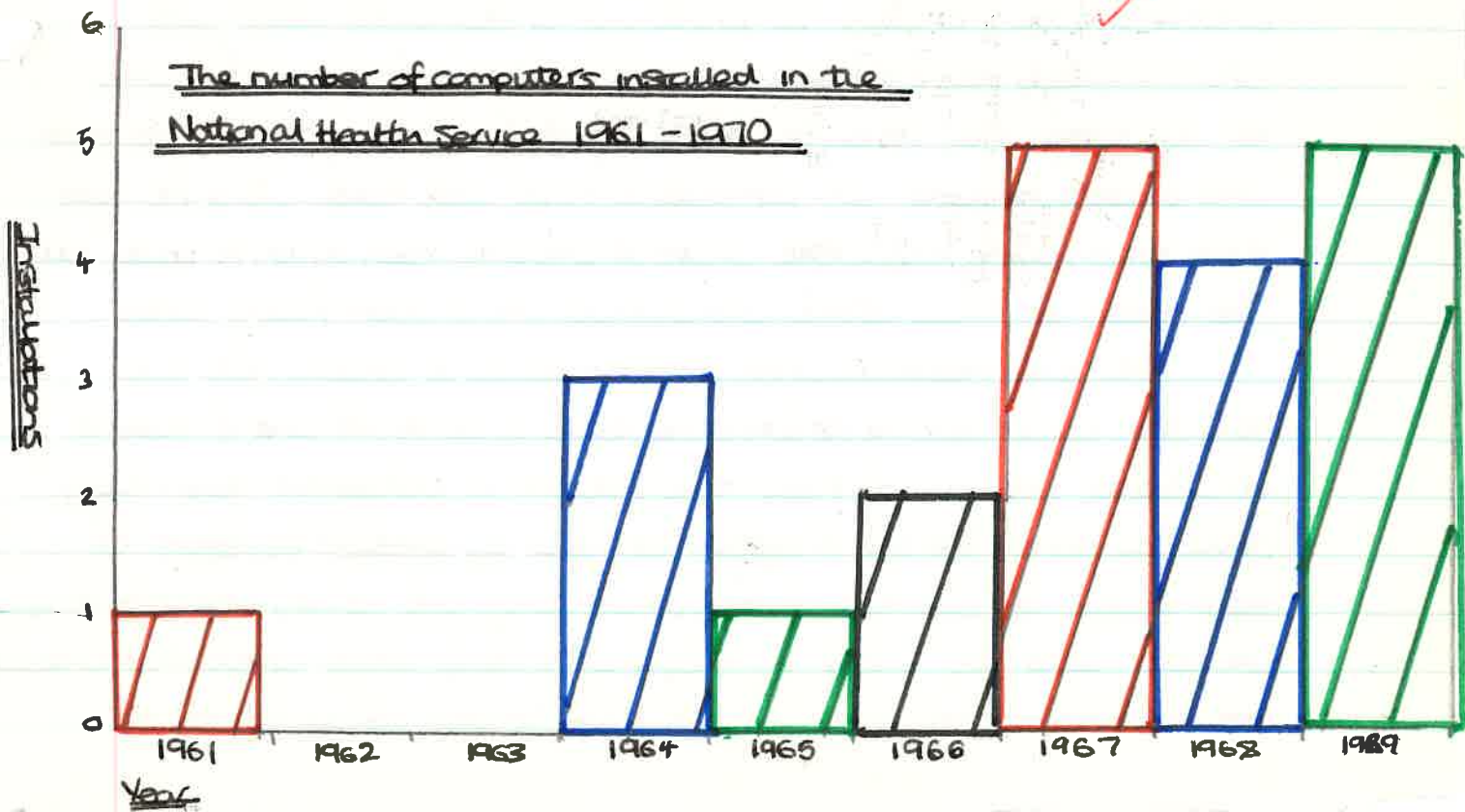


Computers in the Medical World

Computers have many uses in the medical world today. They are used more and more in hospitals today. They can be used to do most of the administration jobs, accounts, pay rolls, allotting beds, laundry, even servicing the ambulances, computers can be used to check timing, exhaust emissions etc. They can be used all the way up to disease diagnosis, and research into incurable diseases and cancer etc. With computers doing these jobs it gives the people more time to do the more important jobs like looking after the patients, nursing etc.

Computers have been used in the health service since the early 1960s. At first they were used just to calculating payroll and cost accounts, the same sort of things that had already been done by computers in industry. The ministry of health developed Hospital Activity Analysis which gathers all the information about the patient, duration of stay in relation to category of illness. The processing of medical information had to wait for faster machines and better peripherals. So far the lack of suitable input equipment has put doctors off using the computers. Not all hospitals have their own computers



Some use the computers of businesses or other bodies outside the health service, or teaching hospital or university computers which are not taken into account on the bar chart. More than half the computers installed in hospitals are used only for pay and cost accounting, and less than five to investigate various aspects of patient care as their main problem.

Considerable use of computers has been made by medical officers and those working in Public Health. Local authorities use computer systems to keep records on children and immunisation and vaccination and to remind the doctors when vaccination is due. The system of reminding parents and doctors has increased the effectiveness of immunisation and helped to stamp out diseases. Computers have also been used to process health surveys and help doctors to deploy their health teams more effectively. Health authorities attempt to screen the population of the entire area using questionnaires which can be optically read.

In the same way the computer can be used to store information on the Blood Donor National Blood Transfusion service. This could be done with a data-base containing information on the donor, blood type, and perhaps a special section with rare blood types for emergencies. It ~~was~~ would contain name and address and a printer is used to print out a standard letter, just changing the name. Also notifications of recent illnesses have to be taken into account. Also, apart from being easier to keep and access records on computers, they also take up a lot less room than having a separate sheet of paper for each donor, it could all be stored on hard discs, wurchesters are or even floppy discs.

At the hospital, when an ambulance is called out the computer could decide which ambulance to send out and if there is an unused ambulance near the patient or patients then they could be sent. The same system as used by London Transport to keep track of all the buses, where they are what's number they are etc could be used by hospitals to keep track of all the ambulances without the ambulance driver have having to worry about

talking to the hospital he can concentrate on the traffic but a normal radio would be needed as well to give details of injuries if the patient needs special treatment.

Once the patient is inside the hospital he needs special care and the computer can allocate him a bed, and arrange the laundry. The patient needs to eat and some people have special diet needs because of their illnesses, and people such as those with diabetes. The computer can work out the number of calories, price, protein, vitamin, and mineral content, and take the average for checks. When ~~to~~ certain foods are running low the computer can order it, perhaps even directly with the use of some type of modem e.g. an acoustic coupler down the phone line. Using the same sort of telephone line link-up the computer in one hospital could look around the others for important things such as donor organs or rare blood types etc.

If a patient is seriously critically ill then he will have to be put into Intensive Care where the computer can be used to monitor all the vital functions such as respiratory rate and volume, heart rate, blood pressure, temperature, and also things like blood sugar concentration and check to see if the patient is dehydrated or not, and set off alarms if something, a computer could also regulate the drip or blood transfusion rate. This could also be done for people with bad kidneys on dialysis machines and record of people reading dialysis kept. Computers could be used to take ultrasound readings and enhance and double X-rays.

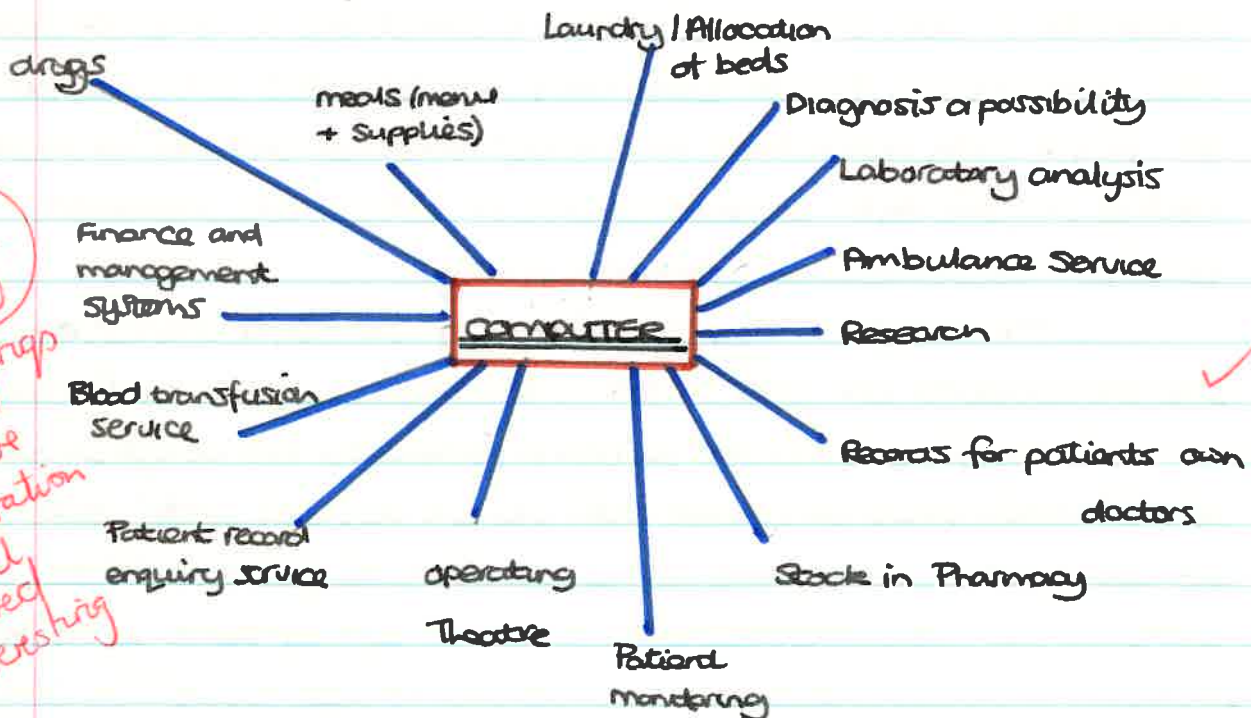
At the Pharmacy stocks of drugs can be monitored and listed and the computer can order drugs in the same way as the food above.

Computer diagnosis is now a possibility but a large amount of information would be needed with all the diseases under the sun with all the symptoms and combinations of symptoms related to them, and not all diseases produce the same ~~symptoms~~ symptoms in different people, and someone might just be a carrier. A large mainframe would probably be needed for diagnosis - but research could easily be done as not so much information is needed at once and molecular

models etc could be done by computer graphics, also the computer can find links between diseases and other factors such as area (whether you live by a Nuclear Power Station), chemicals in food, chlorine and fluoride in drinking water and drugs such as those used to treat arthritis (Opren) and computerised models can be used to show parts of the body.

Using computers in medicine creates extra jobs for systems analysts and programmers, but health service wages are low and few computer experts are prepared to work for them. Patients should have no problem accepting computers in the health service, especially if it means that they will get better attention and treatment. People have raised matters of privacy as far as records are concerned as people can access computers, but if cards for example were used it would be no easier than accessing old-fashioned paper files. Training and the nurses and doctors to use the computers is a greater problem as there is enough training as it is to get into the medical world

Some of the uses of computers in hospitals

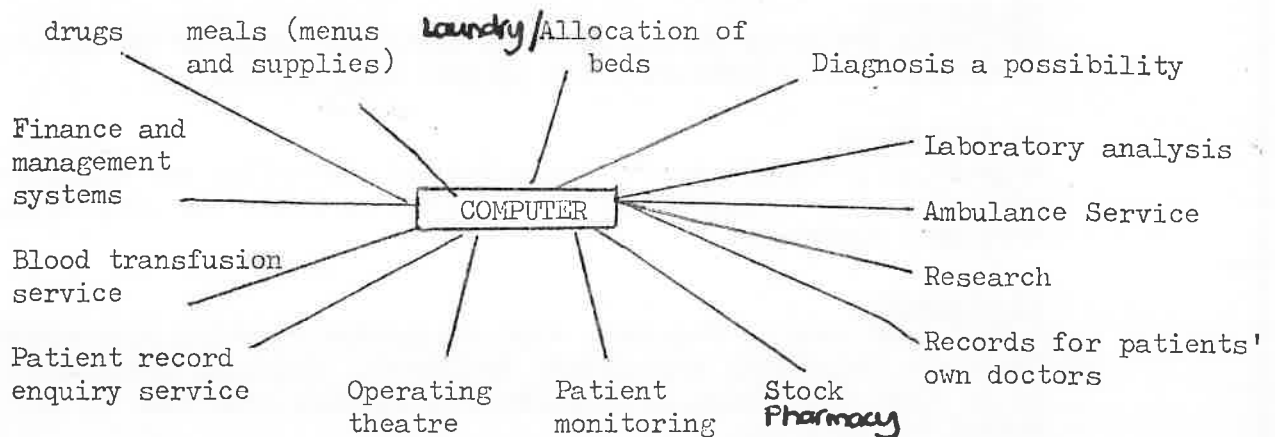


18/20
Headings would improve presentation - well covered & interesting

COMPUTERS IN MEDICINE

Computers can be used in medicine both for data processing (e.g. maintenance of patient records) and in a direct medical sense (e.g. monitoring a patient's condition). The removal of routine work from medical staff allows them to devote more time to patients and to the study of medicine.

Some of the uses of computers in hospitals are:



a) Patient Records

Each patient's file contains a considerable volume of information from various sources. It will be updated with information about drugs used, treatment given, X-ray results, blood pressure, weight, etc.

Using a computer, VDUs are scattered throughout hospital wards, operating theatres, laboratories and offices. Each patient is identified by a number, and the VDU keyboards can be used to add information to each patient's file. During treatment or an operation, the doctor can study the patient's case history by keying in a request for appropriate parts of the file to be displaced on the VDU.

b) Intensive Care

The computer can be used to monitor critical features such as respiratory rate and volume, pulse count, blood pressure, temperature, etc. The signals can be displayed continuously for the doctor, analysed by the computer and warning alarms set off to alert staff of critical conditions.

Patient care is improved because:

1. Nurses can concentrate on direct patient care when computers take over the repetitive and time-consuming measurement and record keeping functions.
2. Uniformity and reproducibility in data collection gives a complete and reliable medical record.
3. A continuous watch is maintained for out-of-tolerance parameter measures and detectable trends.
4. Continuous computer adjustment of therapeutic interventions can provide a level of control unattainable by the periodic human supervisor.

Cont....

c) Pathology laboratory data analysis

The computer can automatically evaluate the results of tests and produce reports speedily for doctors.

d) Diet and food supplies

Computer systems can deal with diet order processing, menu planning, food inventory control, purchasing and special diet therapy planning.

e) Pharmacy

Following the entry of the doctor's order the computer can update medication schedules, drug inventories and prepare drug labels.

f) Admissions

Details of bed availability for scheduled admissions and emergency admissions can be maintained on the computer which can also prepare all necessary documents.

g) Diagnosis

A vast data bank is required, with the system learning from successful cases and suggesting appropriate treatment. Problems occur when there is no clear definition of an illness or doctors miss some of the symptoms needed for matching.

h) Health screening

Some local Area Health Authorities have attempted to screen the population of an entire area using questionnaires that can be read optically.

i) Blood Donor Organisation

Computer files hold details of each donor. Donors can be selected according to the blood requirements and the location of mobile units, taking into consideration any notifications of recent illness.

j) Immunisation and Vaccination

The computer can be used to make appointments at a child's own doctor or clinic, with the system being kept up-to-date with confirmation of treatment.

k) Medical Research

i) Statistical procedures can be used to test potential causal relationships in biological medicine, e.g. evaluation of old and new drugs, environmental and hereditary causes of disease.

ii) Simulation

Computer-based models can be used to develop a better understanding of biological systems.

Computers in Shops

Computers can be just as useful in shops as anywhere else. It can be used for everything from machine readable ticket to payroll and stock control. A lot of shops already have computers, and manufacturers are helping out by printing bar codes on their products.

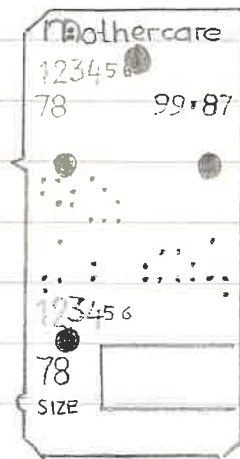
Machine Readable tickets

Quite a number of shops use machine readable tickets. These are tags containing data in a form which can be read by a machine, though the information is usually printed as well for the benefit of customers and staff.

The information on the ticket depends on what it is going to be used for. Generally there will be a code number, identifying the item concerned, and details of size, colour etc where they are needed. In most cases prices are not included in the information on the tag

Kimball tags

Kimball tags contain punched holes similar to those in paper tape. In fact the ten rows of holes are really two portions of five track code. Numbers are represented by binary code as with all tickets used with computers. A punched hole represents a '1' and an absence of a hole to represent '0'



Kimball tags use even parity so 4_{10} would not be represented by 00100_2 but by 10100_2 . In normal binary the column readings are 8, 4, 2, 1 but in the Kimball tag system they are 7, 4, 2, 1. This means that the digits 1-9 can all be coded using only two holes each, reducing the chances of holes being misread or mispunched. Other symbols are also needed on the tags such as "E" and the decimal point. It is common practice to use

the same codes for these as are used for the digits. For example 00011 might therefore mean either 3 or '6' depending upon where on the tag it was punched.

Mothercare is a company with relatively few suppliers, and stocks a smaller range of goods than the average chain store. The company chooses goods it thinks it will be likely to sell over a six month period and publishes a catalogue showing these goods. This means that any goods sold in that period simply need to be replaced. The introduction of Kimball tags has made it possible for this to become totally automatic. Most items have these tags and are removed when it is purchased and are put on a spike through a specially punched hole. There is a second type of tag called a bulk tag, this is used for small items such as nappies which do not merit individual tags. This is removed when a packet of nappies is opened and put on the shelf.

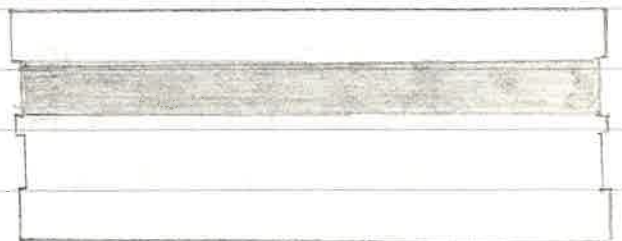
Computer Processing of Kimball tags:

The tags are sent twice a week to the Computer centre together with a Batch Header Tag. This contains a code which denotes which branch of Mothercare has sent them. The computer then prints and sends an order and replacement tags to the relevant suppliers and the goods can then be sent straight to that particular branch.

Many shops attach two- or three-part tags to their goods. When the supplier delivers the goods to the shop the first part is sent to the computer, and the second part is sent when the item is sold. For a three-part tag the last part is given to the customer as a receipt or kept in case the second part fails to reach the computer.

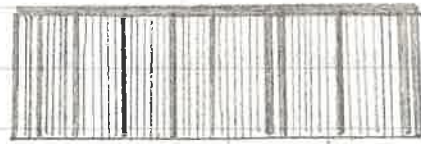
Magnetic Tags

Magnetic tags code information as magnetized spots on the tape, instead of using holes as Kimball tags do. A machine which is capable of detecting the magnetized spots is necessary to read the tags.



Bar Codes

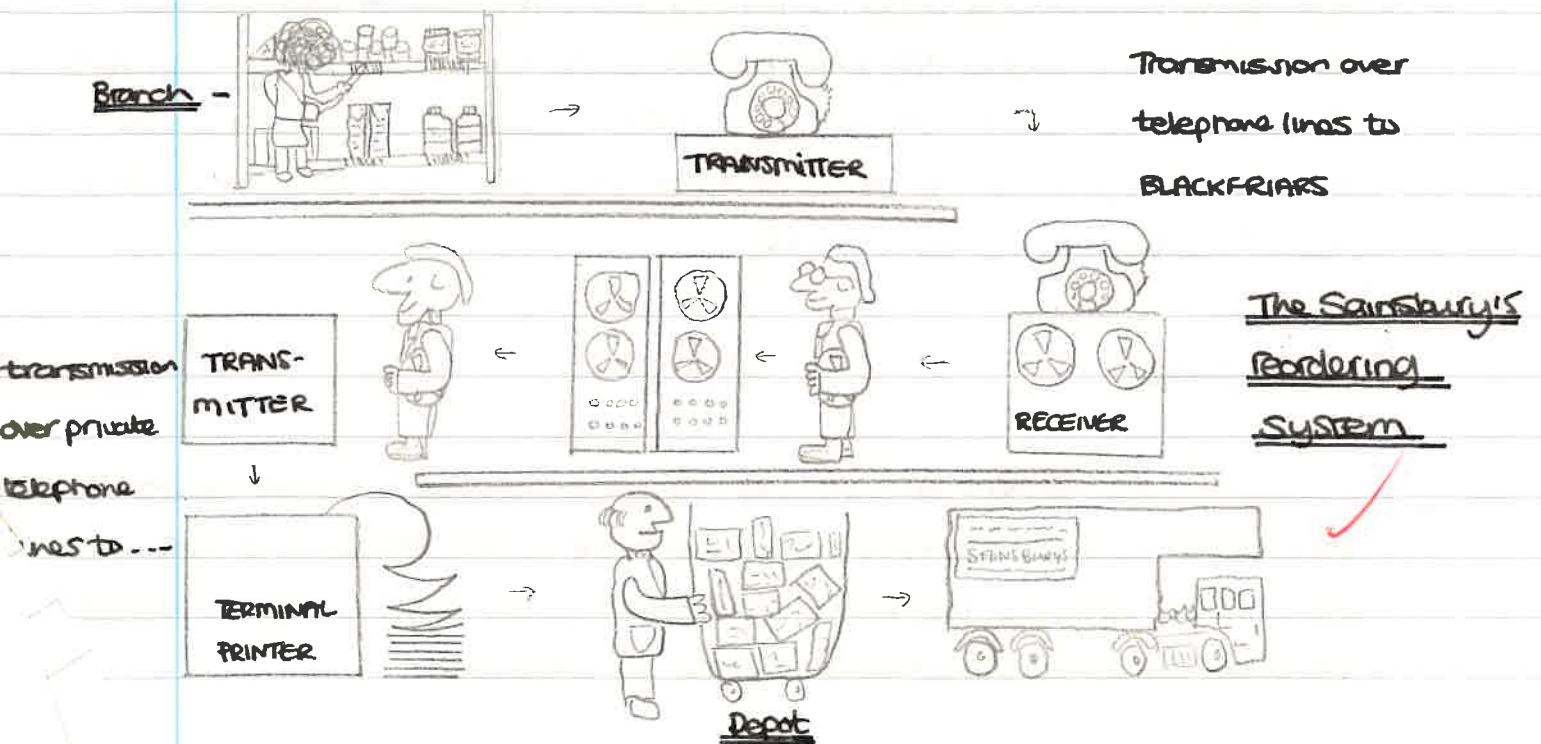
Bar codes store information using thick and thin lines. When a light beam is passed across the tag it is possible for a machine to decode the information.



The Sainsbury Supermarket chain use bar codes attached to the shelf control the reordering of food. The ticket contains information in two forms, a bar code which is read using a light-pen and printed information for the shop assistants. Reordering is a simple task. The light-pen is passed across the bar code and the estimated quantity needed is typed in.

Computer processing of bar coded information

Data is recorded on a hand-held or shoulder unit. Once the order has been completed the unit is attached to a transmitter on the telephone. The central computer automatically phones the shop up in the evening and receives the order over the telephone. The depot nearest the shop is then informed of the order by telephone and is printed out, using a remote printer, in the order in which the goods are stocked in the depot, to make life easier for the people who work there.



Benefits of bar coding

All this activity is taking place while the shop is shut, so it is possible in some cases to receive goods the morning after they were ordered. This way there is less inconvenience to the customer and the shop is less likely to 'sell out' of a certain item. Food remains fresher, and far less needs to be held at the back of the shop. The shops can therefore be smaller, not having such a big store at the back, and in city centres where rent and rates are high. Instead large depots are built where rent and rates are relatively low.

The manager receives with the order detailed instructions of what orders are discontinued, about new items, and even how many part-time staff will be needed to restock shelves in the evenings.

Point of sale systems

In 1978 bar codes began to be printed on food packets themselves, like the one to the right from a tin of baked beans, due to an agreement that had been reached by a group of large British companies. The label identifies the manufacturer of the item, and the item. They do not contain the price because at the time of printing the price is not known. The sale of each item is recorded on a cassette. The label is read either by a light pen or scanning it with a laser beam on the counter. Using this system, unlike the Sainsbury system there is no need to estimate the numbers of items needed, they are all on cassette.



Other uses

Computers can be used for other things in shops apart from stock control. The most common of these is the processing of staff wages. The method used for transmitting the stock data can equally well be used for data concerning the hours worked by shop staff.

Also, if the computer is used for stock control it is then possible to keep details of the money owed to each supplier and print cheques in payment.

For efficient deliveries a computer could plan the routes from warehouse to shop, the load which every van can take, the distance, the cost of petrol etc.

Filing systems

Transaction file

Information from the tags, and from the lists of goods received are combined to form the transaction file.

Master file



Updating a master file

good -
interesting ↑
well laid out
18
20.

The transaction file is sorted and then merged with the old master file to form a new master file and management statistics and reorder list which orders items needed from suppliers.

- 3 Liaising with the users who originate the data to ensure:
 - (i) that the users are satisfied with output results,
 - (ii) that the quality of input data is acceptable for data preparation.
- 4 Keeping records of the work processed.
- 5 Liaising with operating and preparation staff to ensure a steady flow of work.

16 The Social Impact of Computers

16.1 CHANGES IN BUSINESS AND SOCIETY

16.1.1 GENERAL

It is clear that our way of life is changing rapidly, for most people both at home and at work – in fact for many people the important change in their lives is that they have no work. It is also clear that modern technology, particularly computer technology, is helping to make the changes happen. There is not complete agreement on:

- (i) whether the changes are beneficial and, if they are, who they benefit, or
- (ii) what controls there should be over the new methods – particularly whether the laws should be changed.

To answer questions on the subject it is necessary to keep an open mind and to know the relevant facts. For this reason this Unit contains both facts and arguments. As far as possible the arguments are given fairly on both sides.

16.1.2 MICROPROCESSORS AND THE INFORMATION REVOLUTION

Facts

The first microprocessor (the Intel 4004) was introduced in 1971. The main significance of these devices lies in their cheapness, reliability and small size (see Unit 13.2.4), which enables them to be used in far more applications than previous processors. In fact their use has already become widespread.

Examples of the uses of microprocessors

- (i) To monitor and control the operation of equipment, e.g.
 - (a) a 'robot' programmed to weld the joints on a car during manufacture,
 - (b) a fully automated greenhouse, in which the temperature and humidity are kept constant; a microprocessor controls the ventilators, the watering and the heating,
 - (c) controlling the fuel flow in a car to lessen petrol consumption and lessen the pollutants in the exhaust fumes.
- (ii) In offices an array of equipment is available which together is being referred to as the 'electronic office', e.g.
 - (a) word processors
 - (b) workstations which can communicate with other workstations and can store information, eliminating a lot of the previous requirement for paperwork.
- (iii) In the home, e.g.
 - (a) many new models of automatic washing machine are microprocessor-controlled,
 - (b) in video game devices,
 - (c) in home computers,
 - (d) in devices for communicating outside the home, e.g. with information systems such as Prestel.

- (iv) In small business computers, e.g.
 - (a) in newsagents and other shops,
 - (b) in estate agents.
- (v) In schools. In the early 1970s it was inconceivable that an ordinary school could purchase its own computer, but the microcomputer has changed that completely. The Government's Department of Industry has announced a scheme which will soon make it unusual for a school not to have one. It is already not uncommon for a school to have quite a number of microcomputers.

The use of integrated circuits other than microprocessors has also been important, e.g. in watches, cameras, radios, calculators.

Recent British Governments have recognized these changes as being important and, despite the economic recession, have financed three schemes:

- (i) Inmos – a firm which makes integrated circuits,
- (ii) the Microprocessor Application Project, with the main aim of helping industry to take advantage of microelectronic products,
- (iii) the Microelectronics Education Programme to develop work in schools.

Arguments

The main arguments centre round the extent of the impact of this new 'information revolution' and on whether it is beneficial to us. Different people consider:

- 1 That the integrated circuit manufacturers are having difficulty finding things for us to do with their products, and that their major impact on the average home is in computer games. The new technology will make life easier but it will not really change it significantly.
- 2 That this new revolution is more important than the Industrial Revolution. It will:
 - (i) give us more leisure time,
 - (ii) improve the quality of our lives,
 - (iii) completely change our job structure, creating interesting jobs in the 'information industry' as boring ones are lost from traditional manufacturing.

We must enter the new age with enthusiasm or the rest of the world will leave us behind.

- 3 The changes taking place are harmful to society:
 - (i) the centralization of information by large companies and Government departments may help them, but it makes them inaccessible to us and takes away our privacy,
 - (ii) the technology is being used to divide society – to improve the quality of life of the rich but not of the poor.

Which of these three is nearest the truth remains to be seen, and may still be argued about when the 'revolution' is over.

16.2 PERSONAL PRIVACY

People are worried about their rights:

- (i) to withhold information about themselves,
- (ii) not to have data about them passed from one data bank to another without their knowledge or consent,
- (iii) to find out what information about them is stored anywhere,
- (iv) to correct inaccurate data.

Facts

- 1 In recent years, as computer technology and communications have improved, there has been an increasing tendency for large private and public organizations to centralize large banks of data.

Examples of centrally held data

- (i) The police hold records on large numbers of people. These records include:
 - (a) The Police National Computer, which has information on about 23 million people and includes data on:
 - people with criminal records,
 - fingerprints,
 - stolen or suspect vehicles,
 - vehicle owners.

- (b) The Special Branch Computer, which stores data on over 2 million people, many of whom are not criminals or even suspected of crime.
 - (ii) The Driver and Vehicle Licensing Centre at Swansea. Information about all drivers and their cars is now held at this centre. Uses of this data have included:
 - (a) tracing owners of a particular make of car for the manufacturer so that they can be recalled for checking,
 - (b) finding the most recent addresses of people who are dodging Income Tax.
- 2 Many other countries give citizens better protection than Britain does. Britain is at present unable to ratify the European Convention on Data Protection until satisfactory laws are passed.

Examples of data laws in other countries

- (i) *Sweden* – the Data Act of 1973 gives a citizen the right to be present while an official checks centrally held information. If the citizen objects to anything, an independent arbitrator decides what should be changed.
 - (ii) *USA* – a 1974 amendment to the Freedom of Information Act gives citizens the right to be shown all information held about them by Government agencies.
 - (iii) *France* – a law passed in 1978 bans references in computer files to citizens' religion, politics, race or health. Anyone has the right of access to data about themselves if they think the information held infringes the privacy laws. It is thought each person in France is referred to in about 500 files.
- 3 In Britain there is very little protection for individuals. The present situation is:
- (i) 1972 – the Younger Commission reported that there were then few abuses but that they could happen,
 - (ii) 1975 – a Government white paper announced the intention to pass laws on the subject,
 - (iii) 1978 – the Data Protection Committee recommended among other things that:
 - (a) All bodies holding personal information in computers should be made to register with a Data Protection Authority.
 - (b) Data could not be exchanged between computers without permission.
 - (c) People giving information about themselves should know what it was to be used for.
 - (d) People should be able to find out what information is held and correct it if necessary.
 - (iv) 1983 – a Data Protection Bill to carry out these recommendations *failed* to get through Parliament. One important objection to it was that it relates only to computerized data – the National Council for Civil Liberties reports that about 80% of present abuses relate to data which is not on computer files.

Arguments

In favour of more rights for individuals

- 1 The data stored could be used in a 'Police State'. Although there seems little danger of this at the moment, countries such as Chile, with a long history of democracy, have recently been taken over by dictatorships.
- 2 There are many cases where incorrect data is stored relating to such matters as credit-worthiness and traffic offences. Often people have no way of knowing what is stored about them.

In favour of free use of information

- 1 We would never have a Police State in this country. The use of files by the authorities only works against those who are breaking the law in some way and is protecting the rest of us.
- 2 Stories about incorrect data relate to very few cases and are often exaggerated. The proposed measures to protect people would be expensive to put into practice.

16.3 THE EFFECT ON UNEMPLOYMENT

Facts

- 1 In Britain over five years (1978 to 1983) the number of people out of work has risen by about 2 or 3 million (depending on how the numbers are measured). There is a similar problem in many of the other industrialized countries of the world.
- 2 During that same time the amount produced in goods and services has fallen, but not a great deal. In other words roughly the same amount of work is being done by fewer people.

- 3 During the last 20 years the average number of hours worked by each person who has a job (including overtime) has not changed much. A recent survey showed that it has risen slightly.
- 4 If the technology available now were used to the full, the work done at present could be done by far fewer people.

Examples of work which requires fewer people than at present

- (i) It is generally accepted that with a word processor a typist can get through between 1.5 and 6 times as much work as with a typewriter, depending on the kind of work being done.
- (ii) Many workplaces, manned at present, can be completely automated. This has already been happening, e.g.
- (a) telephone exchanges,
- (b) waterworks, many of which now only have to be checked occasionally.
- 5 The introduction of new technology does produce a whole new range of jobs – in the design and manufacture of equipment, in producing software, and in sales and maintenance.

Arguments

In favour of the technology

- 1 Other countries are introducing new technology. If we do not compete with them we will have even greater unemployment. Computers can be used to increase productivity, so that the same number of people are needed, but more work is done.
- 2 As more and more work is done by machines there will be more leisure time for all of us. Society's attitude to being unemployed will change. People without work will no longer be ashamed of it – or short of money.
- 3 The introduction of computers gets rid of all the boring jobs and produces new and more interesting ones. People are released from repetitive tasks and so their work can become more creative. Someone has to design and make all the new devices and program the computers.

Against the technology

- 1 Britain, and in fact the whole world, is in a state of recession. In this situation if one firm uses new technology to produce more, then someone somewhere else is put out of work.
- 2 There has not been any sign of the 'Age of Leisure' yet. Those with jobs work just as long, and the unemployed have so little money and are so worried by their situation that they cannot enjoy the extra time they have.
- 3 (a) The interesting jobs are all being created for skilled and highly qualified people. Those who previously did the boring jobs either have not got one or their job is less rewarding than before.
- (b) Even if the introduction of new equipment does create new and interesting jobs, these cannot be done by the people whose jobs are replaced.

Examples of changes in job

- (i) If word processors are introduced into an office, then the following results.
- (a) Fewer typing staff are required to do the same amount of work.
- (b) Word processors are more complicated and more expensive than typewriters, so that more people are involved in their design and manufacture.
- (c) The typists tend to have less job satisfaction – there is now less skill in avoiding errors, and in the layout of the work. Also the word processors can keep a record of productivity. This helps the management but many typists do not like it, as they feel spied on.
- (d) The machine is far more versatile than before. The work produced is of a better standard.
- (ii) A shop-keeper buys a small computer and some software, to help with his stock-taking and accounts. The result is a better service to customers, more leisure time for the shop-keeper and some work for the hardware and software firms.

Computers and Society

Choose 1 of the following and plan/prepare a 3-4 page essay.

1. "The only thing I want is Facts. Teach the boys and girls nothing but Facts. Facts alone are wanted in life. Plant nothing else, and root out everything else."

Charles Dickens Hard Times

These words were first published by Charles Dickens in 1854. Write, with reasons, the extent to which you think computers are making this a real issue.

2. Give your opinion on the question of unemployment caused by the introduction of computers.

3. Discuss about the use of computers for storing and conveying information about people. Try to list the advantages of computer methods over manual methods with the benefits that arise. Refer also to the point of view of the individual, to some of the dangers that arise.

During the last few years computers have been gradually taking over the world.

Drew

Computers and Society

3. Write about the use of computers for storing and processing information about people. Refer to the advantages of computer methods over manual methods and the benefits that arise. Refer also, from the point of view of the individual, to some of the dangers that arise.

If you walk into nearly any building society these days, and behind the counter is a row of people, all sitting at computer terminals. You hand them your book and money for a deposit, the amount and details about the customer are entered into the computer, the book is put into the printer, and tracks it, their files and your book up to date. This must be considerably quicker than filling in forms, sending them off to head office, and having them processed. Before the invention of the computer, banking must have been a nightmare, records about a certain customer, on paper in a file had to be found, manually updated, and then put back. This can now be done with a computer and the press of a few buttons on a keyboard. The efficiency and accuracy of the whole operation, and the benefits must outweigh the cost of initially installing and then maintaining a computer system ✓

Although the use of computers in banking is not as major a concern as that of the police computers, problems can still occur, numbers can be typed in incorrectly and not noticed, credit card companies, readers digest etc, could look into your account through your account, and a man in America actually stole money from his bank, using his home micro-computer, a telephone and a modem, but there is only as much chance, probably less chance of this happening at the moment, as someone walking into a bank with a shotgun and demanding money. ✓

The main concern of people at the moment, especially after the film "War Games" is the information held in police computers. As the film shows, no system is "hacker-proof" and somebody did actually get access to the NATO computer over the phone in America using a Commodore VIC-20 - hardly the most sophisticated computer around. ✓

✗ I feel that a lot of the concern is without reason, as it is probably easier to alter or destroy old-fashioned files on paper as it is computer files

and equally to access, and won't make any difference at all to spies planted in police and government offices. With the aid of computers, the police can spend a lot less time sorting out files and records and spend more time looking for criminals, and as for people who want the right to see information held about them, there is only as much chance as there was when the police manual filing methods.

Today a lot of people are leaving old-fashioned "snail-mail" and turning instead to electronic mail. Although electronic mail might be faster than the postage system, one can send a letter to someone else, feeling reasonably confident that it will get there without being read, unless that it is it comes out of the envelope or the address cannot be found. This is not so for electronic mail as a lot of businessmen know, who have had their mail tampered with know. The mail is tampered with by a new breed of person, just evolving, called the hacker. The only things you need to become a hacker are

- (i) a computer,
- (ii) A modem / acoustic coupler,
- (iii) a telephone, and
- (iv) a list of telephone numbers of bulletin boards and electronic "post offices"

add to this a big nose and a sick sense of humor, and you get the type of person who will go around cracking codes and altering people's mail, and leaving messages like the Hackers song.

One solution to this problem would be to not make them available via the telephone network, but through a direct line, but this would be more expensive, and once a hacker had got a line we would be back to square one.

B
Not enough