

2010 HSC Information Processes and Technology Sample Answers

This document contains ‘sample answers’, or, in the case of some questions, ‘answers could include’. These are developed by the examination committee for two purposes. The committee does this:

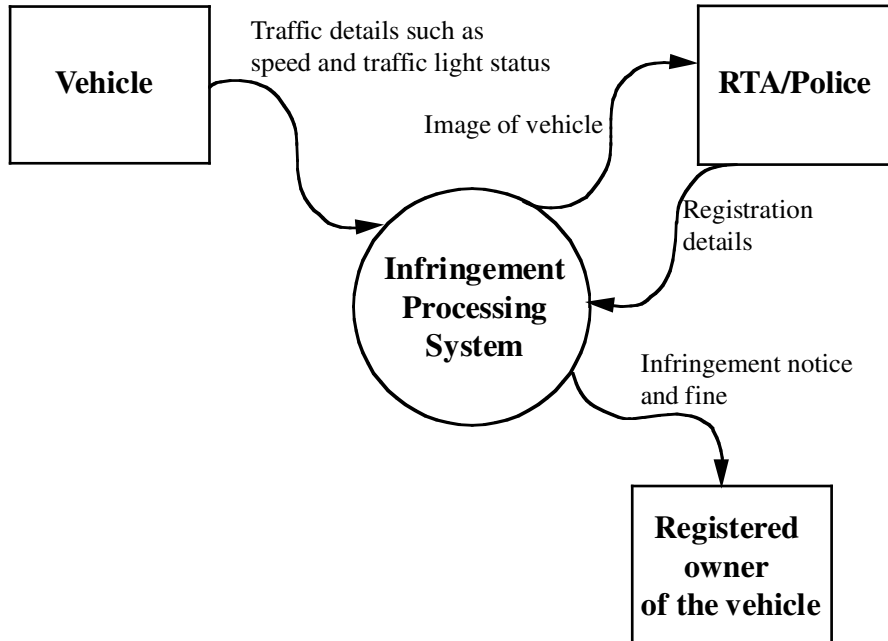
- (a) as part of the development of the examination paper to ensure the questions will effectively assess students’ knowledge and skills, and
- (b) in order to provide some advice to the Supervisor of Marking about the nature and scope of the responses expected of students.

The ‘sample answers’ or similar advice are not intended to be exemplary or even complete answers or responses. As they are part of the examination committee’s ‘working document’, they may contain typographical errors, omissions, or only some of the possible correct answers.

Section II

Question 21 (a)

Sample answer:



Question 21 (b)
Sample answer:

<i>Hardware</i>	<i>Software</i>
<i>Cameras</i> to photograph drivers who have been caught with a red light or speeding infringement	A <i>DBMS</i> to store pictures and infringement notices, record car registrations details
<i>Road sensors</i> to detect when a driver has run a red light or is speeding	<i>Data encryption</i> software to protect images from the cameras
<i>Combined red light/speed cameras</i> that can detect red light and speed infringements	<i>Firewalls</i> to protect data
<i>Digital Imaging</i> hardware that is capable of taking high-resolution photos of speeding cars.	<i>Speed calculation</i> software to detect when a speed infringement has taken place
	<i>Image recognition and processing</i> software that can recognise the car registration from the photo taken.

Question 21 (c)
Sample answer:
Appropriate description of Pilot:

The State government is using a pilot method of conversion because they are installing one digital camera in one location so that it can be trialled before proceeding with a full installation of the cameras across the state. This method can be used to test the cameras to see how accurate they are with detecting infringements such as speeding vehicles or vehicles that run a red light. The cameras can be evaluated with relation to the expectations of the requirements during this trial so that a decision may be made as to whether to proceed with the implementation or not. Some bugs or glitches may be discovered at this time which may be possible to fix or indeed whether they present as show-stoppers that could mean that the project is abandoned.

Justification of this method of conversion:

The pilot method of conversion provides the government with a safe implementation strategy. They can invest in a single camera that they can use as a 'prototype' to test live conditions for the camera without affecting the cameras in the rest of the state. Financially it is a good option because they will not have wasted a lot of money if the system should have problems, as it is only one camera, but it also allows them to make sure that the system works as expected before the installation of cameras across the state.

Question 21 (d)**Sample answer:***Data Accuracy:*

The State government needs to ensure that the cameras are maintained and calibrated properly on a regular basis to ensure that the cameras function properly at all times. If a camera malfunctions, there is the possibility that a motorist could be charged with an infringement due to the inaccuracies caused by malfunctioning technology. In this situation, an owner could be incorrectly issued with a fine.

Others to consider

Changing nature of work

Privacy

Question 22 (a)**Sample answer:**

In client server architecture a thin client is specifically designed to be small so that the bulk of the processing occurs on the server. A thin client does not require a hard disk drive, and acquires software from the server, whereas a fat client will include memory, hard drive and adequate computing power to process data locally.

Question 22 (b)(i)**Sample answer:**

<i>Field name</i>	<i>Data type</i>	<i>Appropriate size</i>	<i>Description</i>
Student ID	text	6	ID of student eg JP1011
Student Surname	text	15	Last name of student eg Williams-Smyth
Student First name	text	10	First name of student eg Annabella
Date of payment	date	8	eg 29/10/10
Fees paid	Boolean	1	Yes/No response eg Y

Question 22 (b)(ii)***Sample answer:***

A connection is set up between home and school computer and handshaking occurs to establish communication protocols between the two computers.

At the application level data is broken up into data packets each containing headers and trailers containing specific protocols including SSL required for security essential for financial data.

At the communication, control and addressing level, further protocols are established including TCP for transmission control and IP for internet to ensure data is sent between home and school computers. To allow the sending and receiving of the file the FTP protocol would be established.

At the transmission level, the modem attached to the parent's computer modulates the data packets so that they comply with the protocols used by the ADSL line. A router determines the path the data packets will take via the IP address of the recipient. Data packets are sent to the school's computer modem, which then decodes the analog signal and reassembles the data into a recognisable digital message.

Question 22 (b)(iii)***Sample answer:***

The most suitable method for error detection when transferring financial information between the home and the school is a cyclic redundancy check. Instead of counting up the number of bits used in the transfer of information and comparing to the sum at the end of the transmission (checksum) or using an eight bit as a check mechanism (parity bit), a cyclic redundancy check has a mathematical remainder that is used to ensure accuracy. Like checksum, the bits are added up before transmission but are then divided by a specified number. The remainder of this calculation is then packaged with the data packets and then is checked at the destination for errors. If an error is detected the packet is retransmitted. This method has a higher accuracy rate than checksum or parity bit.

Question 23 (a)***Sample answer:***

The Carbon Footprint Calculator online web form implements the following techniques to reduce data entry errors:

- Drop down box
- Radio buttons
- Check boxes
- Images (used as radio buttons)

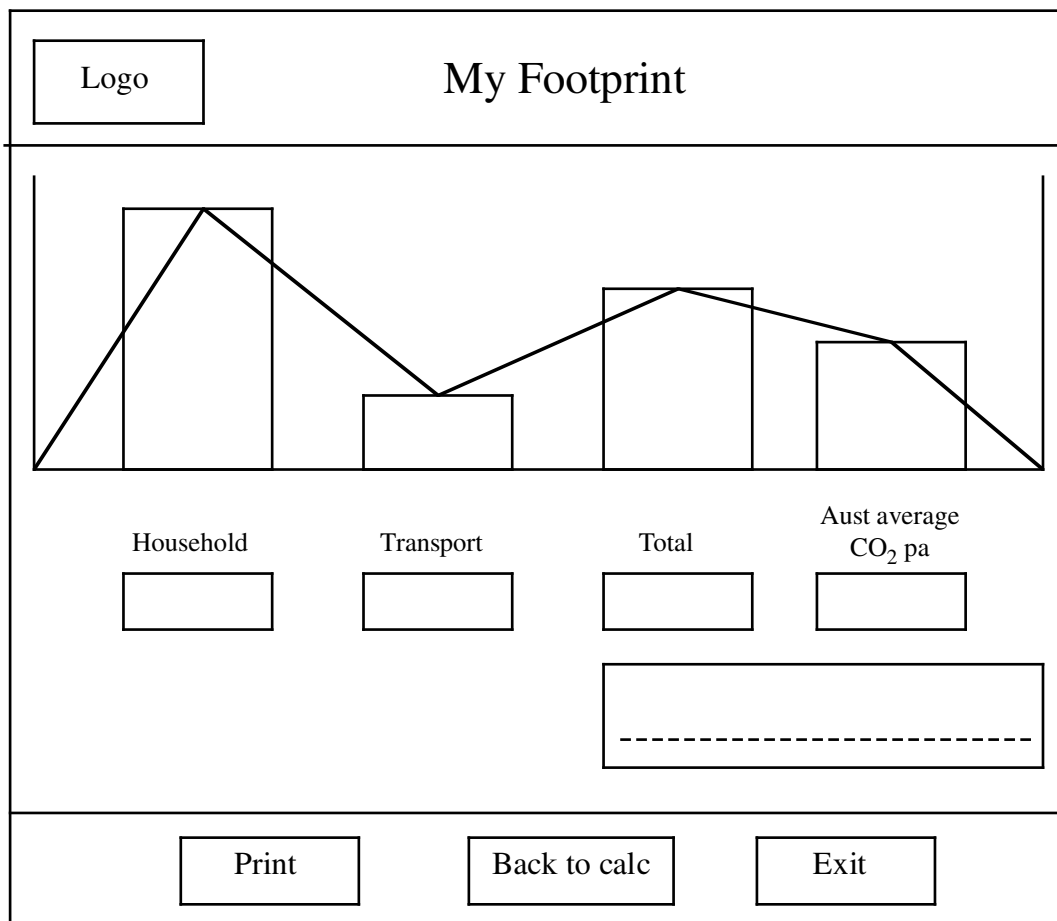
Reasons these techniques reduce data entry errors include:

- Predefined set of answers to choose from
- Use of radio buttons allows one answer only
- Selection and no text boxes mean no spelling errors.

Question 23 (b)**Sample answer:**

Graphics including people and the different size bins are the screen elements used in Questions 3 and 7 because:

- Graphics contribute to the visual appeal and interactivity of the GUI
- Reduction in data entry errors due to limited selection and/or no text entry
- Cater for a range of people such as people with reading difficulties
- Graphics are user friendly and promote good design principles.

Question 23 (c)**Sample answer:**

Question 23 (d)***Sample answer:***

The analysis processes that occur include:

- Comparing results to a predefined data store of Australian averages
- Calculating ‘Totals’ and ‘My Footprint Average’
- Analysing the form for completion ie, no missed fields
- Validating inputted data against predefined criteria

The above analysis processes are displayed to the user in the form of a graph, their ‘Carbon Footprint’ and feedback on how to reduce emissions.

Question 24 (a)***Sample answer:***

A social issue that may arise through the use of the online books purchased for Digibook is the effect on book publishers and printers. If a publisher turns to electronic format for books instead of printing books then many jobs may be compromised. At the same time, the preparation of electronic books will see job opportunities improve for people operating and supporting the information systems. As information systems for Digibooks expand, and printing declines, the nature of work will change, resulting in deskilling, re-skilling and multi-skilling.

An ethical issue that arises is the potential for copyright violation. Once a book is purchased and downloaded by a user, she or he may share the book with other people, or make it available online at no cost to other Digibook users. This would be a breach of copyright.

Question 24 (b)***Sample answer:***

Economic feasibility in this case relates to whether the Digibook can be produced at a cost that the target audience can afford. The price is influenced by the cost of components and the labour to assemble the Digibook. If the Digibook is too expensive and the target audience does not see value in the Digibook then its feasibility is questionable.

Technical feasibility must consider the hardware and software used in the Digibook. Issues that need to be considered include:

- the availability of the required components
- whether the components all work together
- compatibility with the other parts of system that the Digibooks needs to interact with (the wireless communications system, internet access, etc)
- the physical size of the Digibook – is it small enough to be easily carried around by users?
- is the download speed fast enough to satisfy customers?

Scheduling feasibility would need to consider the timing of the release of the Digibook and the availability of electronic books for users to purchase. Is the Digibook able to be assembled and made available for sale by a deadline? Will the electronic books be available when the hardware is released? If there are not enough books available then interest in the Digibook will fade and the product will not sell.

Operational feasibility needs to consider whether the target market can use the Digibook with ease and enjoy all of its features. What is the age of the target market, and will that target market have the skills necessary to use the Digibook?

Question 24 (c)

Sample answer:

Communication protocols are sets of rules used to govern communication. Relevant communication protocols used during the transmission of a digital book from the supplier's server to a user's Digibook include TCP/IP, HTTP, SSL (HTTPS) and may also include FTP.

TCP/IP – Transmission Control Protocol (TCP) manages the assembly of a message or file into smaller packets that are transmitted over the internet and reassembles the packets into the original message when receiving. Internet Protocol (IP) manages the address part of each packet so that it gets to the right destination.

HTTP – manages the HTML data between the web browser on the Digibook and in the internet file server.

SSL (HTTPS) – SSL protects the privacy of data exchanged by the Digibook website and the individual user. Data sent using HTTPS is encrypted during transmission. It is used by websites whose names begin with https instead of http.

Section III

Question 25 (a)(i)

Sample answer:

A RFID tag is a microchip embedded or incorporated into a product. This allows the product to be tracked or identified by the use of radio waves.

Question 25 (a)(ii)

Sample answer:

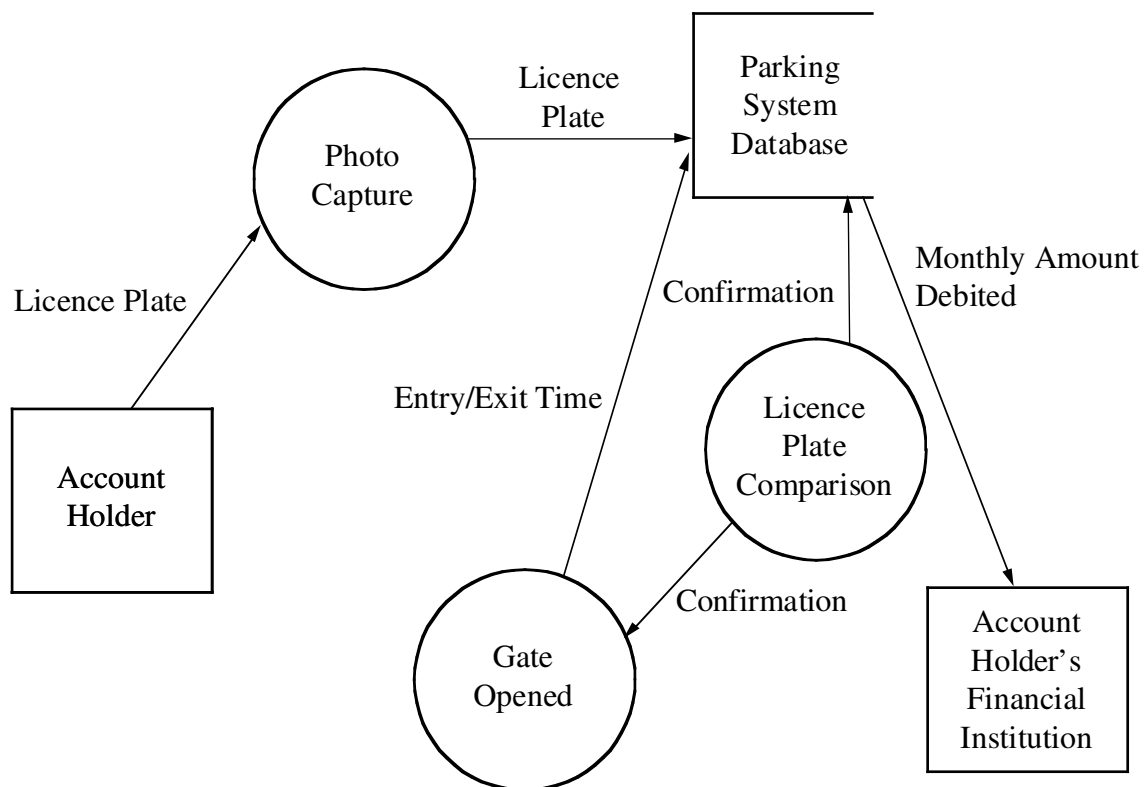
Transaction logs store or record information about the transactions that have recently occurred in the transaction processing system. They are used to restore the lost data in a transaction processing system at the point where a failure occurs (roll back). They can also be used by managers in a system to gain knowledge regarding transactions occurring within the system.

Question 25 (b)(i)**Sample answer:**

Real-time processing is the immediate processing of data. It provides constant confirmation of a transaction and requires access to an online database. Real-time processing is used in systems such as reservation systems to avoid double bookings (concurrency) and transactions must be fully completed for it to be successful (atomicity).

Question 25 (b)(ii)**Sample answer:**

Batch processing would be appropriate when transactions do not need to be immediately processed. Grouping together transactions is more appropriate than real-time processing due to the use of resources, for example batch processing at night to use information technology more effectively. Batch processing is used when producing large quantities of paper documentation such as monthly bill statements.

Question 25 (c)(i)**Sample answer:**

Note: The data flow diagram above represents one of many different correct solutions to this question. Please refer to [Information Processes and Technology – HSC Course Specifications](#) for further information regarding the construction of data flow diagrams.

Question 25 (c)(ii)**Sample answer:***Collecting*

The photo of the vehicle's number plate is collected on both entry and exit to the carpark. The account holder's information will have been previously collected in order for their account to be created. Entry and exit times of the vehicle are also collected by the system.

Storing/Retrieving

The account holder's details that were previously collected are stored in the car park TPS database. The number plate of the registered vehicle is also stored in the car park TPS database. The times of entry and exit of each vehicle are recorded on the transaction log and then stored onto the car park TPS database.

The number plate of the vehicle is retrieved from the TPS database to ensure the vehicle seeking to enter the car park has previously been registered and is therefore stored on the database. This process is repeated as a vehicle exits the car park. At the end of each month the account holder's financial details are retrieved from the TPS database to allow their nominated bank account to be debited.

Question 25 (c)(iii)**Sample answer:**

A future application of the technology in this scenario would involve office workers utilising facial recognition software to enter a building or workplace. As an individual worker attempted to enter their building, a camera captures an image of the person's face. This image is then compared to previously recorded images in a database. If an identical face is found within the system, access is granted to the individual whose face was scanned.

Security

By utilising this method of facial recognition, there would be an increase in security. Only people whose faces were in the database would be granted access to the building or workplace. This would mean that no one could enter the workplace unless they had prior authorisation. Since there are no keys or security cards to be lost, this would also mean there is greater security in the workplace.

Changing Nature of Work

With the introduction of the facial recognition system, security guards that were previously employed to ensure that only authorised people were granted access to the building or workplace are no longer required, thus these employees are now redundant. Also, the method that managers used to determine work hours has changed dramatically. The entry and exit times of employees can now be accurately recorded and this information can be used to calculate weekly wages to a much higher level of accuracy. Managers can now determine who is in a building during critical incidents that may require evacuation. This is important in regard to OHS.

Note: Other valid applications may have included other biometric recognition such as fingerprints or retina scans or the use of photographic technology for:

- the calculation of toll systems on motorways,
- the entry to individual premises, or
- increased security at major venues (for example airports or major event venues).

Question 26 (a)(i)***Sample answer:***

Data warehousing is a historical storage of data from a variety of databases. Later used for analysis by data mining, which searches for patterns and trends in the data.

Question 26 (a)(ii)***Sample answer:***

A semistructured decision support system has a clear method (set of predefined rules) but can allow for variables in determining the outcome. For example, a fingerprint matching system has a clear method of instructions in locating who the fingerprints belong to, however such a task has variables, eg not a full print, its been impaired and therefore making the outcome difficult to find. Semistructured decision support systems follow a pattern to reach a decision yet the answer cannot be guaranteed.

Question 26 (b)(i)***Sample answer:***

An inference engine is a component of an expert system that carries out reasoning by following a set of logical process, involving the application of ‘if-then’ rules, knowledge base and a database of facts. Two possible types of inference engines are backward and forward chaining. Forward chaining is when a series of questions are asked that progressively narrow down the options until a solution is arrived at. An example of forward chaining could be found in a medical diagnosis expert system where a series of questions may be asked about symptoms a person is having. Forward chaining in this example is the process where the answers to these questions are inputted into the system, narrowing down the possibilities until a suggestion is reached. Inference engines are used in expert systems and carry out the analysis of a user’s inputs.

Question 26 (b)(ii)***Sample answer:***

Group decision support systems can assist decision-making between multiple participants in a number of ways. Group decision support systems use a variety of tools that are very useful in making decisions. The ability to provide avenues for brainstorming of ideas, voting on ideas or suggestions, the ability to contribute anonymously as well as encouraging creative and original ideas. Another feature is the ability to bring together parties that are separated by distance in order to reach suitable decisions. Group decision support systems are commonly used in the corporate environment during business meetings or when group decision-making is required.

Question 26 (c)(i)***Sample answer:***

The data presented by the tool's reports could be used by the website manager to determine areas of strength and weakness in the website. For example, the report on how users are accessing the website, what keywords are being used, may prompt him/her to add metatags to the website's description to improve access for the users. An analysis of what search terms are entered may lead the manager to place links in more prominent positions, to make access to these areas easier for users. The manager can use the real-time information in the reports to develop a more user-friendly website that is flexible and responsive to changing needs of the users. Data recorded about clicks on banner ads could result in the manager removing ads that annoyed users (few clicks) and replacing them with ads that the users preferred (more clicks).

Question 26 (c)(ii)***Sample answer:***

The tool collects real-time data from the use of the website, counting clicks on various links and recording entered keystrokes. The tool can also record data from transactions and keywords used to search the site. Clicks on banner ads can be captured and counted, and data from the performance of the competitors' websites can be recorded and saved for benchmarking.

Analysis would occur in a variety of ways. Keywords could be sorted in order of use, to determine those most likely to be used. Transaction data could be stored in a spreadsheet for processing to determine the volume of sales using formulas. Sales data could be analysed into the form of graphs and charts to make it more easily interpreted. Data stored in databases could be analysed using queries to extract various required information and as the volume of stored data increased, data mining could be performed to extract trends and patterns.

Question 26 (c)(iii)***Sample answer:***

The technology can be used to inform a company of trends and support them in their decision-making. This is particularly useful in websites with online transactions, such as e-commerce websites, which would greatly benefit from such information. Data mining can be performed on transaction data provided by reports or even raw collected data, possibly in the form of Online Analytical Processing. This can allow for non-obvious trends, patterns and relationships in the data to be observed. This may be displayed using data visualisation, eg a graph. This allows the data to be effectively analysed by the business to make decisions. Other data such as banner ad clicks and keywords, can be incorporated and linked with the transaction data, the data matched to find relationships and assist the company in marketing decisions. However those performing data mining must ensure that erroneous inferences are minimised as data mining may often produce relationships or trends which may be a mere coincidence. Furthermore, they must protect the privacy of the users of the system before data mining. Personal identification details should be removed and the data kept secure through changing access rights and possibly encryption. Although the system can produce significant amounts of information to support the decisions of managers, it is the manager's choice in the end to act upon the data. Those making decisions must carefully consider the information

presented by the system before decisions are made. Clearly the tool can be effectively applied to assist businesses to make marketing decisions. However, those involved in making decisions must carefully consider and take full responsibility for the decisions they make based on the given data and those performing data mining must protect the interests of both the business and users by ensuring privacy is protected.

Question 27 (a)(i)

Sample answer:

The direct users of an automated manufacturing system include supervisors overseeing operations and people whose task is dependent on the system for information.

Question 27 (a)(ii)

Sample answer:

Radio-frequency identification (RFID) is a technology that communicates through electromagnetic waves to exchange data between a terminal and an object such as a product, animal, or person for the purpose of identification and tracking. Unlike barcodes, RFID does not have to be in direct line of sight. The technology requires interaction between an RFID reader and an RFID tag. In an automated manufacturing system, a RFID tag can be placed on a product and the RFID reader is then used to track the product for inventory control and tracking. It gives increased inventory accuracy as each product has its own unique ID.

Question 27 (b)(i)

Sample answer:

An actuator is a specialised display device that performs a mechanical action under the control of the controller. Examples of actuators are solenoids, DC motors, stepping motors, relays and hydraulic pumps. DC motors are versatile as their speed can be quickly altered and can provide full power as soon as they are switched on as well as being able to reverse the direction of spin. DC motors can be utilised in a conveyor belt. DC motors power the horizontal movement of the conveyor belt in assembly lines and are prominently used in many automated manufacturing systems such as mail sorting and car production.

Question 27 (b)(ii)

Sample answer:

Collecting occurs through the motion sensor. The motion sensor is activated by the passing vehicles and commences the traffic light change. There is a conversion of analog data from the sensor into digital data for processing by the traffic light controller. The traffic light controller processes this input from the sensor and cycles the power between the red, amber and green lights as required by the motion sensor. The timer provides the appropriate times for the cycling of the lights. The traffic light controller changes the data back to analog and displays the change of lights.

Question 27 (c)(i)***Sample answer:***

Human-centred systems have machines assist participants to complete tasks unlike a machine-centred systems where humans assist machines. Human centred systems are designed around the needs of people first and the computers/machines are made to fit in with the needs of the participants. This is human centred as the human (surgeon) controls the robotic arms that perform particular functions during an operation, rather than the doctor assisting the robotic arms in performing their tasks.

Question 27 (c)(ii)***Sample answer:***

The collecting process involves capturing images inside the patient using the camera. Collecting also occurs with the commands from the movement of the doctors joystick which are captured.

Displaying occurs when the data collected from the camera is projected onto a monitor for the surgeon. The movement of the three robotic arms requires the display of data, where the input data from the surgeon is converted into the movement of the arms.

Question 27 (c)(iii)***Sample answer:***

A future application of the technology would be introducing more automated robotic technologies in hospitals and surgery as well as the possibility of doctors being able to operate remotely on patients. Patients in remote rural areas who may not have had access to a doctor previously would now be able to benefit by the installation of the robotic equipment in rural medical centres. A number of sensors can collect data for the robotic medical system. This data can be processed by a controller to enable appropriate mechanical action through actuators like a stepping motor which will be able to move a scalpel to an exact position either in a semi-automated medical robotic system or one under the direction of a doctor who may be operating remotely.

Doctors may operate remotely on patients, making use of greater bandwidth so geographical distance will not be a problem in the future. As a result, greater job flexibility can be achieved. Doctors can operate at times that suit them as well as operate at multiple locations. Doctors with specialised skill would now not be restricted geographically and would be able to perform their duty in a flexible work environment. New skills are required by the doctor. Not only would surgeons require great precision when operating manually on patients, surgeons need to be trained in the information technology as well as being trained to interact with the robotic systems. Without adequate training, the surgeons may not be able to utilise the automotive manufacturing system effectively. Surgeons with training would become more accustomed to controlling precise incisions utilising a robotic arm. The improvements in the relationship between the interface of human and robotic information technology such as the DC motors and stepping motors promise greater job flexibility as well as greater precision.

Question 28 (a)(i)***Sample answer:***

Interactivity is the ability of an end user to navigate and change the outcome or display of a multimedia product. An interactive multimedia product will allow the user to influence/determine the progress of the information displayed. Within an interactive multimedia gaming environment the user receives real-time feedback based on their actions/decisions allowing them to control what they want to click on or sections that they want to go to. The user is able to click on items to control motion and sound, access videos and other multimedia content.

Question 28 (a)(ii)***Sample answer:***

A storyboard is a multimedia design tool, used to plan, orientate and position media and objects prior to the implementation; it is a description or drawing of each screen in the proposed system.

A linear storyboard is one in which each page/media must be navigated in a linear fashion, ie ordered one page after the next. The user is not able to navigate outside this structure; only forward or back through the presentation. (A correct diagram of a linear storyboard may be included.)

A non-linear storyboard is one of which the user can choose a navigational path based on hyperlinks/hypermedia objects. It gives the end user a number of different possible paths to follow and could use any combination of linear and hierarchical navigational structures, ie a website. (A correct diagram of a non-linear storyboard may be included.)

Question 28 (b)(i)***Sample answer:***

Identifies commonly used file formats which allow for embedding into a web page such as .mp3, .mp4, .wmv, .swf and/or .flv. These file formats can be displayed as downloadable video content or viewed as streaming video.

Characteristics of these files may include:

- high compression rates that allow for quick download
- quality can be reasonably good
- commonly read and accepted by a large range of web browsers
- codecs are available and easily deployable
- files are often stored on different servers separate from the web page itself.

Question 28 (b)(ii)***Sample answer:***

Path-based animation is a type of animation where the sprite (animated object) moves along a pre-defined path over a fixed background, resulting in generally smaller file sizes. This lends itself to web-deployment (embedded animations in web pages) such as Flash banners and animations due to the smaller file sizes. Path-based animation makes use of tweening to fill in the animation frames along the path.

Cell-based animation is the traditional animation approach, whereby each cell is drawn individually and, when played at an appropriate speed, creates the illusion of movement. This type of animation is generally used in motion pictures, where file size is not an issue. However the detail is an important consideration. Cell-based animations will generally have a larger file size as each cell is redrawn and stored prior to being displayed.

Question 28 (c)(i)***Sample answer:***

Data compression refers to the ability to reduce overall file size via the use of either lossy or lossless means. Many multimedia games are distributed on DVD; the vast amount of multimedia content (life-like animation, video, audio and text) could not be stored on this media without compression. Gaming devices would also need to process the contents of the game and store it temporarily whilst the user interacts with the game. Looking at emerging trends, the distribution of multimedia games is moving towards the internet, therefore compression is a necessity.

Question 28 (c)(ii)***Sample answer:***

Collecting: data/information is collected at two distinct levels. It is collected at the implementation phase of creating the game. This could be through a digital camera (life-like video), microphone (audio) or graphics tablet. Collecting could also occur at the time of playing the game: data is collected by the gaming console from the balance board (coordinates and pressure via the accelerometers).

Displaying: as a result of interacting with the game, the visual information is displayed on the screen, ie when the user moves on the balance board; this data is reflected in the movements of the animation on the display device (screen). Information is also displayed through the speakers; the audio data changes as the user interacts with the system and sound effects correspond with the user actions.

Question 28 (c)(iii)***Sample answer:***

A clear description of a valid application (new, emerging or existing multimedia system) with characteristics that are similar to those of the multimedia system described in the scenario, eg

- interface between movement and the user and output
- use of complex projected output (video and sound)
- interactivity between the user, the multimedia interface and the display of data

The description will also indicate a consideration of future multimedia systems and virtual worlds.

In the future, this system could be modified so that a person wearing Virtual Reality (VR) gear and standing in a room with built-in pressure sensors will be able to compete individually or in a team of other users negotiating a series of obstacles in a virtual world while earning points for reaching various milestones or mastering new skills. Although gaming is popular, this system could also be modified for other uses such as technical training. Simulations and training in the virtual world would remove some of the risks of learning how to do new things that have an element of danger if done incorrectly in the 'real world', eg defusing a bomb, test piloting an experimental aeroplane or responding to a critical incident. The virtual reality gear consists of suit with built-in accelerometers and other sensors along with a special head-up display helmet or goggles that give the user the impression that they are inside a virtual world rather than just looking at a large display. Like the balance board in the scenario, the room would have pressure sensors and accelerometers in the floor, walls and on other objects or obstacles in the room. Surround-sound can also be utilised to increase the VR emersion experience. As the user interacts with the scenario the data generated causes dynamic changes within the virtual world.

Other applications include using this equipment to help rehabilitate people with injuries that necessitate their learning to walk again. Exercise programs with interactive games forming the stimulus to perform the repetitive physical movements and the teaching/learning of new skills such as specialist martial arts kicks or practicing complex gymnastic techniques.