

2009

HIGHER SCHOOL CERTIFICATE
TRIAL EXAMINATION

Information Processes and Technology

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using blue or black pen
- Write your student number and/or name at the top of every page

Section I

Total marks (20)

- Attempt questions 1-20
- Allow 40 minutes for this section
- Mark your answers on the answer sheet provided

Section II

Total marks (40)

- Attempt questions 21-24
- Allow 1 hour and 10 minutes for this section
- Answer in the spaces provided on this paper

Section III

Total marks (40)

- Attempt TWO questions from Questions 25-28
- Allow 1 hour and 10 minutes for this section
- Answer each question on a *separate* piece of paper

STUDENT NUMBER/NAME: _____

Section I**Total marks (20)****Attempt Questions 1 – 20****Allow 40 minutes for this section**

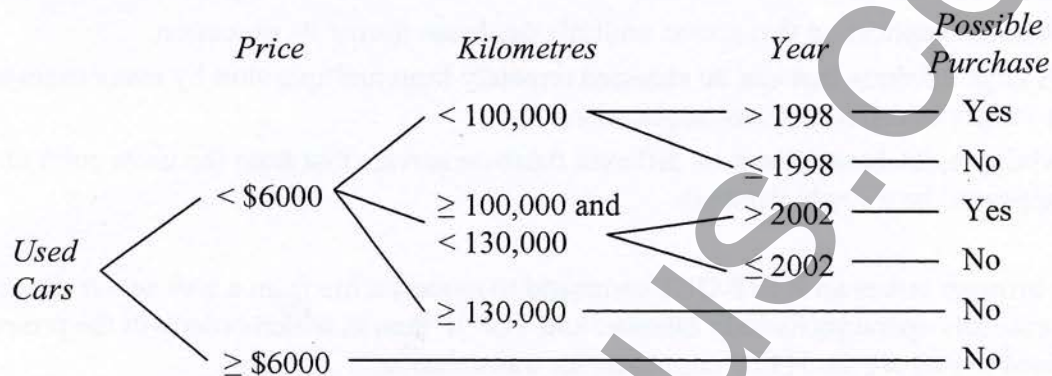
Use the multiple choice answer sheet

Select the alternative A, B, C or D that best answers the question

-
1. When using a traditional system development approach, during which stage would the existing system be analysed to determine how it works, what it does and who uses it?
 - (A) Understanding the problem
 - (B) Planning
 - (C) Designing
 - (D) Implementing
 2. Which of the following best describes the purpose of performing a feasibility study?
 - (A) To assess the technical, economic, schedule and operational feasibility of the chosen solution.
 - (B) To define the requirements of a new system so that suitable solutions can be proposed.
 - (C) To fairly assess the feasibility of different proposed solutions and recommend the most suitable solution.
 - (D) To ensure the final solution will meet all requirements specified within the requirements report.
 3. On all Gantt charts, what data is most significant?
 - (A) Project tasks and when each will be completed.
 - (B) Data entering the system and information leaving the system.
 - (C) Stumbling blocks and decisions.
 - (D) Who is responsible for task completion and deliverables from each task.
 4. The following two quotes refer to Google's system development approach:
"The entire application is kept in a deployable state from the first week"
"Requirements change as the customer has a chance to validate the design through play testing"
The above quotes indicate Google uses which system development approaches?
 - (A) Traditional
 - (B) Prototyping
 - (C) Participant development
 - (D) Agile methods

5. Currently both analog and digital free-to-air television broadcast systems are in operation across Australia. Throughout 2010 to 2013 all analog television broadcasts will be switched off. Which type of system conversion is being used?
- (A) Direct conversion
 - (B) Parallel conversion
 - (C) Prototype conversion
 - (D) Pilot conversion
6. A new database system is used to collect and store a variety of data central to the operation of a business. The new system operates as expected for the first year or so. Response times then begin to increase despite no increase in the number of users or processes performed. Which type of testing could have uncovered this issue prior to the system's implementation?
- (A) Acceptance tests
 - (B) Volume data tests
 - (C) Simulated data tests
 - (D) Live data tests
7. Which document would be of most use to new participants as they learn to perform tasks within an information system?
- (A) Journal
 - (B) Communication management plan
 - (C) Operation manual
 - (D) Requirements report
8. Consider the following SQL statement.
- ```
SELECT Schools.SchoolName
FROM Schools
WHERE Schools.SchoolName > "Ep" AND Schools.SchoolName <= "Ev"
```
- Which of the following is a possible set of results returned by the above query?
- (A) Engadine High School  
Erina High School  
Erskine Park High School
  - (B) Epping Boys' High School  
Erina High School  
Erskine Park High School
  - (C) Epping Boys' High School  
Erina High School  
Erskine Park High School  
Evans High School  
Evans River K-12 School
  - (D) Erina High School  
Erskine Park High School  
Evans High School  
Evans River K-12 School

9. The sales department maintains a relational database to store details of each contact between sales representatives and customers. Each time a customer contacts the sales department, they may deal with a different sales representative. Which type of relationship exists between sales representatives and customers?
- (A) one to one  
(B) one to many  
(C) many to one  
(D) many to many
10. Ray is looking for a used car. He uses the following decision tree to define potential purchases:



Which column in the table shows Ray's potential purchases?

| Car Details                                     | Possible Purchase |     |     |     |
|-------------------------------------------------|-------------------|-----|-----|-----|
|                                                 | (A)               | (B) | (C) | (D) |
| 2002 Lancer with 130,000km at a cost of \$4800  | ✓                 | ✗   | ✗   | ✗   |
| 1998 Barina with 87,000km at a cost of \$3400   | ✓                 | ✗   | ✗   | ✗   |
| 1999 Lanos with 89,000km at a cost of \$4200    | ✓                 | ✓   | ✓   | ✓   |
| 2003 Corolla with 125,000km at a cost of \$6000 | ✗                 | ✗   | ✓   | ✗   |
| 2004 Camry with 105,000km at a cost of \$5800   | ✗                 | ✓   | ✓   | ✓   |
| 1999 Prelude with 98,000km at a cost of \$6500  | ✗                 | ✗   | ✓   | ✗   |
| 2000 Excel with 100,000km at a cost of \$4300   | ✗                 | ✗   | ✗   | ✓   |

11. Within a communication system, the hardware that performs the physical transfer of data uses protocols operating at which level?
- (A) Application level  
(B) Communication control and addressing level  
(C) Transmission level  
(D) Encoding/decoding level

12. Marina wishes to include a hyperlink to Google Australia from an image on her webpage. The image is called "google.gif" and is stored in a folder called "images" within the folder where the HTML file is stored. Which HTML fragment will create this hyperlink?
- (A) `<a href="http://google.com.au"></a>`
  - (B) `<href></href="http://google.com.au">`
  - (C) `<a img src="images/google.gif"><href="http://google.com.au"></a>`
  - (D) `<a href="http://google.com.au"></a>`
13. Which of the following best describes a distributed database?
- (A) Multiple databases controlled by a single database server such that users can access any or all databases.
  - (B) A client application that access multiple databases during its execution.
  - (C) A large database that can be accessed remotely from multiple sites by many users using a variety of different client applications.
  - (D) Multiple databases stored on different database servers that from the users point of view appear to be a single database.
14. A web browser issues an HTTP GET command to request a file from a web server. If the LAN protocols operating include Ethernet and TCP/IP then in which order will the protocols be utilised to prepare the HTTP command for transmission?
- (A) HTTP, IP, TCP, Ethernet
  - (B) Ethernet, IP, TCP, HTTP
  - (C) HTTP, TCP, IP, Ethernet
  - (D) TCP, Ethernet, IP, HTTP
15. An Ethernet switch uses which of the following unique identifiers to determine the destination for messages?
- (A) IP Address
  - (B) User name
  - (C) MAC Address
  - (D) Computer name
16. Which device is used to connect two networks that use different lower level protocols?
- (A) Bridge
  - (B) Router
  - (C) Switch
  - (D) Gateway

17. When a web browser communicates with a web server using Secure Sockets Layer (SSL), which of the following occurs?
- (A) Both the web browser and the web server generate a public and a private key. Public keys are exchanged and are then used to encrypt messages. Private keys are used to decrypt received messages.
  - (B) The web browser and the web server negotiate to agree on a secret key. All messages are encrypted using this secret key prior to transmission. The secret key is also used to decrypt received messages.
  - (C) The web server generates a public and a private key. Both keys are transmitted to the web browser. The public key is used to encrypt messages and the private key is used to decrypt received messages.
  - (D) A user name and password is sent from the browser to the web server. The web server verifies the identity of the user by examining its connected user database. If a match is found then the web server provides access to the secure data.
18. What is the purpose of parity bits, checksums and CRCs?
- (A) To protect against unauthorised access to sensitive data.
  - (B) To ensure messages reach their intended destination.
  - (C) To provide a mechanism for detecting transmission errors.
  - (D) All of the above.
19. On a network, each node always receives data packets from one particular node and always sends data packets to another particular node. Which network topology is used in this network?
- (A) Bus
  - (B) Ring
  - (C) Star
  - (D) Hybrid
20. Search engines utilise search robots, such as Google's GoogleBots. What is the function of these search robots?
- (A) Locating a list of websites and files that match a user's entered search criteria.
  - (B) Generating and formatting the web pages that form part of the search engine's web site and search results.
  - (C) Create an index of the words found on web pages that have already been downloaded from the Internet to the search engine's servers.
  - (D) Retrieve web pages and files, including following links to discover other web pages and files.

**Section II****Total marks (40)****Attempt Questions 21 – 24****Allow about 1 hour and 10 minutes for this section**

Answer in the spaces provided on this paper.

If you include diagrams in your answer, ensure that they are clearly labelled.

**Question 21. (8 marks)****Marks**

- (a) Distinguish between a requirements prototype and a prototyping approach to system development.

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- (b) An innovative new web application has been proposed to assist builders ensure their projects comply with the large number of ever changing legal requirements and regulations. The new web application will initially be implemented with minimal functionality, then over time new functionality will be developed and implemented progressively as budget constraints allow.

- (i) Suggest and justify a suitable system development approach.

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Question 21 continues on the next page

Question 21 (continued)

**Marks**

- (ii) Discuss how project management tools can assist the efficient management of the new web application's ongoing development.

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End of Question 21

**Question 22.** (12 marks)**Marks**

A website requires users to be verified based on their UserName and Password. Users are able to tick a "Remember Me" check box which causes two cookies to be stored on their local machine – one cookie contains their UserName and the other contains an encrypted version of their Password. Cookies are linked to particular websites and are automatically sent to the relevant web server each time the website is revisited.

The web server is linked to a database that stores UserNames and encrypted Passwords. Code running on the web server is able to convert Passwords into their encrypted equivalent; however it is not possible to decrypt the encrypted Passwords back into Passwords.

When an existing user returns to the website the following checks are performed in sequence to login users:

- If the two cookies exist on the user's machine then the contents of the cookies (namely the UserName and encrypted Password) are sent to the web server along with the initial HTTP request from the browser.
- If the cookies do NOT exist then the login screen is displayed to collect the UserName and Password from the user, which is then sent to the web server.
- If a UserName and Password (either encrypted or not) is received by the web server then the user is verified by comparison with the User database. If a match is found then the user is logged in, otherwise they are refused access.
- A response (in the form of a simple HTML file) is returned to the web browser to indicate the success or failure of the login process.

(a) Construct a dataflow diagram to represent this system.

4

Question 22 continues on the next page

## Question 22 (continued)

## Marks

- (b) Construct a decision tree to describe the decisions required if the two cookies exist, to determine login success or failure when a user revisits the website. 2

- (c) Identify the client-server operations occurring during the login process. 3

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- (d) Analyse the system's method of securing passwords. 3

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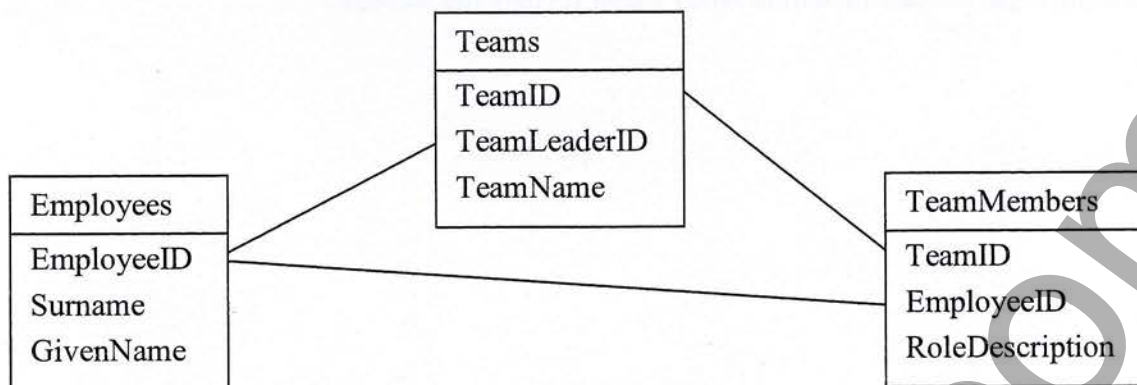
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End of Question 22

**Question 23.** (12 marks)**Marks**

Consider the following incomplete schema for the parts of a relational database that store details of teams within an organisation that develops information systems:



Each team includes a single team leader and some team members. Each employee is likely to be a member of multiple teams. A team leader can lead a number of teams and could also be a member of these and other teams.

- (a) On the above schema, indicate all primary keys, foreign keys and the nature of each relationship. 3
- (b) Construct an SQL SELECT statement that returns all team names together with the surname and given name of each team's leader, in ascending team name order. 2
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- (c) Design a data input screen suitable for users to enter all details of new teams and their members. 3

Question 23 continues on the next page

### Marks

- 4

us.com

Page 13 of 23

**Question 24.** (8 marks)**Marks**

Sue lives in Sydney where she works for a small firm on a project for a national supermarket chain. She uses a laptop that connects wirelessly to a small local area network in the office where she works. In this office, there is a broadband connection to the Internet shared by all of the staff in the office.

John works in the Melbourne office of the same company. He has been asked to work with Sue on a part of the project. They are both working within a strict budget.

Sue needs to communicate with John regarding a particular aspect of the proposed system, over which there has already been some disagreement between them. They will both need to look at a draft online database that Sue has set up.

Sue decides to send John an e-mail.

- (a) Describe what is meant by Netiquette, with specific reference to Sue's e-mail communication.

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- (b) Draw a labelled diagram to show the likely data links and hardware that will be used as the email travels from Sue's laptop until it arrives at the mail server within the Melbourne office. You may include the Internet as a single symbol on your diagram.

3

Question 24 continues on the next page

Question 24 (continued)

Marks

- (c) Compare and contrast the use of e-mail for this communication between John and Sue with the alternative approaches of VOIP and teleconferencing. 3

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End of Question 24.

**Section III****Total marks (40)****Attempt TWO questions from Questions 25 – 28****Allow about 1 hour and 10 minutes for this section**

Answer each question on your own paper or writing booklet, if available.

Start each question on a new page.

If you include diagrams in your answer, ensure that they are clearly labelled.

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**Question 25 – Transaction Processing Systems. (20 marks)****Marks**

Start a new page.

- |     |      |                                                                                                         |   |
|-----|------|---------------------------------------------------------------------------------------------------------|---|
| (a) | (i)  | Describe the operation of an RFID tag used to allow identification of a product in a warehouse.         | 3 |
|     | (ii) | Describe what is meant by the term <i>enterprise system</i> , and its relevance to a large corporation. | 3 |

Question 25 continues on the next page

## Question 25 (continued)

## Marks

Use the following information to answer parts (b) and (c).

WiseTrack is an asset tracking system that can be used to keep track of assets as they move around a corporate facility.

As staff members borrow a particular item, they are required to log into the web-based system and record which item they have borrowed, including details such as time and date, item number, number of days borrowed for, and where it will be housed while it is being borrowed.

When the item is returned, the staff member must log in again and record the fact that the item is now being returned to its original location.

The data from each transaction is stored in a database. A search for particular items can be performed to determine their current location. Management can request various reports. For instance, lists of products that have been borrowed the most times, or which items have the longest borrowing times. It is also possible to print a report listing items which have been borrowed but have not been returned.

- (b) (i) Construct a context diagram to represent the WiseTrack system. 2
- (ii) Describe how the use of this system has changed the nature of work for staff members and management, compared to how they used to work before this system was implemented. 4
- Consider the work of:
- staff members who borrow items,
  - clerks whose job is to track, locate and monitor borrowed items, and
  - management.
- (iii) Describe with particular reference to this system what is meant by data quality and how it can be ensured. 3
- (c) If the network is temporarily unavailable, it is important that an alternate procedure is clearly documented and periodically tested.
- (i) Propose a suitable alternate manual procedure. 3
- (ii) Explain how this alternate system could be periodically tested, and why such testing is necessary. 2

End of Question 25

**Question 26 – Decision Support Systems. (20 marks)****Marks**

Start a new page.

- |     |      |                                                                                                                                |   |
|-----|------|--------------------------------------------------------------------------------------------------------------------------------|---|
| (a) | (i)  | Explain what is meant by a Geographic Information System (GIS) and outline an example of its use as a decision support system. | 3 |
|     | (ii) | Describe the use of a “drill down” process during the operation of an OLAP system.                                             | 3 |

Question 26 continues on the next page

## Question 26 (continued)

## Marks

Use the following information to answer parts (b) and (c).

A system is currently being developed to analyse incoming sounds to detect if they are 'known' recognizable sounds, or if they are unrecognisable (that is, they cannot be identified as being similar to a set of recognisable sounds 'known' by the system).

The potential of this system is significant -

- identification of significant sounds for hearing impaired people (such as bells, alarms, important commands...).
- recognition of songs (as in the current iPhone Shazam application).
- recognition of individual tones or musical notes (to allow activation of specific actions depending on the tone or note).
- identification of unknown sounds in a warehouse after hours that may indicate the presence of an intruder.

At this early stage in its development, the system utilises a neural network to 'hear' sounds, and then output a message indicating either the identification of the sound, or the fact that it is not a recognisable sound.

- |     |       |                                                                                                                                                                                                              |   |
|-----|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| (b) | (i)   | Identify a number of possible sources of input data to this system.                                                                                                                                          | 2 |
|     | (ii)  | Explain how this neural network system can be 'trained' to recognise a set of 'known' sounds.                                                                                                                | 3 |
|     | (iii) | Describe the role of the 'hidden' layer of neurones in this neural network system.                                                                                                                           | 3 |
| (c) | (i)   | Distinguish between the use of this neural network approach, and the use of an expert system to solve the same problem.                                                                                      | 3 |
|     | (ii)  | Describe the relationships between the participants, data and information technology used in this system if it is used within a mobile phone (such as an iPhone) to recognise a song currently being played. | 3 |

End of Question 26

**Question 27 – Automated Manufacturing Systems. (20 marks)****Marks**

Start a new page.

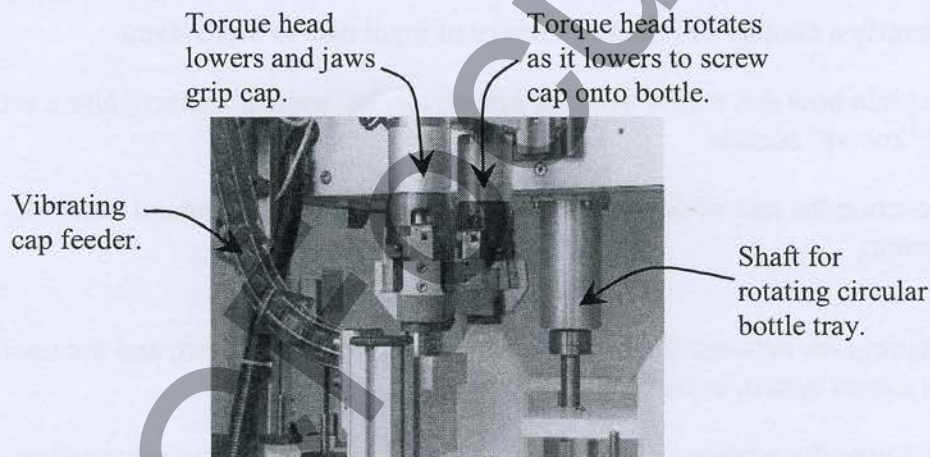
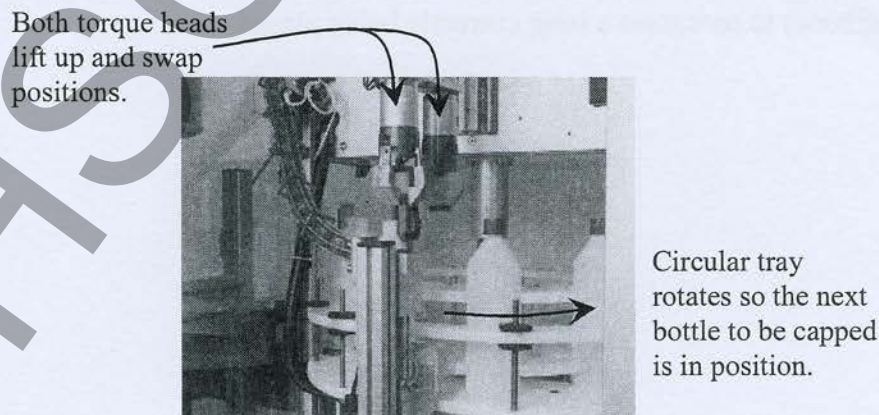
- (a) (i) Identify an example of a *sensor* and describe its operation. 3
- (ii) Distinguish between *human-centred* and *machine-centred* automated manufacturing systems. 3

Use the following information to answer parts (b), (c) and (d) on the next page.

Cap Coder is a UK based company who produces the CC560 capping machine. This machine is able to pick up and screw a variety of different caps onto a variety of different bottles.

The machine includes two torque heads. Whilst one torque head lowers to retrieve a cap from a vibrating cap feeder the other torque head spins and then lowers to screw its cap onto a bottle (refer *Fig 1*). The torque heads then lift up and change position whilst the circular tray moves the next bottle to be capped into position (refer *Fig 2*). The process is performed repeatedly. The CC560 is able to cap up to 40 bottles per minute.

Each torque head includes three rubber lined jaws which close to grip the cap. The force applied by the jaws can be adjusted to suit caps of different sizes and materials. Various other adjustments can be made including the spin speed of the torque head, vertical lift of the torque heads and degrees of tray rotation. It is critical that caps are screwed on tight enough that they seal, but not so tight that they cannot be manual unscrewed.

*Fig 1.**Fig 2.*

Question 27 continues on the next page

## Question 27 (continued)

## Marks

- (b) Propose and justify suitable actuators for performing each of the following tasks.
- (i) Lifting and lowering the torque heads. 2
  - (ii) Rotating the torque head as it screws on a cap. 2
  - (iii) Rotating the circular tray so the next bottle to be capped is in position. 2
- (c) During operation of the capping machine feedback from sensors to the controller is used to fine tune the operation of its various actuators. Describe TWO areas where such feedback would improve the operation of the capping machine. 4
- (d) Describe reasons why a bottling plant would choose to automate their bottle capping operation. 4

End of Question 27

**Question 28 – Multimedia Systems. (20 marks)****Marks**

Start a new page.

- (a) (i) Describe how *JPEG* image files are compressed. 3
- (ii) Explain how *plasma* screens produce images. 3

Use the following information to answer parts (b) and (c) on the next page.

Maths Online is a quality online maths tutoring program developed by qualified mathematics teachers. This commercial software has recently been made freely available to all Australian secondary schools and students via a deal with McDonald's restaurants throughout Australia. All content is streamed using flash SWF files.

Students, once logged on, are presented with a menu where they select the stream, topic and then lesson to be completed (refer Fig 1). Each lesson is a flash animation accompanied by a narrated sound track (refer Fig 2). The sound track explains the maths concept as the animation progresses. Lessons can be rewound and fast forwarded as required. A printable worksheet accompanies each lesson (refer Fig 3). Students complete the worksheet using pen and paper. Once completed a set of fully worked solutions is available (refer Fig 4). The system maintains a record of lessons completed by each student.

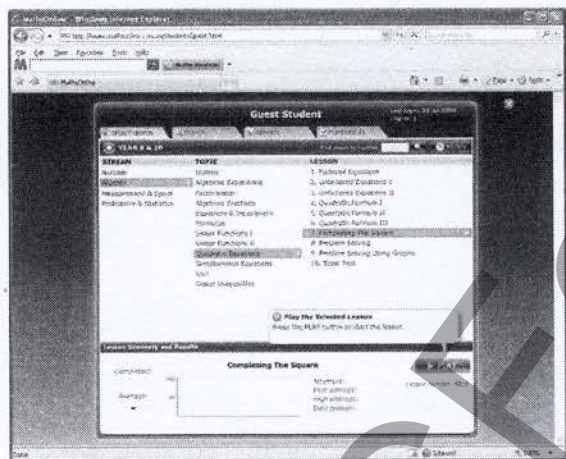


Fig 1.

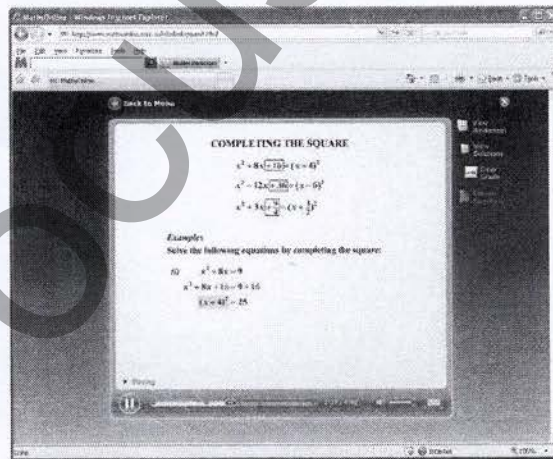


Fig 2.

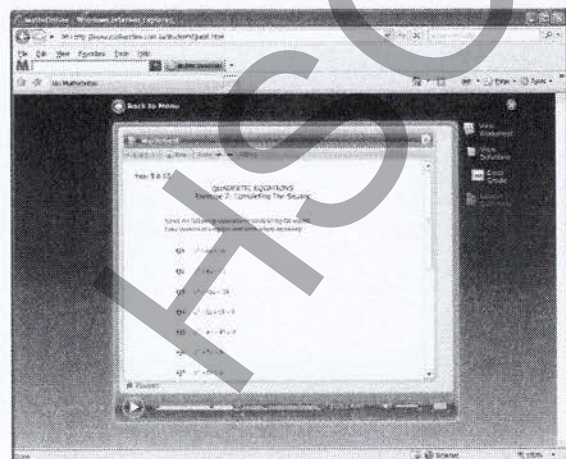


Fig 3.

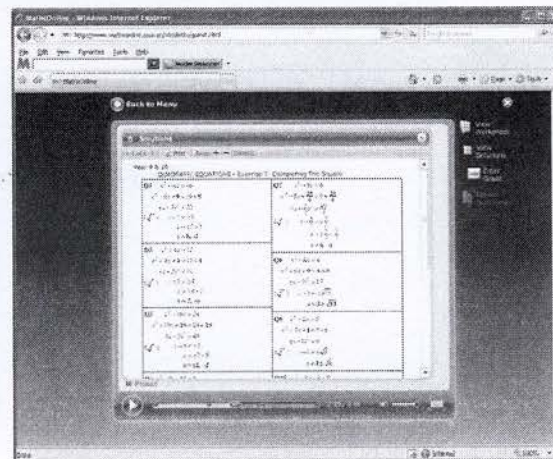


Fig 4.

Question 28 continues on the next page

## Question 28 (continued)

## Marks

- (b) (i) The URL <http://www.mathsonline.com.au/students/guest.html> is the same on each of the screen shots shown on the previous page, however the content displayed is different. Explain how this is achieved. 2
- (ii) Each lesson plays for approximately 5-10 minutes. Over a 512kbps ADSL connection, lessons begin almost instantaneously and are completely downloaded to the local machine in just a few seconds. 4
- Contrast the above performance using SWF with the likely performance had MPG been used instead. Justify your response in terms of the organisation of MPG data compared to SWF data.
- (c) (i) The Maths Online system includes some 800 lessons. Each lesson includes the animated and narrated lesson together with a printable worksheet and solutions sheet. Clearly developing and combining all this content is an enormous task. 4
- Describe suitable software applications that would assist during the development of the Maths Online system.
- (ii) Presenting a new concept followed by practice using pen and paper worksheets largely mirrors a traditional classroom Maths lesson. 4
- Compare and contrast the Maths Online system compared to a traditional classroom Maths lesson.

END OF EXAMINATION