

Booklet 2

This covers the following topics found in section 2 of the computer studies syllabus:

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Systems Analysis

A systems analysis team is often brought in to improve on an existing system. Frequently this involves moving from a paper-based filing system to one which is computerised. The following revision notes describe some of the key stages in a systems analysis study.

Many of the topics are covered elsewhere (such as how to choose hardware, validation techniques, testing, etc.).

2.1 Feasibility Study

This involves writing a report to convince management of the merits of adopting the proposed new system. Some aspects of the study include:

- Terms of reference:
 - objectives
 - boundaries
 - constraints
- Description of the existing system (including any problems and the projected costs)
- Criteria (essential requirements and desirable features of the proposed system)
- Solution (including development plan and cost/benefit analysis)

If the feasibility study is accepted then the systems analyst moves to the next stage which is a full analysis of the system.

2.2 Analysis

The analysis involves some or all of the following stages:

- Fact finding – this is usually done in four ways (see page 2)
- Understanding the current system
- Produce data flow diagrams
- Identify the user requirements
- Interpret the user requirements
- Agree the objectives with the user
- Collect data from the current system

Fact finding

Observing the existing system first hand

This involves watching the personnel using the existing system to find out exactly how it works. There are a number of advantages and disadvantages of using this method to gather information about the existing system:

- Advantages
- the analyst obtains reliable data
 - it is possible to see exactly what is being done
 - this is an inexpensive method compared to other techniques

- Disadvantages
- people are generally uncomfortable being watched and may work in a different way
 - what they are watching may not be representative of a typical day's work
 - if workers perform tasks that violate standard procedures, they may not do this when being watched!!

Questionnaires

This involves sending out questionnaires to the work force and/or to customers to find out their views of the existing system and to find out how some of the key tasks are carried out. As with observation, there are a number of advantages and disadvantages in using this technique:

- Advantages
- questions can be answered quickly
 - an inexpensive way of gathering data from a large number of people
 - allows individuals to remain anonymous
 - it is quick to analyse data

- Disadvantages
- number of people returning questionnaires is often quite low
 - questions asked tend to be rather inflexible
 - no immediate way to clarify a vague/incomplete answer to a question
 - it is difficult to prepare a good questionnaire

Interviewing

This involves a one to one question and answer session between the analyst and employee/customer. A good method if the analyst wants to probe deeply into one specific aspect of the existing system. As with the previous method, there are a number of advantages and disadvantages:

- Advantages
- opportunity to motivate the interviewee to give open and free answers to the analyst's questions
 - allows the analyst to probe for more feedback from the interviewee (easier to extend a topic than it is when using questionnaires)
 - can ask modified questions or questions specific to the interviewee based on previous responses

- Disadvantages - can be a very time consuming exercise
- can be expensive to carry out
 - unable to remain anonymous

Looking at existing paperwork

This allows the analyst to see how paper files are kept, look at operating instructions and training manuals, check accounts, etc. This will give the analyst some idea of the scale of the problem, memory size requirements, type of input/output devices needed, and so on. They will often gain information not obtained by any of the other methods described above. However, it can be a very time consuming exercise.

2.3 Design

Once the analysis has taken place and the systems analyst has some idea of the scale of the problem and what needs to be done, the next stage is to design the key parts of the recommended system. The following is a list of tasks that are usually done (this is by no means an exhaustive list):

- design the data capture forms/input forms
- design the screen layouts
- design output forms and reports
- produce systems flowcharts and/or pseudocode
- select/design any validation rules that need to be used
- select the most appropriate data verification method(s)
- file structures/tables need to be designed/agreed
- select/design the hardware requirements for the new system
- select/design the software requirements
- produce any algorithms or program flowcharts
- design a testing strategy/plan

2.4 Implementation

Once the “final” system has been designed it is then necessary to put together the hardware and software and introduce the new system. There are many stages in this complicated process:

- produce the documentation; there are two basic types here to consider:

User documentation

this usually consists of:

- how to load/run the software
- how to save files
- how to do a search
- how to sort data
- how to do print outs
- how to add, delete or amend records
- the purpose of the system/program/software package
- screen layouts (input)
- print layouts (output)
- hardware requirements
- software requirements
- sample runs (with results and actual test data used)
- error handling/meaning of errors
- troubleshooting guide/help lines/FAQs
- how to log in/log out

Technical documentation

this usually consists of:

- program listing/coding
 - programming language(s) used
 - flowchart/algorithm
 - purpose of the system/program/software
 - input formats
 - hardware requirements
 - software requirements
 - minimum memory requirements
 - known “bugs” in the system
 - list of variables used (and their meaning/description)
 - file structures
 - sample runs (with results and actual test data used)
 - output formats
 - validation rules
- install the hardware and, if necessary, the new software
 - fully test the new system once installed

it is necessary to develop a proper testing strategy to ensure all possible scenarios are covered and that all error trapping techniques are fully tested; for example if inputting data to represent somebody’s age, the test plan may include: 0, 5, -2, fred, 3.5, 215, 85 etc. to see whether each piece of data is correctly dealt with; test data often falls into 3 types:

normal data

- this is data which is acceptable/valid and has expected outcomes (for example, if a date is being input the day should be in the range 1 to 31)

abnormal/erroneous data

- this is data outside the limits of acceptability/validity and should cause an error message to be generated (for example, if a date is being input the day can't be -1 or 50 etc.)

extreme/boundary data

- this is data at the limits of acceptability/validity (for example, if a date is being input, the two values at the extreme limits of valid days would be 1 and 31)

- train the staff to use the new computer system
- transfer the paper files across to the new system; this may involve the following:
 - scanning in the documents
 - keying in the data
 - create databases etc. to allow downloading of files etc.
- changeover to the new system

change over is usually done in one of four ways; the following notes summarise these methods and gives advantages and disadvantages of all the techniques:

direct changeover

with this technique, the old system is stopped and the new system is used straight away;

- this method can be disastrous if the new system fails at any point
- however, the benefits are immediate and less time is wasted
- costs are reduced (only one system in use so save on staff costs)
- less likelihood of a malfunction since the new system will have been fully tested

parallel

with this technique, the old and new systems are run together for a time

- if the new system goes down for any reason, you still have the old system to fall back on so a failure wouldn't be disastrous
- it is possible to gradually train staff/time to get used to the new system
- more expensive than *direct* since need extra staff to run both systems
- more time consuming since both systems need to be run and evaluated

pilot

with this technique, the new system is introduced into one part of the company (e.g. into one warehouse of a supermarket) and its performance assessed

- if the new system fails only one part is affected; the rest is still functional
- it is possible to fully train staff in one area only which is much quicker and less costly than *parallel*
- the costs are also less than *parallel* since only one system is being used in the *pilot* warehouse

phased

in this technique only part of the new system is introduced and only when it proves to work satisfactorily is the next part introduced, and so on, until the old system is fully replaced

- if the latest part fails, only need to go back in the system to the point of failure; hence a failure isn't disastrous
- more expensive than *direct* since it is necessary to evaluate each phase before moving to the next stage
- can ensure the system works properly before expanding

The following table summarises the risks involved in all four methods:

Method	Relative costs	Input needed by the user	Input needed by Systems team	Impact of failure of method
Parallel	High	High	Low	Low
Pilot	Medium	Low	Medium	Low
Phased	Medium	Medium	Medium	Medium
Direct	Low	Medium	Low (if successful; otherwise VERY High)	High

2.5 System Maintenance and Evaluation

Once a system is up and running it is necessary to do some evaluation and carry out maintenance if necessary. This is summarised below:

- compare final solution with the original requirement
- identify any limitations in the system
- identify any necessary improvements that need to be made
- evaluate the user's responses to using the new system
- compare test results from new system with results from the old system
- compare performance of new system with performance of old system
- update hardware as new items come on the market or the company changes in any way which requires new devices to be added/updated
- update software if necessary if company structure changes or legislation is introduced which affects how the company operates

(text in blue refers to evaluation and text in green refers to maintenance)

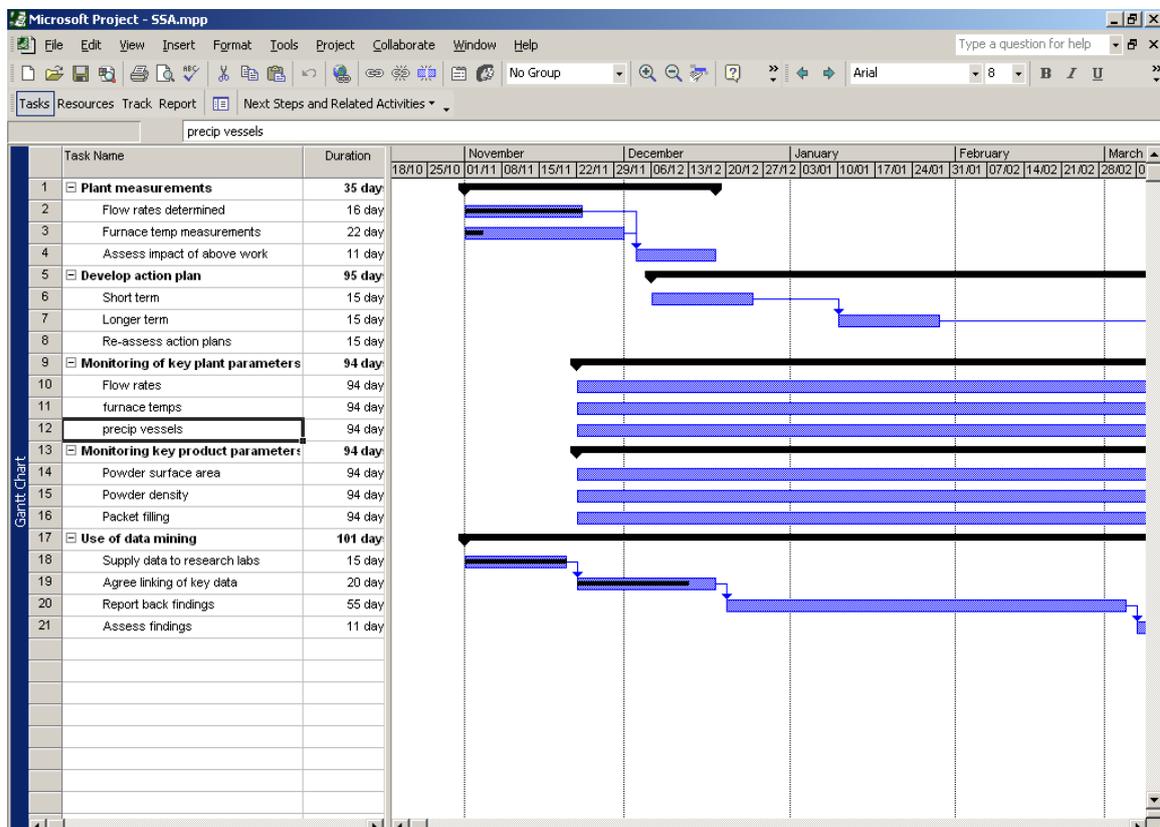
2.6 Other information

Tools

Systems analyst have a number of tools to help them in carrying out their work. Since many of their projects are for big companies it is necessary to keep track of costs, resources and time. The following are only mentioned as a **basic introduction and a guideline for further study**:

- Gantt charts show
 - all stages/tasks to be done
 - the critical path(s)
 - key project milestones
 - number of days to do tasks
 - progress on tasks as % complete
 - progress versus expected time to do work
 - how tasks are all linked together
- Gantt charts allow emailing of tasks/project info to others automatically
- Gantt charts allow use of the intranet/email facility to post or download project information to others
- Gantt charts permit the use of PERT charts (A PERT chart is a type of chart used for project management; it represents each task of a project as a box (circle or rectangle), arrows between tasks are used to show the sequence and task dependencies (i.e. which tasks need to be complete before others can start).

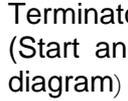
Below is a sample of a project summary using a Gantt chart:



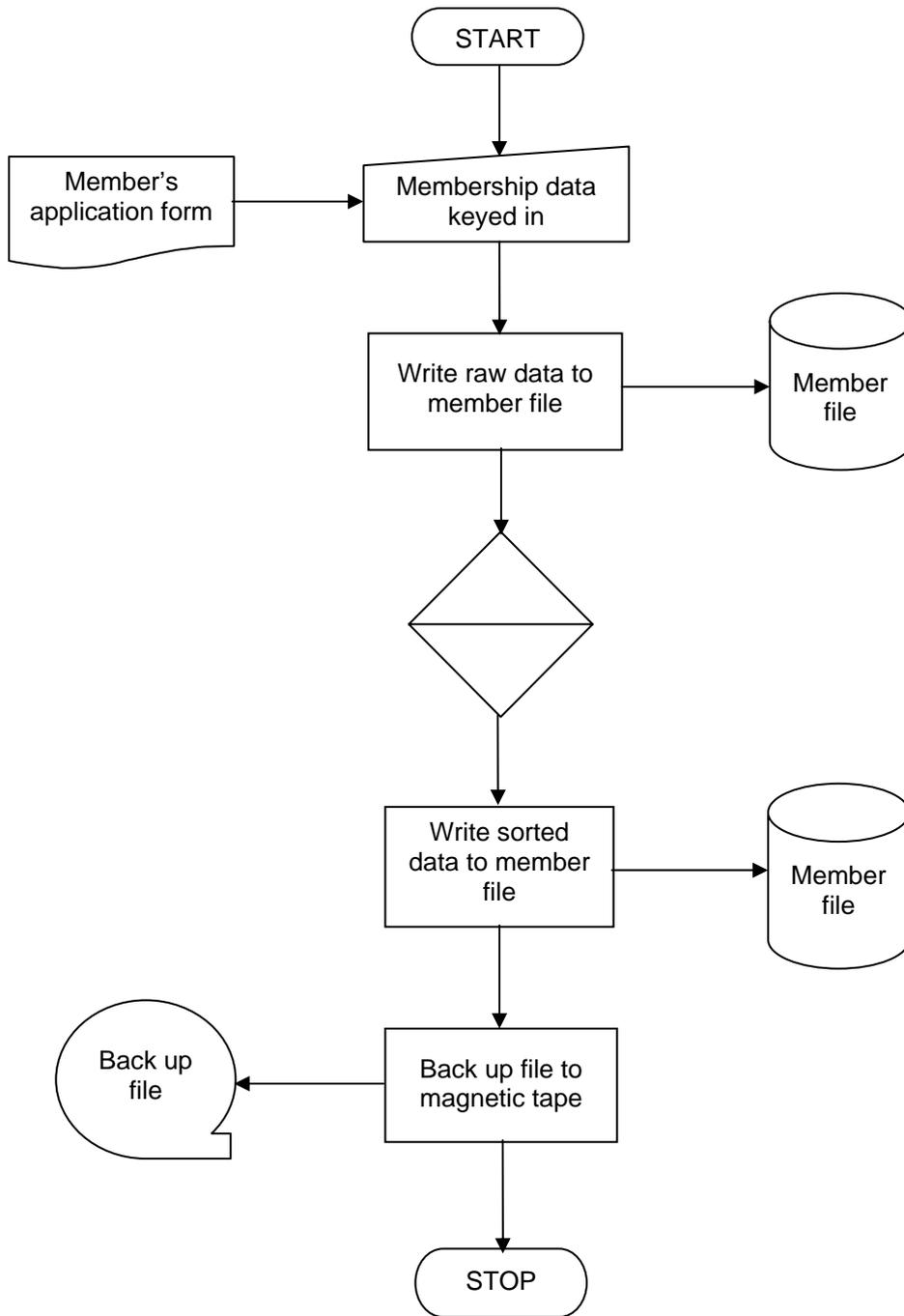
Typical Gantt chart showing some aspects of project management

System flowcharts

System flowcharts are used to show how all the components in a system link together (e.g. input, storage, output, processing, etc.). They are very different to normal flowcharts since they don't go into detail of how something is actually done – they are a general overview. The table below shows the most common system flow chart symbols:

 <p>Online storage (files stored on hard discs, etc)</p>	 <p>Connector (a link to or from another part of diagram)</p>	 <p>Magnetic Tape</p>
 <p>Visual Display Unit (Monitor)</p>	 <p>Terminator (Start and end of the flow diagram)</p>	 <p>Data processing operation</p>
 <p>Document output (printed hard copy)</p>	 <p>Manual input (e.g. keyboard)</p>	 <p>Merge (e.g. join two files together)</p>
 <p>Sort (alphabetical, chronological, numeric)</p>	 <p>Collate</p>	 <p>Communication line (e.g. telephone line)</p>
 <p>Hard disk (file)</p>	 <p>Connector, off-page. (link from this diagram to another diagram)</p>	 <p>Input/Output operation</p>

A simple example of a systems flowchart is shown below:



2.7 Problems

- (1)
 - (a) A systems analyst was brought in to computerise a paper-based car sales system. What methods could be used to gather data about the existing system? Give reasons for your choice.
 - (b) What would need to be done before the new computerised system became “live”?
 - (c) Why would PILOT and PARALLEL change over methods be suitable in this application?

- (2) A program is written to input daily temperatures. Name **three** types of test data that could be used. Give examples of each type of test data which could be used and discuss the outputs you would expect to get.

- (3) Name **five** tasks that would be carried out at the DESIGN stage in systems analysis.

- (4) Name **four** methods used to change over from a manual system to a new computerised system. Discuss the relative advantages and disadvantages of these four methods.

- (5) Describe how the effectiveness of a new computer system can be assessed.

- (6) What tools exist to help the analyst draw up an action plan and ensure that the project is completed on time and to budget?

- (7) What information would a systems analyst need to gather to decide on what hardware is required for a new computerised system?

- (8) What **five** items need to be included in the USER GUIDE and in the TECHNICAL GUIDE of a newly developed computerised system?

- (9) Choose **six** symbols used in systems flow charts and explain what each symbol means.

(10) A company selling CDs and DVDs presently uses a manual, paper-based system to keep track of:

- stock levels
- files containing CD and DVD information
- sales information

The company has shops in five major cities.

When a customer comes into the shop s/he goes to the desk and either asks the assistant to find a particular CD/DVD. The shop assistant locates the files for the item the customer has requested and,

- (i) checks if it is stock
- (ii) checks the price of the CD/DVD
- (iii) finds where the CD/DVD is in the shop

If the customer has already found the CD/DVD in the shop s/he takes it to the desk and the shop assistant finds the item file to check for its price. The customer pays for the CD/DVD and the following then happens:

- shop assistant fills out a sales receipt and puts it into a file
- at the end of the day, all the sales are recorded and the number of each item in stock is updated
- if the number of items are low a request for new stock is filled out
- the value of the day's sales are recorded in an accounts book.

The new system

The system is to be computerised. The following will be created:

- (i) all CD and DVD data will be stored on a database
- (ii) all items for sale will have a bar code on them
- (iii) a sales file will be set up
- (iv) a database will be created showing supplier and customer details

A customer goes into the shop and finds a CD/DVD s/he wants to buy. The shop assistant scans the bar code on the item and the CD/DVD details have been found including its price. The stock files are updated (i.e. 1 is reduced from the number in stock) and the takings file updated. The stock levels for that item are checked and an automatic order is sent out after accessing the supplier database.

If the customer has requested the assistant to find a particular CD/DVD the assistant keys in the name/artist and finds out if the item is in stock, where it can be found and its price (the next stage is the same as above). If the item isn't in stock, the assistant takes the customer details and updates the database and adds a request for the item to be ordered and this is added to the customer's file.

- (a) Draw the systems flow charts to show how the above system will work.
- (b) Discuss the advantages of the new computerised system when compared to the manual paper-based system.
- (c) Why would the new system reduce the shop's costs?