excel. These viruses spread in Microsoft Office by infecting documents and spreadsheets. Since Word and Excel were also available for Mac OS, most of these viruses were able to spread on Macintosh computers as well. Numerically, most of these viruses did not have the ability to send infected e-mail. The viruses that did spread through e-mail usually worked by accessing the Microsoft Outlook COM interface.

Macro viruses pose unique problems for detection software. For example, some versions of Microsoft Word caused macros to replicate themselves with additional blank lines. The virus behaved identically but would be misidentified as a new virus. In another example, if two macro viruses simultaneously infect a document, the combination of the two, if also self-replicating, can appear as a "mating" of the two and would likely be detected as a virus unique from the "parents".

A computer virus may also be transmitted through instant messaging. A virus may send a web address link as an instant message to all the contacts on an infected machine. If the recipient, thinking the link is from a friend (a trusted source) and follows the link to the website, the virus hosted at the site may be able to infect this new computer and continue propagating.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 8.3 The vulnerability of operating systems to viruses

Another analogy to biological viruses: just as genetic diversity in a population decreases the chance of a single disease wiping out a population, the diversity of software systems on a network similarly limits the destructive potential of viruses.

This became a particular concern in the 1990s, when Microsoft gained market dominance in desktop operating systems and office suites. Users who use Microsoft software (especially networking software such as Microsoft Outlook and Internet Explorer) are especially vulnerable to the spread of viruses. Microsoft software is targeted by virus writers

due to their desktop dominance, and is often criticized for including many errors and holes for virus writers to exploit. Integrated applications, applications with scripting languages with access to the file system (for example Visual Basic Script (VBS), and applications with networking features) are also particularly vulnerable.

Although Windows is by far the most popular operating system for virus writers, some viruses also exist on other platforms. Any operating system that allows third-party programs to run can theoretically run viruses. Some operating systems are less secure than others. Unix-based OS's (and NTFS-aware applications on Windows NT based platforms) only allow their users to run executables within their protected space in their own directories.

As of 2006, there are relatively few security exploits [5] targeting Mac OS X (a Unix-based operating system); the known vulnerabilities fall under the classifications of worms and Trojans. The number of viruses for the older Apple operating systems, known as Mac OS Classic, varies greatly from source to source, with Apple stating that there are only four known viruses, and independent sources stating there are as many as 63 viruses. However, Mac users are advised to install anti-virus software, because they can accidentally pass on a file that is infected with a Windows virus or Trojan. While this malware does not affect the Mac, it can infect a Windows PC. It is safe to say that Macs are less likely to be exploited due to its secure Unix base. Virus vulnerability between Macs and Windows was/is a chief catalyst of the platform wars between Apple Computers and Microsoft.

Windows and Unix have similar scripting abilities, but while Unix natively blocks normal users from having access to make changes to the operating system environment, Windows does not. In 1997, when a virus for Linux was released – known as "Bliss" – leading antivirus vendors issued warnings that Unix-like systems could fall prey to viruses just like Windows.[6] The Bliss virus may be considered characteristic of viruses – as opposed to worms – on Unix systems. Bliss requires that the user run it explicitly, and it can only infect programs that the user has the access to modify. Unlike Windows users, most Unix users do not log in as the administrator user except to install or configure software; as a result, even if a user ran the virus, it could not harm their operating system. The Bliss virus never became widespread, and remains chiefly a research curiosity. Its creator later posted the source code to Usenet, allowing researchers to see how it worked.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Text 8.4 Anti-virus software and other countermeasures

There are two common methods that an anti-virus software application uses to detect viruses. The first, and by far the most common method of virus detection is using a list of virus signature definitions. The disadvantage of this detection method is that users are only protected from viruses that pre-date their last virus definition update. The second method is to use a heuristic algorithm (Heuristic (computer science)) to find viruses based on common behaviors. This method has the ability to detect viruses that anti-virus security firms' have yet to create a signature for.

Many users install anti-virus software that can detect and eliminate known viruses after the computer downloads or runs the executable. They work by examining the content

heuristics of the computer's memory (its RAM, and boot sectors) and the files stored on fixed or removable drives (hard drives, floppy drives), and comparing those files against a database of known virus "signatures". Some anti-virus programs are able to scan opened files in addition to sent and received emails 'on the fly' in a similar manner. This practice is known as "on-access scanning." Anti-virus software does not change the underlying capability of host software to transmit viruses. There have been attempts to do this but adoption of such anti-virus solutions can void the warranty for the host software. Users must therefore update their software regularly to patch security holes. Anti-virus software also needs to be regularly updated in order to gain knowledge about the latest threats.

One may also prevent the damage done by viruses by making regular backups of data (and the Operating Systems) on different media, that are either kept unconnected to the system (most of the time), read-only or not accessible for other reasons, such as using different file systems. This way, if data is lost through a virus, one can start again using the backup (which should preferably be recent). If a backup session on optical media like cd and dvd is closed, it becomes read-only and can no longer be affected by a virus. Likewise, an Operating System on a live cd can be used to start the computer if the installed Operating Systems become unusable. Another method is to use different Operating Systems on different file systems. A virus is not likely to affect both. Data backups can also be put on different file systems. For example, Linux requires specific software to write to ntfs partitions, so if one does not install such software and uses a separate installation of msWindows to make the backups on an ntfs partition (and preferably only for that reason), the backup should remain safe from any Linux viruses. Likewise, msWindows can not read file systems like ext3 (which is also known to be very reliable), so if one normally uses msWindows, the backups can be made on an ext3 partition using a Linux installation.

Tasks

1. Make 10 questions to the text above.
2. Speak about the most recent development in the field described in the text.
3. Find the articles on the stated topic in a newspaper, a magazine or at an internet-source. Present an oral summary of the article.

Exercises

Exercise 8.1

Complete these sentences with a suitable preposition.

1 Do you know of a cure *for* hiccups?
2 The public is taking a lot of interest_____the new courses being offered by the university.
3 The attendance_____Saturday's match was very poor.
4 Did he give you any reason_____his awful behaviour?
5 Take advantage_____this special offer! 50% off list price while stocks last!'
6 At school today, we had a long discussion_____the best way to learn a foreign language.
7 There's a big difference between being fond of someone and being in love_____them!
8 'Because of a lack_____interest, tomorrow has been cancelled.' (notice outside a theatre)
9 It's a pity_____poor old Fred: everyone got a Christmas present except him.

10 There has been a sharp increase_____house prices in recent months.
11 Competitors in the New York Marathon began to drop out of the race one_____one.
12 There seems to be some confusion_____what Nelson actually said as he lay dying. Was it 'Kiss me, Hardy' or 'Kismet, Hardy"?
13 Professor Jonah Newt is a specialist_____marine biology.
14 Because of the increase in the number of firms offering financial services, there's a bigger demand than ever_____qualified accountants.
15 If you want to know how to get into other people's computers, pay a visit_____the website www.hackers.com!

Exercise 8.2

Read the text below and use the word given in capitals at the end of each line to form a word that fits in the space in the same line.

FORTUNE TELLING

We live in a (1)_____age in which everything we do is based	SCIENCE
on rational (2)_____and careful investigation of the facts.	DECIDE
In other words, we try to act (3)_____and as a result of using our	SENSE
brains. But, if this is so, how can we explain the (4)_____of	POPULAR
of horoscopes and similar ways of (5)_____the future? I once	TELL
learned to read palms, and then tried out my newfound (6)_____	KNOW
on several friends and (7)_____. They were amazed at the	ACQUAINT
(8)_____of my reading of their characters and even more by	ACCURATE
my (9)_____about their future lives, but of course there was	PREDICT
nothing (10)_____about my palmistry: it was just intelligent guesswork	MYSTERY
on my part. After all, I knew my 'victims' and could (11)_____assess	EASY
the (12)_____that they would travel abroad or marry or change jobs in	LIKELY
the near future.	

Exercise 8.3

Match each of these extracts from e-mails (a-l) with the type of message (1-12).

1 Acknowledgement c
2 Request ____
3 Complaint ____
4 Congratulations ____
5 Forwarded message ____
6 Attachment ____
7 Advice ____
8 Deadline ____
9 Apology ____
10 Appointment ____
11 Confirmation ____
12 Thanks ____

a
Hi Bill,
Next Monday is fine, but can we make it 10.30? I have to catch a plane.
All the best, Linda.

b
Bill,
Here's the latest version as promised.
With best wishes, Linda.

c
Bill,
File received this morning.
Best, Linda.

d
Hi Bill,
Could you send copies of the invoices asap.
Cheers, Linda.

e
Dear Bill,
Really good of you to see us at such short notice last week. We're all really grateful.
With best regards, Linda.

f
Bill,
Next Monday 10.30.
Looking forward to it, wbw, Linda.

g
Bill,
This came from Alfredo yesterday. Thought you should see it.
Best, Linda.

h
Dear Bill, It looks good but I think you should sharpen up the beginning a bit. OK?
Linda.

i
Bill,
Really sorry. It'll never happen again!
Best regards, Linda.

j
Dear Bill,
We've now asked for payment for the last quarter three times. This is not good enough. Please send it soonest.
Will call tomorrow if no news, Linda.

k
Bill,
Thanks for the latest section. Whole thing by Monday 9 a.m.?
See you, Linda.

l
Bill,
Saw the news on TV this morning. Well done! Thoroughly deserved.
Best regards, Linda.

МЕТОДИЧНІ ВКАЗІВКИ
З АНГЛІЙСЬКОЇ МОВИ

ДЛЯ СТУДЕНТІВ IV ТА V КУРСУ

Рівень підготовки – Магістр
Напрям підготовки – "Комп'ютерні Науки"
(VIII - IX СЕМЕСТР)

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