

AQA AS ICT INFO1 Revision Guide (2008/10)

Practical Problem Solving in the Digital World

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Introduction

In this resource the main elements of each unit, according to the AQA AS Level ICT specification (2008) INFO1, are incorporated and divided into sections. The sections are numbered 1.1-1.10, but should you require them, the full AQA unit references from the specifications can be found listed on the following page.

This resource is designed to allow the learner to revise one unit at a time, while on the move carrying minimal paperwork.

The Revised checklist overleaf is for the learner to TICK (✓) once the unit has been revised and fully understood.

Also available from ZigZag Education by this Author are further resources for AQA AS Level ICT. The INFO2 Revision guide, to accompany this resource, and the INFO1 Practical Work Guide, which shows students the detail of what work is required for the analysis and testing sections for the practical work.

Revision Checklist

AQA Unit	Revised	Topic
3.1.1	<input type="checkbox"/>	Health and Safety in relation to the use of ICT systems
3.1.2	<input type="checkbox"/>	Analysis
3.1.3	<input type="checkbox"/>	Design of solutions
3.1.4	<input type="checkbox"/>	Selection and use of input devices and input media
3.1.5	<input type="checkbox"/>	Selection and use of storage requirements, media and devices
3.1.6	<input type="checkbox"/>	Selection and use of output methods, media and devices
3.1.7	<input type="checkbox"/>	Selection and use of appropriate software
3.1.8	<input type="checkbox"/>	Implementation of ICT related solutions
3.1.9	<input type="checkbox"/>	Testing of ICT related solutions
3.1.10	<input type="checkbox"/>	Evaluation of ICT related solutions

The bold sections above relate to material that has to be taken into the examination. This material will be used to answer questions in the examination but will not be marked even though it is submitted. As the work has to be free from annotations you will need to get your teacher to print off a clean document before your INFO1 examination.

What is needed for the examination?

The new specification is different from the previous specification as it does not require you to produce a formal project at AS level. It does, however, require you to develop your knowledge and understanding of the development of ICT systems through practical work using a range of application software in a structured way.

The range of applications should include the processing of text, images, numbers and sound.

However, you *will* need to hand in two pieces of work for the examination.

- The first is an analysis for the solution to a practical problem,
- The second a test plan plus the subsequent testing of a system (it need not be related to the work on the analysis).

This will be assessed in the examination; all work then has to be submitted at the end of the examination.

The work that you submit for the examination should be between 10 and 20 pages in length – any more pages and you could have difficulty finding the information in the examination.

All pages should be numbered sequentially, not split into sections.

You will need to refer to page numbers in the examination.

1.1 – Health & Safety in relation to the use of ICT systems

This section is separate from the other sections in this unit and covers all aspects of health and safety. As you are working on computers for a great deal of this unit you need to familiarise yourself with the dos and don'ts of using computer equipment. It looks at the need for and application of current health and safety legislation that relates to the use of ICT systems as well as health and safety guidelines which cover the design and introduction of new software.

Health & Safety and the Law

Employers responsibility

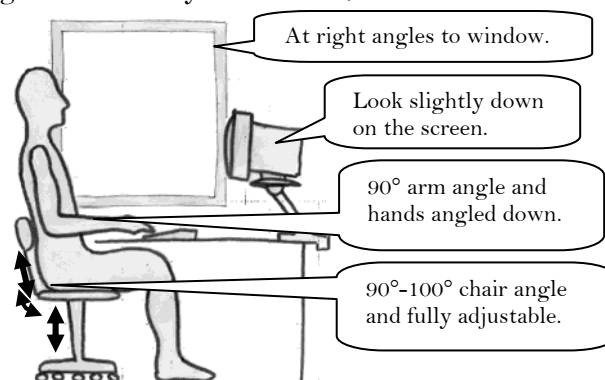
- Employers have the responsibility to make sure the equipment is used correctly and safely. Employees should not be allowed to plug and unplug electrical equipment unless supervised.
- Employers should ensure that the equipment is positioned where it can be easily accessed by employees without stretching, and without obstructing anyone
- Employers have to provide training to employees in the use of workstation components.
- Provide regular eye tests for workstation users and pay for glasses.

Remember you are not covered by the Act as it only refers to employees, i.e. people who are paid.

Other responsibilities

Ensure that:

- **Electrical:** safety testing is carried out regularly, each wall socket has only one cable plugged into it, all trailing leads are covered or tied up, there are no hanging mouse and keyboard cables, relevant fire extinguishers are used and serviceable.
- **Lighting:** lighting should be from above so shadows are reduced, work surfaces should be non-reflective, computer screens should be 90 degrees to the windows to prevent glare, blinds and curtains should be used to prevent glare.
- **Heat:** the temperature of the room should provide a pleasant working atmosphere.
- **Noise:** ICT equipment is noisy therefore noise pollution should be reduced.
- **Space:** access to workstation – aisles, positioning away from cramped or busy areas – corners and doorways, space between workstations for use of the mouse and for reading documents.
- **Comfort:** desk at right height – ergonomic seats that are adjustable, with tilting backrest, swivelling on a five-point base. There should be space under the desks for knees and legs, keyboards that can tilt, screens that can have the position adjusted and swivel, and the brightness and contrast adjustable. Screens should also be flicker-free, with the keyboard separately attached.
- **Regular breaks:** ensure that regular breaks are taken from looking at the monitor, to prevent eye-strain.
- **Software:**
 - Should be easy to use and adaptable to user's experience. Bad software can be extremely stressful to use.
 - Bad software slows you down due to to:
 - Inefficient design or bugs.
 - Incomprehensible error messages.
 - Use of non-standard keys.
 - Badly structured menus.
 - Poorly laid-out input screens.
 - Flashing effects and inappropriate colour usage can all lead to frustration on the part of the user.



Employee's Responsibilities

Use workstations and equipment correctly, in accordance with training provided by employers.

Bring problems to the attention of their employer immediately and co-operate in the correction of these problems.

Manufacturers of IT equipments are required to:

- Ensure that their products comply with the Directive. E.g. Screens must tilt and swivel.
- Keyboards must be separate and moveable.
- Promoting the use of Laptops NOT for the entering of large amounts of data.

Health and Safety

Problems caused by using ICT equipment

Here are a few examples of the problems that can be caused by using ICT equipment:

Stress

This is a major factor in work-related illness. Symptoms can include headaches, stomach ulcers, sleeplessness and loss of appetite.

ICT systems put additional pressure on employees:

- They may be used to monitor performance.
- They induce fear and panic particularly in older people.
- Constantly bring about the need to perform new tasks that you may not be able to cope with.
- It can be impossible to escape them.
- Information overload.
- New software can be difficult to use

RSI (Repetitive Strain Injury)

Caused by excess use of a keyboard, mouse and even mobile phones (used for texting) and can usually affect the hands, wrists, elbows, arms, shoulders and / or neck. It can be very painful and debilitating. Once it develops, it tends to recur. This is caused by repeated similar movements and incorrect use of the keyboard, i.e. resting the wrists on the desk whilst typing. Many laptops have a built in wrist rest due to the positioning of the keyboard and are therefore better to use. Ways of reducing RSI is to have a wrist rest, take frequent breaks and have the keyboard at the right height.

Eyestrain

Brought on by long hours spent in front of a screen. Although there is no evidence that computers cause permanent damage, they do accelerate current problems.

Factors that could contribute to eyestrain are:

- Glare from lighting affecting the screen.
- Lighting that shines directly on the screen or causes shadows.
- Constantly refocusing – i.e. looking down at a paper and back to the screen.
- Sitting too close to the screen – should be about 2 – 3 feet away.

Eyestrain can be prevented or reduced by taking regular breaks from working at the computer, every 10 minutes or so looking into the distance and therefore relaxing the muscles of the eye, use blinds to reduce the glare on the screen and sit at least 3 feet from the screen.

ELF (Extremely Low Frequency) Radiation

Exposure to ELF is an everyday occurrence as it occurs naturally – sun, fire and magnetic effects.

Backache / Neck problems

This is often caused by improper seating posture of human beings and position of the keyboard / screen especially over long periods. This can be prevented by taking regular breaks and sitting properly in the chair.

Deep Vein Thrombosis

This is caused by sitting still for very long periods of time and not moving the legs; this develops blood clots which then track back to the heart. As with many of the problems associated with computer usage the prevention is to take breaks and move around.

Health and Safety Legislation

The Health and Safety at Work Act 1974 & Health and Safety (Screen Equipment) Regulations 1992

These Acts of Parliament are the employer's responsibilities and cover employees working on computer systems. An employee is someone who is paid therefore a student is not an employee and therefore not covered.

It is the employer's responsibility to ensure:

- That all employees have regular eye examinations and where necessary pay for the glasses needed.
- That all electrical equipment and workstations are checked regularly and are safe and also provide workstations with adequate space for comfortable working.
- That they provide ergonomic chairs that have a lumbar support and height adjustment.
- That they ensure working conditions have sufficient lighting to be able to work and move around, reduced glare, good ventilation and a comfortable temperature.
- That they plan work so that regular breaks can be taken or changes in activity.
- That they provide health and safety training and fire and emergency training for employees.
- That they ensure the working environment is safe from fire hazards and obstructions.
- That they provide trained first aid personnel.
- That they allow pregnant women to work away from VDU equipment due to radiation levels.

Most of the health and safety problems relate directly to hardware although software can also cause problems.

- Poor software design can breach the health and safety guidelines drawn up for developers.
- When most software companies upgrade their software they tend to make the new software look and feel like the one it is replacing. This ensures that the user does not get stressed by trying to learn the software. Stress leads to health problems and fatigue.
- If the user interface is too complex then this itself can cause stress; therefore it must be easy to use. If the user interface is too simple then it will help the inexperienced user but the experienced user will become frustrated, which causes stress as the user interface cannot allow the user to do what they want to do. A reduction in the stress levels can be achieved by the use of shortcuts.
- Training for software must be available for all, and comprehensive enough to allow users to use the software easily.
- The new system is an improvement on the old system and therefore must appear to work in the same way. If it does not then this itself can lead to problems. Many companies allow backward compatibility so that data stored on a previous version can be used on newer versions; this means that the user does not have the problem of re-producing all the data.
- Computers cause health problems, the main two being eyestrain and RSI. Newer versions of software must be able to reduce these health problems by reducing the amount of keyboard and mouse work that is needed to use it. Also eyestrain can be reduced by making sure the colours used for the text and backgrounds are easy on the eye; contrasting colours help as do larger, clearer fonts.

Activity

Study health and safety guidelines for an organisation and then draw up guidelines for your own use of IT equipment and software.

Research regulations on software and look at some examples of software to see how well it fits guidelines and then discuss the implications for design of solutions.

Sample Questions

A bursar in a college office works at a computer workstation all day.

To ensure the health of the member of staff, state with reasons:

- (a) **Two** features that the workstation used by the member of staff should have. (4 marks)
- (b) **Two** features that the software used by the member of staff should have. (4 marks)
- (c) **Two** work practice procedures that the college could introduce. (4 marks)

1.2 – Analysis

In this section we look at problem identification; producing a list of client requirements and interpreting this list in terms of input, processing and output. This section is important as you will need to take work into the examination from the analyses that you complete.

What do I need to include in the analysis of a problem?

Statement of problem and background information

This is where you set the scene and give some background information for the reader. This will include information about the client as well as what you are trying to solve.

As you do not have to create a formal project for the new specification this reduces the amount of work that you will need to do; however you do need to produce an analysis of a real system. This work is then taken into the examination where you will use it to answer questions from the paper.

Analysis is often thought of as being difficult and as a result students do badly on this section. Think of it as a scene setter, finding out exactly what the client wants from the system. A good place to start is to explain what you are planning to do – this is the **statement of problem** – and then produce a background to both the problem and the organisation. The background explains what you are going to do, giving information about both the client and problems he is facing with the current system.

You then need to find out as much information about the problem from the client as possible. This could include:

- **An interview with the client**
This gives you a one-to-one situation with the client and allows you to ask questions about the problem and what the client wants from the solution. It has to be planned to work effectively but if questions come up in the course of the interview then they can be quickly dealt with. Recording the interview with a Dictaphone and then analysing it afterwards is a good way of keeping a record of it.
- **Viewing the current system in operation and looking for problems**
Looking at people working in an organisation helps to see where the problems occur.
- **Viewing documentation from the current system**
Looking at the current documentation is a good way of finding out what is going on in the current system. It is also useful for locating the inputs, processing and outputs that we will need later in the analysis.
- **Producing a questionnaire from the client and / or the users**
Questionnaires tend to be used when you and the client cannot get together for a formal interview. They are filled in when the client has time to fill them in. The questions have to be mostly closed questions so they are easy to analyse. Questionnaires tend to be of use when information is needed from the users of the system.

Having gathered the information which you will need to complete the client's requirements you now need to analyse what you have found. The client's requirements are simply what the client wants from the solution to the problem. It may be that they want a great deal from the solution, far more than you can produce; do not be put off by this but simply break the problems down and choose the bits you can do. If they do not want a lot from the solution then this would have been a problem in the past, as any program would have been small, but now you are only using the analysis to help in the examination, so as long as there is sufficient scope the solution need not be limited.

What is the difference between a user and a client?

A user is a person that uses the system whereas a client is the person that has commissioned you to produce the software as well as the person who will maintain it.

Examination tip

In an examination you may need to identify in your analysis where you identify your client and where you identify your user(s).

Breaking the problem down

A large problem should be broken down into smaller ones and then each of these analysed to help with the design section.

Produce requirements specification for the identified problem to match the client's needs

The requirement specification should be clear and concise as this lays out the plan of what the client wants from the new system. A description of the client's requirements will give a clear picture of what you are aiming to solve. Having produced the requirements you need to go back to the client to see if what you produced is what they wanted; if it is then they can sign it; if not then changes can be made and then signed.

Describe the input, processing & output needs to match the requirements specification

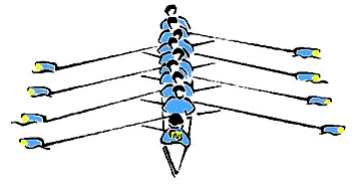
Having described what the client wants from any new system you now need to describe the inputs that are needed to achieve this, followed by a description of any processing that needs to be carried out and finally a description of the information that is produced following this processing. These inputs, processing and output must match what the client wants not what **you think** the client wants.

Having a clear idea at the end of the analysis leads onto a good starting point for the designs.

Example Analysis

Whitborough Rowing Club

Whitborough Rowing Club is a thriving club which operates out of the harbour in the Yorkshire town of Whitborough. The club itself has a membership of around 50 rowers and over 50 supporters. They operate regattas throughout the season and practise every Thursday evening, weather and tides permitting, in the North Sea. Every Saturday they operate a social club for the supporters and the rowers and this is used to raise money for the club.



You have been asked by the Secretary of the Club (**CLIENT**) who is having a problem with searching for individual members of the club as well as producing lists of rowers for each of the teams. She also needs to be able to send out letters to members of the committees explaining to them when the next committee meeting is as well as produce a list of committee members and their photographs. Both the secretary (**CLIENT**) and the team captain (**USER**) have access to the computer and can add and delete data.

Following the initial request for the solution to the problem you would have to find other information about the club and the problems that they are facing.

- We can do this by collecting documentation that is used by the rowing club and analysing each piece in order to get an idea of how the system works.
- We could also do this by carrying out an interview with the client. This will give an idea of what the client wants from the solution and how they solve problems like this at the moment. This is the best way of getting the results needed.
- We could also produce questionnaires; this gives a more informal way of finding out information rather than interviewing the client. It also allows the client to answer the questions when they want to do as opposed to setting up a formal interview.
- We could also observe processes carried out now; this allows us to see the problems occurring and how they can be solved.
- The final method, which will not be used here, is to observe a similar business in operation and then gain ideas for the solution of this problem.

Now we have collected all the information we need to look closely at what was said or what was seen so that we can get a clear picture of what the client actually wants from the solution to the problem. These are some of the requirements that the secretary wants a new system to do.

In our example the secretary of the club wants to be able to store data on all of the members of the group so that information on particular members can be found; this means that a database must be created and that a search facility needs to be added.

The secretary of the club wants to produce a list of the rowing teams for each of the boats and list these. This means that a search is needed with the criteria typed in and then an output produced. This output will be in printed form.

The secretary also needs a quick way of contacting the members of the committee to inform them of the next meeting. Criteria again used to search the database and then a mail merge produced to send a standard letter to all.

The secretary wants to produce a list of the committee members, together with personal details and a photograph of each of them

Occasionally the rower's club is used for private functions and the secretary wants to be able to create a system that can deal with the invoices that have to be sent out to the borrowers of the hall. This is a separate system to the one above but as you do not have to produce the actual solution to the problem then this could be included.

Any system produced must be simple to use therefore the user interface must be simple to use and easy to navigate. The screen layout must reflect the house style and as the secretary is a novice at using computers must be quick to learn.

All data on the system is confidential, therefore security must be in place so that only authorised personnel can gain access to the data.

Inputs, processing and outputs

Finally, and something that has been looked at previously, are the inputs, processing and outputs. Taking each of the client's requirements we need to break them down so that we can produce the inputs, processing and outputs needed to solve each of them.

For example if we look at the requirements we can draw up some ideas.

Information needs to be found on certain members, therefore we need to ask ourselves and the client: what information is needed and how will it be produced? The client needs to have a database set up of different types of information. They will need to search for types of member, for example junior members (**INPUT**); this will search for all the junior members in the database (**PROCESSING**) in order to produce a list of junior members and their addresses in a grid (**OUTPUT**).

In order to produce a list of the rowers for the weekly teams, the criteria for the search must be specified: the level of the rower, their availability and the team of which they are a member (**INPUT**). The database is then searched for this information (**PROCESSING**) and a list is produced showing the names, grouped as teams (**OUTPUT**).

We need to look at the other requirement which is a way of contacting the committee members with the information about the next meeting. The database needs to be searched using the criteria of type of committee (**INPUT**); the database is searched (**PROCESSING**) and a list of committee members and addresses are then available (**OUTPUT**). This is then used as the **INPUT** to a template which is then mail merged with this information (**PROCESSING**) in order to produce letters for the committee members containing their names and addresses, etc. and pre-written envelopes with names and addresses (**OUTPUT**).

The list of committee members the database needs to be searched (**PROCESSING**). These are then printed out in the form of a document (**OUTPUT**) and photos added (**INPUT**). The document is then printed (**OUTPUT**). Added to this we can look at the production of the photos. The photos are taken using a digital camera (**INPUT**) and then cropped, edited to resize and brighten, etc. (**PROCESSING**); they are then saved as a small file size (**OUTPUT**).

The extra problem regarding the production of the invoices is not as simple as the previous ones as it does not include the same database and could be part of another system entirely. This is a classic problem that could be broken down into smaller parts so that it is more manageable.

The secretary gets a new invoice from the pile of blank invoices.	INPUT
She then adds the client's details to the invoice taken from the booking book.	INPUT
She then adds any extra charges to the invoice, like electricity used, etc.	INPUT
She checks that the data is correctly added to the invoice.	PROCESSING
Then the invoice is totalled.	PROCESSING
A copy is made of the invoice.	PROCESSING
This copy is stored in the filing cabinet.	STORAGE
An envelope is taken from the pile of envelopes.	INPUT
The original invoice is placed in an envelope.	OUTPUT
The name and address of the client is written on the envelope.	OUTPUT
and then sent off.	

This is another way of writing out the requirements of the system that you are trying to solve.

Remember that the inputs, processing and outputs should be described clearly and concisely so they help the developer move onto the design of the solutions.

This completes the analysis required for the examination; the documentation for the examination should not exceed 20 pages, (this includes analysis and the testing elements).

Sample Questions

For each of the following questions either use your own work as the example or the Whitborough Rowing Club.

- 1(a) Identify the client that you are producing the solution for.
- 1(b) Identify the user(s) who will be operating your solution.
- 1(c) Explain what is meant by *a client and a user*.
- 1(d) Explain the difference between *a user of the solution* and *an audience for the solution*.

(4 marks)

- 2(a) Identify where you have stated your client's requirements.
- 2(b) Describe **one** of your client's main requirements.
- 2(c) What, in detail, does your ICT solution need to produce for your client's main requirement?

(9 marks)

1.3 – Design of Solutions

In this section we look at the selection of design tools and techniques and how to apply them, and then we look at the design of data entry into ICT systems, processes and the output of information. We look at validation and verification of the input. Finally we look at the need for designs to be clear and concise as they are needed for other people.

The analysis of a system is to break the problem down into smaller parts and then each part is analysed to see if it can be improved, the design then puts all the parts back together again.

Standards

When you design a solution to a problem professionally you do not work on your own, you work as part of a team. Therefore it is very important to ensure that the designs adhere to standards, just in case one of the team has an unplanned absence and cannot continue with the work. This means that other members of the team will easily continue with the work. Standards are agreed and formal ways of carrying out tasks. They are agreed nationally so that all developers use the same standards when working on a project. One widely used standard is Structured Systems Analysis and Design Methodology (SSADM). This is a structured methodology that provides a set approach to information systems development. It specifies the stages and tasks which have to be carried out, what needs to be produced and the techniques used in production.

SSADM has three techniques:

- Logical data modelling
- Data flow modelling
- Event modelling

These will ultimately create templates which can then be used in the design process.

Other design tools

The following are other design tools that you could use:

- Gantt charts
- Impact analysis
- Cost-benefit analysis
- SWOT analysis

Gantt charts are possibly the most popular form of design tool. They are a diagrammatic overview of the timing of your project. They predict when an event will start and when one will end. By using a Gantt chart you can clearly see how your project should progress.



Cost-benefit analysis is used to justify the cost of the proposal by offsetting this against the benefits. This provides an overview of the costs involved in a project by producing each cost and then noting one or two benefits against this.

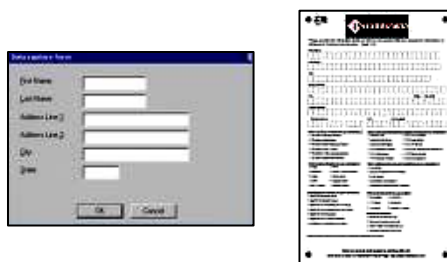
Impact analysis is used to examine the impact of a proposal on the system's environment. Each impact is then given a positive or negative value. When the system has been fully analysed the positives should outweigh the negatives.

SWOT analysis is used to examine the strengths, weaknesses, opportunities and threats of a given project. Strengths and weaknesses are examined from an internal view; and opportunities and threats from an external view. For a proposal to be viable the strengths outweigh the weaknesses and the opportunities outweigh the threats.



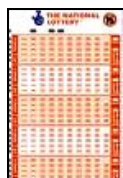
Design of data entry

Having analysed the problem and looked at what needs to be input into the system we now need to design the data entry, so that the data entered is accurate and the entry of data is efficient. We also need to look at the form of data that is being entered, the amount of data and how it is to be entered into the system.



The way we enter data into a system is through a data capture form; these can be either electronic (computer-based) or manual (paper-based).

What are the benefits of using each of these methods? Computer-based data entry allows for checking of the data as it is typed; if the data entered does not match the parameters set for a particular field then it is rejected. This makes data entry quicker and far more efficient, however, for computer based data entry to work there must be a computer available to use. Larger volumes of data are entered using an electronic data entry system, which is far faster than using a manual system. Paper-based systems allow the user to fill in the form anywhere but then it has to be entered into the computer either manually or using a computerised system. This increases the chance of errors being made on computer entry.



The Lotto data entry sheet is read by OMR and becomes



Designing a computer-based data entry form

- The finished design must be good enough for someone else to pick up and produce exactly what you were going to produce.
- The finished design should look like the data form that you are trying to create. This would include the positioning of the data entry boxes as well as any drop downs lists or buttons and the types of colours to be used.
- The positioning of the data entry boxes is important to give a user-friendly and logical layout.
- All validation checks should be notes.
- It is easier and more professional to produce designs on paper rather than using a computer.

Remember

Analysis is linked directly to the design of the solution therefore if you analyse the problem properly then the design will be so much simpler to carry out.

Designing User Interfaces

- The first thing you need to think about when designing the user interface is the way in which the data is going to be entered into the system; is it going to be by keyboard, or mouse selection, or something else?
- Related to this first part is the problem with accessibility, namely how do disabled users work with the interface? Do we need voice output for the visually impaired or sound output, etc.?
- The next thing that we have to look at is the screen display: what is it going to look like? Is the whole screen going to be used to enter the data or is part of it going to be used for images? What are these images going to be?
- Are we going to use the house style colours?
- The user interface must be logical in its use, therefore reducing the amount of key depressions and mouse clicks. A good user interface is simple to use and builds on the skills developed from other interfaces.

Example

The secretary of the Whitborough Rowing Club wishes you to create a way of entering the data into the database.

It must include:

- the club logo
- the club colours; red, white and blue
- user-friendly method
- data entry by keyboard
- easy navigation to the next record

Verification and validation

- Verification means checking that the data entered matches the original.
- Validation means that the data entered is reasonable or sensible. It is **NOT** checking the data is correct.

Different ways of verifying data

When data is entered into an ICT system it can either be checked by re-entering the data or re-reading the data. A good example of re-entering data is password check. When you change your password the system asks you to type it out again; this is a validation check to check that the two match each other and that characters were not entered incorrectly. Another example is checking that the backup of a system has been carried out correctly by backing up the data again and comparing it with the original backup. A good example of re-reading the data is carried out during an online transaction where at the bottom of the screen there is an *ok to proceed* button. It is assumed that the user will read the page again, to check everything before pressing ok. Credit card details can be checked against the credit card.

Remember
Proofreading is not an example of verification as it does not check against the original.

Validation of data – Types of validation check

- **Format check** – this checks that data is entered in the correct format. Sometimes this is called a picture check. An example of this type of check is short date which has a format check of DD/MM/YY. Any data entered must be in this format but if you meant to type 1st April 2008 (01/04/08) but typed 11th April 2008 (11/04/08) then the computer would still state that it was correct as it matches the format.
- **Range check** – this checks that a number entered lies between two pre-defined ranges. For example students who are over 10 and under 19 are classed as junior members of the Whitborough Rowing Club. A range check can be set up giving the specified range as >10 and <19.
- **Check digit** – this is a different type of check and is used for longer numbers over 10 characters, say. The check digit is calculated from a formula using all the other digits. This is used extensively on bar codes where it is scanned plus the check digit then the check digit stored and the one read are compared to ensure that they match. If they do not then a warning red light shows and the bar code is re-scanned.
- **Cross Field check** – with this type of checking we are looking at not one field but two. These two fields are linked in some way, for example if we have a cross field check in place on Gender and title then the computer will allow Mr and Male but not Mrs and Male.
- **Hash and control totals** – these checks are used to check for missing records especially after transmission. They are the same check but are on different types of fields. A hash total is the total of a non-calculable field, for example candidate number, and then after transmission the field numbers are added again and compared with the original. A control total uses a field where it makes sense to add the data, for example a bank balance. As with the hash total the field is added, then following transmission is added again and the total compared.

Drop Down list – validation check or not?

This is where we enter the grey area of validation checks. Some experts say these are not validation checks as new incorrect ones can be added; however, others say they are. A true drop down list is a closed list, i.e. new ones cannot be added. But if they are set up in MS Access from the wizard new ones can be added. For example a list of Radio Presenters in a drop down list could include Terry Wogan, Sarah Kennedy, Jeremy Vine, Tony Blackburn but if someone was to type in Terry Wagon then the data would be added to the list. Now we have an incorrect list, however creating this as a separate table stops other being added and therefore is a true validation check as the user selects from a list.

Activity

Using the inputs from the Whitborough Rowing Club, see if you can identify a validation check that could be carried out on the data input.

Designing the processes

The part of the design that in the past was badly carried out was the design of the processes, as many students thought that clicking a button was the process, not what was behind the button. For example, if a button on a spreadsheet selected an area of the spreadsheet and then only printed this area, clicking the button would not be the process, the selecting and printing would be the process.

So what do we need to look at in the processing? Sorting data, any calculations, and any searches that have to be carried out are all processes. How do we go about designing this?

- Write a brief about what the process is going to do (write this in plain English, not jargon)
- Look at it to see that it does what you want it to do.
- Make changes as necessary.
- Document the original and the changes made – this forms part of a project log.

What is a project log?

This is a log of everything you do when you produce your system. It helps other members of the team if there is a problem.

Example

The secretary of the Whitborough Rowing Club wants to be able to store the details of members of the club in a database. What questions do you need to ask before this can be designed?

- **What fields are going to be in each of the tables?**
This information can be found from the secretary and has been noted in the analysis. All you have to do is to see where they should sit logically in the database. This process is known as normalisation, but is not on the specification.
- **What fields are going to link each of these tables together? Which are the primary and secondary keys?**
Unique fields like ID number will be the primary keys and their links will be secondary keys.
- **Taking each field in turn we need to design the data type (whether it is text or number, etc.) and the format or the number of characters.**
This can be as simple as using your own initiative or asking the secretary as to the format they now use.
- **Again taking each field we need to look at whether validation checks should be used or not.**
For example in the Whitborough Rowing Club we could have a field that states the kind of membership that the member has. The validation check for this could be a drop list that only allows S (Senior), J (Junior), C (Committee), T (Team).

Having planned what is going to go into the database we now need to look closely at what we are going to do with it, namely the processing that will be needed.

Let's take one of the tasks that the secretary wants us to do.

The secretary of the club wants to produce a list of the rowing teams for each of the boats and list these. This means that a search is needed with the criteria typed in and then an output produced. This output will be in printed form.

Assuming that we have planned the data that is to be entered into the database we need to look at the search that has to be carried out.

- **Search:** To search for the team members of rowing eight 1
- **Tables used:** TblClubmember; TblTeams
- **Criteria:** Club Member = "T" and "RE1"
- **Output:** list of the team names and the captain and cox.

What do I need to do when I design a spreadsheet?

- Use a template grid made in a word processing document. Write down on each of the grids the name of the worksheet.
- Note which cells are storage cells, which are input cells and which are going to be used for output.
- Decide how the cells will be formatted.
- Decide what formulae will be used and which cell these will be stored in.
- Decide what macros will be used; what they are called, what they will do and how they will be activated.
- Plan how the worksheets are linked.
- Plan the navigation of the workbook as a whole.
- Plan the security of the cells and the worksheet.

What do I need to do when I design a podcast?

- This is essentially an audio or possibly a video media system, therefore when designing the podcast the audio or video must be the first part to design.
- What is the podcast going to be about? What name are you going to give it?
- Produce a script for the podcast.
- What sound effects or music is going to be used and where can these be found?
- How many pods are there going to be?

Designing the output

The system that you produce will produce both screen and paper outputs. You need to pick up documents currently being used by the organisation so that any outputs match these documents. What do they need to contain?

- The layout of the output should be similar to current documents; this is to keep continuity.
- The information stored must be what the user wants – anything extra must be needed and not just for show
- Information should be organised sensibly and match what is required. For example the sales figures for different flavours in a local ice cream factory could be displayed as a chart rather than text.
- The printouts must look professional and have a consistent feel about them.
- The output must look good in black and white as well as in colour.
- You must look closely at the output to ensure that it sits sensibly on the page.
- If the output is to be sound or moving images as in a podcast then this must work well on the client's computer. The sound produced must be professional.

What should I be designing?
Inputs, processing and outputs
Testing (see later)
Validation (see later)
Backup
Security
Flow of data

Designs also have to be clear and concise so that the client can easily see what is going on and what is being produced. The designs that you produce need to be clear and concise enough for someone like you to pick them up and implement your solution. Following the designs you will need to go back to the client to make sure that you have designed what the client actually wanted.

Activity

Using the Whitborough Rowing Club scenario list the inputs, processing and outputs and then complete designs that match the given input, the processes required and the output needed. Then get one of your friends to try and realise these designs.

1.4 – Selection and use of input devices and input media

In this section we are going to look at different input devices and input media and justify why items selected are suitable to solve problems.

In this chapter we are looking at:

- The broad characteristics of a sample of current input methods.
- Appropriate situations where each could be found.
- Input devices and media used for each method of input.
- Any limitations of a sample of current input devices and media.

The concept of ICT is input of data, processing of the data to transform it into information and then the output of the information.

There are two types of input devices, manual entry and automatic entry. If the volume of data is large then automatic data entry is far more efficient than manual, despite the cost of installation. Training and maintenance are major factors when deciding on the most suitable type of input device. You should be thinking about the kind of input devices that the client uses and not the kind of devices that your school or college uses.

Thinking about the practical work that you will be producing for this unit there are four types of data that can be entered into a computer system: text, images, moving images and sound.

Devices used to enter text

The most appropriate way of entering text manually is to use a keyboard; automatically the most appropriate way is to use a scanner and Optical Character Recognition software. There are many types of keyboard, the most popular one is the QWERTY keyboard although there are ergonomic keyboards and even ones with icons (these are concept keyboards), which can be found in public houses or fast food restaurants. Text can be easily entered into the computer system and a user does not need to be an expert typist to enter the data into the system. The main limitation is the size of the device; if it is too small then it is difficult to type and if it is too large then it becomes cumbersome.

A Sinclair ZX81 computer had a keyboard that was about half the size of a standard keyboard and when one key was pressed there was a chance of hitting four other keys.



If there is a great deal of text to be entered into the computer system then automatic text entry would be far more efficient. This could be achieved by the use of a scanner and then changing the scanned image into text using optical character recognition software. A scanner reads a paper document and changes the data into a graphic, then OCR software takes this graphic and using templates of characters selects a character that closely matches the one on the image. There are problems with some characters, for example **rn** could be read as an **m**. The cleanliness of the input document and the resolution of the scanner will affect the result. A modern example of the use of OCR technology is ANPR (Automatic Number Plate Recognition). This uses a camera in the same way as the scanner to record a number plate, and then can identify the car using templates, and the details of the registered owner, etc. using the DVLA database.



Pointing devices

Sometimes input devices are not used to enter data like sounds or text; they are used to point at icons, for example, and click on these. Most computers have mice or other pointing devices like keyboard pads. Essentially they are point and click devices. The main problems with these devices are that traditional mice can become clogged with dirt and grease and this impairs their operation; also mice need a large surface on which to work. The problem with the keyboard pad is that the device is so small that any movement is accentuated across the screen.

Touch screens

These are used in public places like train stations or public libraries. These are sensitive screens that work in the same way as a mouse; as you touch the screen your finger acts as a pointing device. The images on the screen need to be large as it is difficult to point to a small area.

Devices used to enter images

Sometimes the user will wish to enter an image, as they draw it; they would use a graphics tablet to do this. The tablet uses a stylus which draws on the flat bed on the tablet. This allows for drawings to be produced from scratch or to be traced from an original. Part of the tablet could be an area where the thickness of lines, colour, fill, etc. can be selected.



Mark sensing

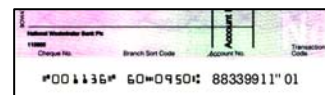
Every day in the UK a mark sensing system is used to record someone's lottery numbers. The pink cards that are used have specified boxes where the customer colours in the lozenge (that's the technical word for it), and then this is fed into the lottery machine. The reader notes the position of the mark and from that can store the day, the number of plays, and then numbers. Multiple choice examination papers use the same kind of operation when they are read. The advantages of this type of system is that large amounts of data can be rapidly read; however if the mark is not clear enough or there is a smudge on the paper then the data can be easily misread.

Magnetic Ink Character Recognition.

This is a dying method of data collection, as it tends to be used on cheques only.

This is by far the most secure way of reading data but by far the most expensive.

The data is written on the bottom of the cheque in magnetic ink; it is then magnetised as it is read. This means that even if the cheque is photocopied it cannot be read by the computer; therefore the cheque is safe. Cheques, however, are becoming less and less popular; if in the near future they vanish, so will MICR.



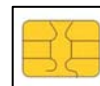
Bar code Reading

Bar codes are appearing on more and more items nowadays. In the past they tended only to be on food goods bought in the supermarket but nowadays you find them on magazines, library cards, parcels, etc. They are cheap and easy to use, hence their popularity. They are read either by scanner or by hand-held wand. The disadvantage of using bar codes is that if they crease then there may be problems with reading them.

Magnetic Stripe, Chip and PIN and Smart cards

Magnetic stripes are used on cards like bank cards although most bank cards now use chip and PIN. The magnetic stripe on the back of the card holds data and is read by a magnetic card reader. This is very fast and accurate, although a strong magnetic field could destroy the data. They are used on train and tube tickets as well as parking tickets.

A **chip and PIN** card has a microprocessor on the card which holds similar data to the magnetic stripe. The card is authenticated by the use of a **Personalised Identification Number**. A special reader is used to read the card. Cards like the London Oyster card also use a microprocessor which uses a special card reader. The chip holds the amount of money that has been placed on the card; this then makes it a smart card. As the card is read an amount of money is removed from the chip.



Touchtone phones and speech recognition

Other ways of entering data into a computer is through the use of sound. A touch tone phone, one with buttons, allows the user to select items from a menu using the numbers of the phone's key pad. Each key emits a note and it is this note that the computer senses in order to make the choice. In more modern systems the touch tone is replaced by speech. So the user would either press a key or speak the number. These are used in BT's 1571 answering phone system or Virgin Rail's online booking system where the user tells the computer the details. Speech recognition systems are fast and efficient although if there is a great deal of background noise then the command can be distorted.

Digital cameras and camera phones

With the improvement of technology digital cameras and camera phones are getting better and better. Having taken the photographs with either of these devices we then need to upload them into the computer. This is achieved by using a cable and then sending the pictures into the computer where they can be stored and used. Digital cameras are not input devices on their own they need to be attached to a computer using a USB port.

Activity

Using the Whitborough Rowing Club scenario identify and justify appropriate input methods and devices.

Sample Question

3. You have been asked, by the manager, to develop a website for the Ravenshead Village Community Centre. You are going to work on this development at home, where you have a PC, with an old VDU screen and an inkjet printer.

You will need to purchase further hardware in order to develop and test the website that you create.

State, with reasons, **three** items of hardware that you will need to purchase.

(6 marks)

1.5 – Selection and use of storage requirements, media and devices

In this section we are going to look at different storage media and devices, and justify why items selected are suitable to solve problems.

In this chapter we are looking at:

- The fact that these devices need to store data for future use.
- The fact that storage devices are portable.
- The broad characteristics of current storage media.
- Appropriate contexts for the use of media.
- The devices needed for reading and / or writing data to the storage media.
- The limitations of current storage devices and media.

There are currently four types of storage devices:

- **Magnetic:** these are written and read using magnets to create magnetised areas on the surface of the storage medium, and include the floppy disk, hard disk and magnetic tape.
- **Optical:** these are written and read using a laser which burns the surface of the storage medium. Once burnt the medium cannot be erased. These include CD-ROM, CD-R, DVD-ROM and DVD-R.
- **Magneto-optical:** These give the best of both worlds read by laser but written by magnetic means. This allows the medium to be re-written several times. Examples of these storage devices include CD-RW and DVD-RW.
- **Flash memory:** these use semi conductor memory similar to memory chips within the computer; the pen drive or memory stick is an example of their use.

Magnetic storage devices

Floppy Disk

This has all but disappeared from the computer industry. Most computers nowadays do not contain floppy disk drives. Floppy disks only contain 1.44Mb and are therefore too small and expensive for modern computing.



Hard Disk

This is the main storage device for all computers. Hard disks are not just one disk but a stack of disks sitting on top of each other stored in a sealed sterile unit. The read / write head hovers over the disk, but a piece of dust on the drive will scratch the surface. These are mass storage devices and therefore can be used on all devices.

Magnetic Tape

These are still cheap enough to be used as mass storage. Although the use of tapes for storing standard files has never really caught on they tend to be used, nowadays, for storing backup copies of work. The data, however, is stored sequentially so if a record is needed the tape has to be run through until the record is found. Industrial tapes read the data in two directions, which cuts down the amount of data that has to be read to find the record. There are two types of magnetic tape, DAT (Digital Audio Tape) and AIT (Artificial Intelligent Tape); these contain a chip that stores a catalogue of the data.



Other Devices

A magnetic tape can be used to back up data; however that is a commercial system. Supposing that we are looking at your class work, what would you back up this data on? You could use an mp3 player or a mobile phone. Students always have these devices with them and therefore are less likely to lose them.

Optical storage devices

CDs store about 800Mb whereas DVDs store about 4.7Gb.

CD-ROM

This storage medium is bought with its contents already stored on it. As the title suggests the CD-ROM is a read only storage medium. It is used to transfer pre-written material onto a computer. Access is very fast as the data is read by laser.

DVD-ROM

As above but the storage medium stores about 4.7Gb whereas the CD-ROM stores about 800Mb. These are specially designed to store video, graphics and sound, which take up a great deal of storage.

CD-R / DVD-R

This is a write once but read many (WORM) storage device. This is being used more and more for storing data and programs permanently. Disks nowadays are very cheap and therefore are becoming a very efficient backing storage unit.



Magnetico-optical storage devices

CD-RW / DVD-RW

These allow the storage device to be read and written to many times. The data is written magnetically but is read by laser at a fast speed. These are replacing the floppy disk in many computers as they are relatively cheap and can store around about 800Mb where a floppy disk stores 1.44Mb.

Flash Memory

Memory Stick

These use semi-conductor memory. They are becoming cheaper as the memory increases and therefore more popular. They are another alternative to the floppy disk as they are a mass storage device. Their size makes them useful for backing up data either as individual files or a full backup of the files on a computer. All modern computers have at least one USB port and therefore will read a memory stick.



Activity

Using the Whitborough Rowing Club scenario identify and justify appropriate storage media and devices.

Sample Questions

- DVD-ROM
- Flash Memory
- CD-ROM
- CD-RW
- Portable Media Player
- 500Gb External Hard Drive

4. Choose a suitable storage medium from the list above for:

- | | |
|-----------------------|----------|
| (a) Saving your work | (1 mark) |
| Reason | (1 mark) |
| (b) Storing a podcast | (1 mark) |
| Reason | (1 mark) |
| (c) Keeping a blog | (1 mark) |
| Reason | (1 mark) |

5. You want to make a digital photo album available to other members of your family. There are three methods that you might use, distribution on CD-ROM, distribution on DVD and uploading the photos to a website.

Explain, with reasons, which method or methods of distribution would be most suitable.

(6 marks)

1.6 – Selection and use of output methods, media and devices

In this section we are going to look at different output methods, media and devices, and justify why items selected are suitable to solve problems.

In this chapter we are looking at:

- The broad characteristics of a sample of current output methods.
- Appropriate situations where each could be found.
- Output devices and media used for each method of output.
- Any limitations of a sample of current output devices and media.

There are four types of output that can be used by an ICT system:

- Visual dynamic output – VDU
- Visual physical output – printer or plotter
- Sound output – speaker
- Movement – robot

Think about how the data should be displayed; should it appear on paper or on screen? Many things like bills are now displayed and it is up to the user to print the bill or to leave it on screen. You should also consider what kind of viewer would you need for this – a PDF viewer or perhaps a word viewer.

Visual Display Units show text and graphics and display what is on the computer. There are two types of these devices, CRT (Cathode Ray Tube) and Flat Screen. Flat screens use LCD technology and are used on laptops. These are better from the user point of view as the screen has a matt finish and therefore there is less glare to hurt the eyes. CRT technology is old and therefore the device is bulkier taking up more space; the monitor however is sturdier than the flat screen, which can be damaged if something is pushed into it.

Data projectors are used in schools to display the work from the teacher's desk so that all the class can see the work. However when the display is magnified colours and the resolution is reduced.

Thermal printers are used in supermarkets or on buses to produce bus tickets. The problem with thermal printers is that over time the writing disappears and therefore can only be used where the output has a short life. They produce the output by using specialised paper.

Inkjet printers are a cheap alternative to laser printers as they give good quality printing but at a cheaper price. There are problems, however, with the printout until it is dried as it will smudge, and over time the colour can drain from the ink especially if it is placed in strong light. These types of printers tend to be used for domestic use.



Laser printers these are more expensive than the ink jet printer although they give a far better quality printout. The toner is fused onto the paper and this means that the print quality and durability improves. Laser printers tend to be used in business nowadays replacing the character printer as the laser printer is far more versatile and can produce colour printouts as well as graphics.

You may think that the **Dot matrix printer** is dead and gone with the reduction in price of the ink jet printer, but you would be wrong. The dot matrix is alive and well and used for one of the most important jobs in the UK. They are the first line of defence in the nuclear industry. When a reactor goes critical it is important to know straightaway; if a laser printer was used to display the readings then the output may be missed due to the quietness of the printing. However, as a dot matrix is not quiet, it is used to print out the figures. Due to this the dot matrix, although still cheap, is not as cheap as it should be. It uses pins to form characters, and then fires them through an ink ribbon onto paper; this gives the appearance of a dotted character.

Graph plotters are a specialised printer type output device. They are used in drawing offices or CAD (Computer Aided Design) offices where a high quality, large output is needed. A graphics plotter draws the output onto the paper using a number of computerised pens; this means that the output looks as though it has been drawn by a draughtsman. Some graph plotters operate on a drum or cylinder whilst others use a flat bed similar to a drawing table.

Embossers are printers that produce output in the form of raised sections of the paper or card. These are used for blind people and the output is a series of raised dots which the blind person can then read by running their finger over the printout. This is called a Braille printer.

Speakers are used to display audibly the output from the computer. This could be a warning or for entertainment.

Robotics can both be used as the output from a computer system. The robot is programmed to undertake a number of activities many of which may use sensors. As the data is processed then the computer sends a signal to the actuator which then activates the output device. For example in a greenhouse the output could be the automatic opening of the windows.

Activity

Using the Whitborough Rowing Club scenario identify and justify appropriate output media and devices.

1.7 – Selection and use of appropriate software

In this section we are going to identify different types of software and justify why each was suitable to solve each particular problem.

In this chapter we are looking at:

- An awareness of the concept of software, the need for and the function of software.
- The role and functions of systems software and the role and the functions of applications software.
- Appropriate uses of current applications software.

There are two different types of software, **applications** and **systems**. Systems software is at the heart of the computer and is designed to control the hardware whereas applications software is designed to solve specific problems using the computer.

Systems Software

An example of systems software is a utility, which is a piece of software that performs a specific and useful task, for example compressing files, or defragmenting the hard disk.

Compressing files software reduces the size of a data file, for example a document, spreadsheet, image, sound file, etc. Why do we compress files? We compress large files because they can take up a lot of storage space on the hard disk. They will also take a long time to send as an attachment by email (that is if it's possible to send them as an attachment, as many email systems set limits). Before you can use a compressed file, you must uncompress it. An example of compression software is WinZip.

Defragmentation software cleans up the hard disk. Files are stored on a hard disk in 'small segments' and a special table, a catalogue, on the hard disk keeps track of which segment belongs to which file. As the hard disk fills up, files begin to be stored in segments far away from each other. This eventually causes the system to slow down as the hard disk struggles to put a file back together again. So a utility called a "defragmenter" will arrange the file segments neatly next to each other, so speeding up file access once more.

Many Utilities come as part of the Operating System.

The Operating System is a software program that manages the components of a computer system and its resources. The operating system performs many tasks such as resource allocation, scheduling, data management and input / output control. Examples of operating systems are Windows XP, Vista, NT, 98, RISC OS, MS-DOS, Linux and Unix.

The Operating System:

- Controls and monitors all the applications on the system.
- Provides an interface between the user and the computer.
- Allocates internal memory.
- Schedules programs and resources.
- Monitors the input and output devices.
- Logs errors.
- Checks for unauthorised access.

Applications Software

Applications software is a program which enables someone to perform a range of useful tasks. Examples of applications software are word processing programs, spreadsheet software, databases or graphics packages.

There are three types of applications software:

- **Generic software**
This is general purpose software, for example word processing, databases, etc. An integrated package contains several generic software packages, for example MS Office.
- **Specific software**
This type of software is used to solve problems for one specific purpose, for example CAD / CAM, etc.
- **Bespoke software**
This piece of software is written specially to solve a specific task; it is unique to that task and therefore is very expensive to produce. The expense of bespoke software needs to be weighed up against its advantages over 'off the shelf' software. A piece of software that has been bought off the shelf may not exactly solve the client's task; the client will have to fit his problem into what the software can do, while some features may never be needed. However, it takes time to produce bespoke software whereas software bought off the shelf is available straight away, and may then be customised to solve a particular task, or nearly solve it. With bespoke software the production and testing takes a long time but software that has been produced and sold off the shelf is fully tested when it is bought. Support is similar – off the shelf software has a strong support section as many people use it, whereas support for the bespoke comes from the development team. The support for the off the shelf automatically provides upgrades, but with the bespoke software the client has to wait for any upgrades.

Wizards and things that appear by magic (Macros)

Wizards allow you to create applications in the software by helping you through the process; they are generators, for example application generators or report generators etc.

Macros allow you to automate tasks; they can be either written by hand or they can be recorded from key depressions. These can then be run and therefore reduce the time it takes to undertake a task. For example printing part of a spreadsheet and changing the printout to landscape can be run using a button on screen.

Activity

With reference to the Whitborough Rowing Club, suggest and justify suitable applications and systems software that you would recommend to the client.

Sample Questions

6. Folders are used to organise files on computers.

Draw a suitable folder structure that you could use to organise INFO1 work and INFO2 work that you have to keep on your computer.

(2 marks)

7. Every month the organiser of the West Thornton Agricultural Show, Mrs Andrews, sends an email to all the members of the committee in the area. The email has been sent to Mrs Andrews from the National Agricultural Society. She likes to add a scanned picture of 'tractor of the month' to the email before she sends it on.

State **three** functions provided by email software, and explain how each one would help her to carry out the above task efficiently.

(6 marks)

8. Spreadsheet packages can be used to solve many different problems.

Describe a problem that you have solved using a spreadsheet and explain how the functionality of the spreadsheet helped you solve that problem.

(6 marks)

9. State, with reasons, two types of applications software packages that you would need in order to develop a website. Your reasons must be different in each case.

(4 marks)

1.8 – Implementation of ICT-related solutions

In this section we look at the production of working solutions. This section links to the sections on hardware, software and communications technologies as explained previously.

Gone are the days of writing out exactly how you produced your solution as there are now no projects as such, although you will need to create a solution so that it can be tested in the next section. Implementation is realising the designs that you produced.

The best way to undertake implementation is to follow the designs carefully and systematically; in this way you will produce a solution without getting bogged down. As you work through the implementation you should check your work is satisfying the designs laid down by your client and also what you produce is workable in the user's environment. Much of this comes under the banner of testing and therefore needs to be placed in your testing folder. Any change you make to the design of your solution should be noted as this forms part of the testing of your solution.

What should I think about when creating my solutions?

Look closely at the design of your solution and place it into a logical order.

- How the data is entered into the system (Human computer interfaces).
 - How easy is the data capture method to use?
 - Is it user friendly, clear and simple?
 - Does it match the needs of the user or client?
 - Is there enough navigation on the screen?
 - How is help / support dealt with?
- Control mechanisms of the solution (Validation checks).
 - What validation checks have to be carried out?
- How the data is processed and organised (processing).
 - What existing methods are in place?
 - Are you adapting these methods or creating new ones?
 - How is the data going to be organised?
- What is going to be the output and how it is going to look (reports).
 - Is the output in the form of reports?
 - Is the output in the form of charts and graphs?
 - Is the output going to be in document form?
- An overview of the solution.

Tip

You should not spend time documenting every step of the implementation of the solution but concentrate on building a working solution.

Appropriate tools

You should find the most appropriate tools for the task and this may mean that you use more than one package to solve the problem. Creating a simple solution will not help you in the examination, but taking a generic package and customising it so that it solves the problem effectively will help you in the practical work needed at A2 level as well as the theory work.

Activity

Using the Whitborough Rowing Club example solve one of the problems set by the client.

Sample Questions

10. You have agreed to set up an electronic photo album to display family photographs.

Explain how you would load and organise these photos on your PC.

(3 marks)

How would you load older non-digital photos onto your PC?

(2 marks)

1.9 – Testing of ICT- related solutions

In this section we look at the construction of test plans that include a range of suitable test data, so that expected outcomes can be identified that ensure that the client's requirements have been met.

A test plan uses test data that ensures:

- The validity of the data input.
- The accuracy of the data input.
- The presentation of the output.
- That the solution meets the needs of the client.
- That the solution is usable by the end user and / or intended audience.
- That it incorporates the data to be used for testing the solution and the expected results of each test.

Before you start testing your solution you need to think about the overview of the test plan. What you are going to test and how you are going to test it; what order are you going to do the tests; what do you expect to happen when the tests are run. Remember testing is about making sure that your solution does what your client wants it to do; it is not forcing it to make mistakes.

Your testing consists of three main elements:

- Testing using the performance indicators (within analysis) to prove that your solution does what your client wants it to do.
- Testing through development; this is testing the solution as you develop it.
- Testing during operation; this is using the test plan.
 - During this section we can test the solution further.
 - Unit testing – each individual element is tested and then the elements combined are tested to check the data flows properly.
 - System testing – the whole system is tested.
- User testing – this is where the end user tests the system as though it were in real life to see if everything works as it should.

Once you have tested it and made changes then test to see if the changes work.

Designing a test plan

In the new specification you do not need to produce a test plan with the actual outcome and comments removed and then a copy of this with these elements present; simply produce one of these.

Test No	Purpose of test	Test data	Expected outcome	Actual outcome	Comment or evidence
1	To test the validation rule for entering the student's candidate number. Range check >0 and <=9999.				
1.1		0000 – extreme test	Data is not accepted due to range check.	Data accepted.	Check the range check is correct. Check changed to >0 was written as >=0 at lower boundary. Data failed on re-test.
1.2		1234 – normal test	Data is accepted.	Data accepted.	
1.3		-9999 – erroneous test	Data not accepted as out of range.	Data failed.	
2	Testing navigation button on main screen.	Click buttons to see if they do what they are supposed to do.	Buttons should do as they are supposed to do.	All worked.	All buttons checked, sample of screen shots produced.
3	Testing client requirements that all pages contain the company logo and company colours.		All pages contain the company logo and colours.	Correct	

Note that in Test 2 only a sample of the tests needs to be produced; the same will apply for hyperlinks, etc.

Choosing test data

There are three types of test data that you can use:

- **Normal data**
This is the data that would normally be used to run the system.
- **Extreme or boundary data**
This is data at the boundary of acceptance.
- **Erroneous or incorrect data**
This is data that is outside the boundary of acceptance.

Example

In the Whitborough Rowing Club rowers that are junior members are aged 14 to 17 years old. A range check has been placed on the file so that members born after 1st January 1994 and before 31st Dec 1990 are junior members.

Therefore the test data would be:

- **Normal** – 21st February 1996
- **Extreme** – 1st January 1994
- **Erroneous** – 1st January 1989

Activity

Using an implementation either produced by yourself or given to you by your teacher produce a suitable test plan.

Get a colleague to test that your test plan does work.

Using a requirements specification, either produced by yourself or given to you by your teacher, produce a suitable test plan, noting the normal, erroneous and extreme test data that you will use.

Sample Question

11. Using the test plan that you created in the activity above, explain how your solution has been tested using normal, erroneous and extreme data.

(7 marks)

1.10 – Evaluation of ICT- related solutions

In this section we look at the assessment of the effectiveness of the solution in meeting the client's requirements and understand what makes an ICT solution effective.

You should ask yourselves the following questions:

- Does the solution do what it is supposed to do?
- Does the solution do it in the way it is supposed to do it?
- Is the solution an effective one?
- If it is not, what is wrong with the solution and what would make the solution an effective one?

Evaluation is very important as it looks back at the work that has been produced and reviews the progress in meeting the requirements set by the client. In order to produce a good evaluation you need to understand what has been done and any mistakes you have made must be corrected.

How to produce a good evaluation

Evaluations are always badly written as most students believe that they are writing about what they DID and not whether they did what they were supposed to do. Comments like *'If I had more time'* or *'I was doing well until the printer broke down'* should now be a thing of the past as there is no formal project at AS level, although they still could appear at A2 level. You are not writing about what you learnt by doing the task, how you used the packages, a lack of time or how much help you were given.

So what do you write about?

Go back to the original analysis and your performance indicators. These are your targets to ensure that you did the work correctly. If I was producing an evaluation I would take these and paste them into the evaluation and then comment on them individually. Having done this you can now discuss how successful you were in meeting each of these targets. Use evidence from your project to support this write up, this could include user testing or even your own testing. You have to give two sides to the evaluation so you need to write about the limitations in the work, what went wrong, and what couldn't be solved, and then link this to any improvements that you could make if you were to do this project again.

Activity

Using a requirements specification, test plan and results either produced by yourself or given to you by the teacher produce an evaluation of each requirement and the effectiveness of the whole solution.

Sample Question

12. Explain how you would evaluate one of the main requirements in your analysis.