South Australian
Certificate of Education

Information Technology
2018

Question booklet

- **Part A: Core topics** (Questions 1 to 4) 70 marks
  Answer ***all*** questions
  Allow approximately 70 minutes
- **Part B: Option topics** (Questions 5 to 9) 50 marks
  Answer ***two*** questions
  Allow approximately 50 minutes
- Write your answers in this question booklet

Examination information

Materials

- Question booklet
- SACE registration number label

Reading time

- 10 minutes
- You may begin writing during this time
- You may begin using an approved calculator during this time

Writing time

- 2 hours
- Use black or blue pen
- Approved calculators may be used

Total marks 120

Government of South Australia

Attach your SACE registration number label here

PART A: CORE TOPICS (Questions 1 to 4)

(70 marks)

*Answer **all** questions in this part.*

Question 1 (19 marks)

A toll road is one on which a motorist pays a fee (called a toll) to travel. The Cit-ee company operates one toll road, along which there are several toll points (see Figure 1).

The toll road is available for all motorists to use. A motorist who travels regularly along the toll road can obtain a 'Toll-tag' electronic device, which contains a motorist identifier. The Toll-tag attaches to the motorist's vehicle and beeps whenever the vehicle passes a toll point. A motorist who has a Toll-tag receives a discounted monthly account.

The system that recognises and records the passing of vehicles through the toll points is a computer-based information system.

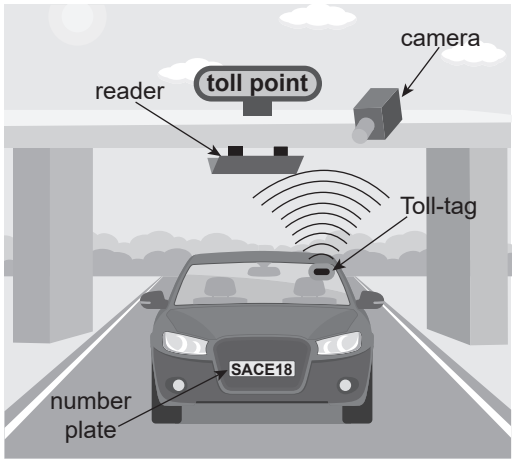


Figure 1

Source: adapted from © Elena Tumanova | Dreamstime.com

(a) Complete the table below by describing the functions of the reader (see Figure 1) and the motorist identifier when a vehicle passes a toll point.

Element	*Example*	*Description of function*
Hardware	Reader	
Data	Motorist identifier	

(4 marks)

(b) Kim has a Toll-tag attached to her vehicle, and regularly travels along the toll road.

(i) Identify *one* feedback mechanism of Kim's Toll-tag, and suggest the purpose of this mechanism.

(2 marks)

(ii) Describe how the data generated by Kim's Toll-tag would be collected and processed by the computer-based information system, and presented to Kim.

(4 marks)

(c) John does not have a Toll-tag attached to his vehicle, yet he travels along the toll road.

When John passes a toll point, his vehicle's number plate is recorded. John then receives an account that is not discounted.

(i) Describe *one* possible constraint — other than power loss — that might affect the collection of data about John's vehicle.

(2 marks)

(ii) Describe *one* way of minimising the impact of this constraint.

(2 marks)

(d) The Cit-ee company developed the Toll-tag computer-based information system, and continues to maintain it.

(i) Identify *one* statistical output of the computer-based information system that could be collected by the Cit-ee company, and outline how this output could help the company in their decision-making processes.

_____

_____

_____

_____

_____

_____ (3 marks)

(ii) Identify and explain *one* information technology-related career that could exist within the Cit-ee company.

_____

_____

_____

_____ (2 marks)

Question 2 (17 marks)

Sam is putting some clothes in the washing machine. The washing machine has a number of pre-programmed washing cycles, as shown in Figure 2.

Figure 2

Source: adapted from © H368k742 | Dreamstime.com

(a) With reference to Figure 2, identify *one* input device through which Sam could select a washing cycle.

_____

_____ (1 mark)

(b) Identify *one* output device through which the washing machine could alert Sam that the washing cycle has finished.

_____

_____ (1 mark)

(c) Identify *two* forms of memory that operate while the washing machine is switched on, and state their functions.

(i) (1) Form of memory: _____ (1 mark)

(2) Function: _____

_____ (1 mark)

(ii) (1) Form of memory: _____ (1 mark)

(2) Function: _____

_____ (1 mark)

(d) The washing machine company offers an application (app) that Sam could install on a smartphone.

(i) Suggest *two* functions that this app could perform.

_____

_____

_____

_____ (2 marks)

(ii) Suggest why a smartphone app would be an appropriate way to connect remotely to the washing machine.

_____

_____ (1 mark)

The washing machine contains an embedded processor, as represented in Figure 3.

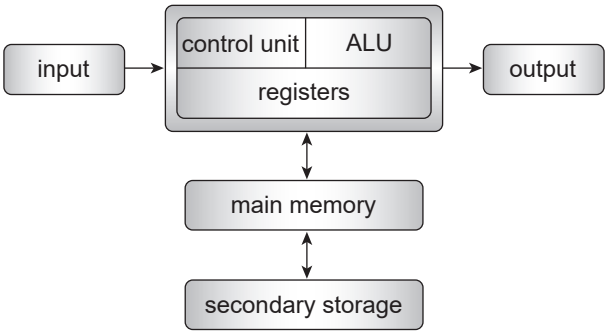


Figure 3

(e) Sam sets the washing machine to delay the start of the washing cycle by 2 hours.

With reference to Figure 3, outline how data are used by the control unit, ALU, and registers in determining that 2 hours has elapsed and that the washing cycle can start.

(i) Control unit: _____

_____

_____

_____ (2 marks)

(ii) ALU: _____

_____

_____

_____ (2 marks)

(iii) Registers: _____

_____

_____

_____ (2 marks)

(f) Sam is able to create a new type of washing cycle; however, when the washing machine is switched off, the new washing cycle is lost.

Identify and discuss how this washing cycle could be retained when the washing machine is switched off.

_____

_____

_____

_____ (2 marks)

Question 3 (26 marks)

Ace Design is a business that produces computer-generated advertising posters and videos.
Ace Design is expanding its computer network.

(a) Outline *two* advantages to Ace Design of having a LAN.

(2 marks)

(b) Discuss *one* advantage to Ace Design of using a client–server network operating system.

(2 marks)

(c) Ace Design can connect devices on its computer network using either copper cable or fibre optic cable.

Compare the characteristics of these cabling options, and suggest where in this network each cabling option could be used.

(3 marks)

(d) The incomplete diagram below (Figure 4) shows Ace Design's computer network, which includes several desktop computers, a wireless-enabled laptop, the internet, a printer, and a modem / router device.

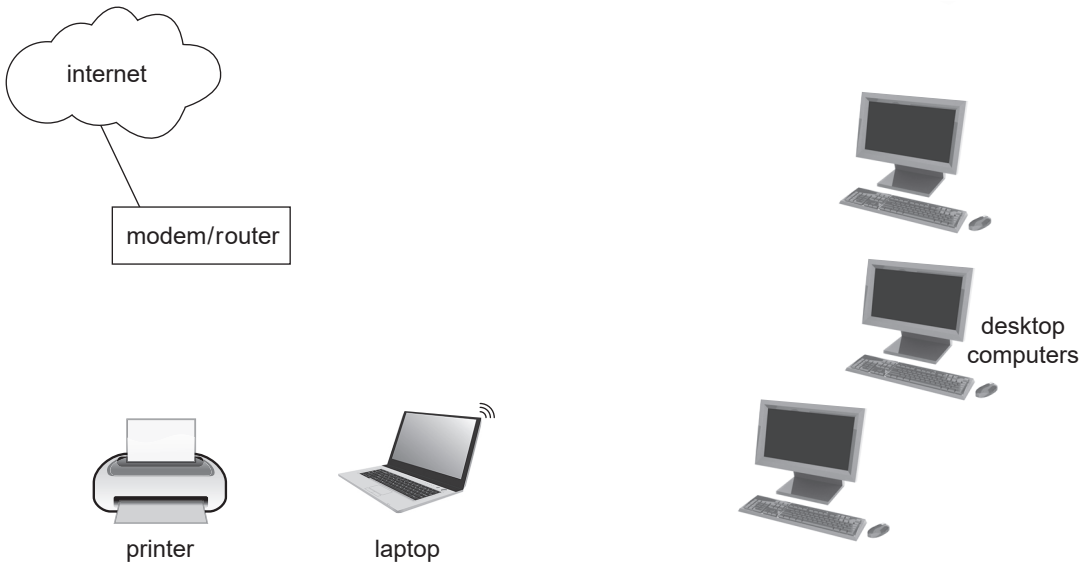


Figure 4

Source: adapted from © Farsh | Dreamstime.com (desktop computer), © Nataliya Kostenyukova | Dreamstime.com (laptop)

Refer to Figure 4 and do the following:

(i) Draw and label a switch and any connections required. (1 mark)

(ii) Draw and label a file server and any connections required. (1 mark)

(iii) Draw and label a wireless access point (WAP) and any connections required. (1 mark)

(e) Discuss *one* advantage to Ace Design of adding a WAP to its computer network.

_____

_____

_____

_____ (2 marks)

(f) Suggest what would happen if two devices on Ace Design's computer network had the same IP address.

_____

_____ (1 mark)

(g) Identify and describe *one* additional server that Ace Design could connect to its computer network.

_____

_____

_____

_____ (2 marks)

(h) The manager is printing a file.

Explain the role of TCP in transferring the file from the manager's computer to the printer.

_____

_____

_____

_____

_____

_____ (3 marks)

(i) Ace Design's website is hosted externally, and the employees regularly upload new videos to this website.

Explain why the bandwidth of Ace Design's internet connection is important in this situation.

_____

_____

_____

_____ (2 marks)

(j) A customer can place an order through Ace Design's website, using a credit card. The website uses HTTPS to encrypt the customer's data during transit.

Explain the role of both public keys and private keys in enabling this encryption to occur.

(4 marks)

(k) The manager regularly travels around Australia to attend conferences and meetings.

Discuss how a virtual private network (VPN) connection to the Ace Design computer network can be useful to the manager when travelling.

(2 marks)

Question 4 (8 marks)

Nigel Phair, University of Canberra cybersecurity expert, recently stated that 'all Australian companies … need to take cybersecurity seriously'.

Discuss the following issues in relation to the collection and storage of data in a modern computer-based information system:

- data protection
- customer privacy
- system security.

(8 marks)

PART B: OPTION TOPICS (Questions 5 to 9)

(50 marks)

*Choose **two** of the following questions.*

OPTION TOPIC: RELATIONAL DATABASES

Question 5 (25 marks)

Read the following scenario.

A school library has a relational database borrowing system that is able to print out the following information about books that have been borrowed:

StudentID	*Surname*	*FirstName*	*Barcode*	*Title*	*Author*	*DueDate*
14123	Snow	John	0012354X	*Harry Plotter and the IT examination*	JK Rolling	10 November 2018
14123	Snow	John	0054524K	*Smartabases*	NE Author	15 December 2018

(a) Identify the data type for the following fields:

Field	*Data type*
Barcode	
DueDate	

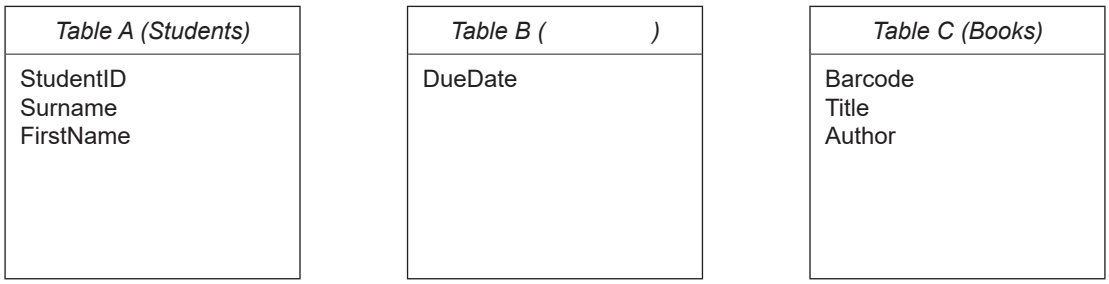
(2 marks)

(b) With reference to normalisation, explain why the borrowing system data should be stored in a relational database.

(2 marks)

Question 5 continues on page 14.

(c) Below is a section of the table relationship diagram for the borrowing system.



(i) Two of the entities being stored are 'Students' and 'Books'.

Explain the relationship between these two entities.

_____

_____

_____

_____ (2 marks)

(ii) Suggest an appropriate name for *Table B*, and write it in the space below.

_____

_____ (1 mark)

(iii) Complete the table relationship diagram above by including the following details:

(1) additional fields required in *Table B*. (2 marks)

(2) table relationships. (2 marks)

(3) a Boolean field that will record whether or not a book has been returned. (1 mark)

(iv) Explain why a default value of TRUE is a poor choice for the Boolean field that you included in part (iii)(3).

_____

_____ (1 mark)

(d) A composite key could be formed from the foreign keys within a transaction table.

Explain why this form of composite key is ***not*** desirable for *Table B* in this context.

_____

_____

_____

_____ (2 marks)

(e) Design a query that will identify all of the students who borrowed *Harry Plotter and the IT examination*.

(2 marks)

(f) Design a query that will identify all of the students who borrowed books during April 2018, and then rank these students in order of the number of books that they borrowed (from highest to lowest).

(3 marks)

(g) (i) Identify *two* database features that can help students to use a school library effectively.

_____

_____

_____

_____ (2 marks)

(ii) Identify *three* ways in which this database can help the school librarians.

_____

_____

_____

_____

_____

_____ (3 marks)

OPTION TOPIC: APPLICATION PROGRAMMING

Question 6 (25 marks)

Read the following scenario.

At the HoleInOne minigolf park, players are able to play a short round (9 holes) or a regular round (18 holes) on one of three themed courses.

The courses are: Jurassic (courseCode 1), Back to the Future (courseCode 2), and Around the World (courseCode 3).

For each course, the fee for a 9-hole round is $10 and the fee for a 18-hole round is $15.

Part of a possible algorithm for an application to process players is shown below.

```
CONST shortFee = 10
CONST regularFee = 15
BEGIN ProcessSale
    INPUT NoOfPlayers
    WHILE NoOfPlayers <> 0
        INPUT courseCode
        INPUT NoOfHoles
        IF NoOfHoles == 9 THEN
            shortRound(courseCode)+= NoOfPlayers
        ELSE
            regularRound(courseCode)+= NoOfPlayers
        ENDIF
        INPUT NoOfPlayers
    ENDWHILE
END ProcessSale
```

(a) On the algorithm above, *clearly* circle *one* condition. (1 mark)

(b) Desk-check this algorithm, using the following data:

2, 1, 9, 2, 2, 9, 4, 1, 18, 1, 2, 9, 4, 1, 9, 0

INPUT			shortRound			regularRound		
			1	2	3	1	2	3

(5 marks)

(c) Explain what would happen if '6' was the input for `NoOfHoles`.

_____

_____

_____

_____ (2 marks)

(d) Using pseudocode or otherwise, write an algorithm for a function that will calculate and then output the total daily revenue.

```
BEGIN TotalRevenue




END TotalRevenue
```

(4 marks)

(e) HoleInOne allows a maximum of eight people per group.

Using pseudocode or otherwise, write an algorithm that will check whether or not `NoOfPlayers` contains a valid input.

```
BEGIN CheckInput




END CheckInput
```

(3 marks)

(f) HoleInOne decides to offer a 10% discount to groups that have four or more players.

Using pseudocode or otherwise, write an algorithm that will:

- calculate the total fee payable by a group of players
- calculate a 10 % discount if there are four or more players in the group
- display the total fee and any applicable discount.

```
BEGIN FeePayable




END FeePayable
```

(5 marks)

(g) The developers of this application software wish to distribute it to other minigolf businesses.

(i) The developers could distribute the application software either commercially or under a Creative Commons licence.

Outline the differences between these two distribution approaches.

(3 marks)

(ii) Identify and explain *one* form of media by which this application software could be distributed.

(2 marks)

OPTION TOPIC: MULTIMEDIA PROGRAMMING

Question 7 (25 marks)

Read the following scenario.

Jigsaw Babies is a multimedia application created for touchscreen devices, to help children learn the names of baby animals (e.g. kitten, puppy). When 'Jigsaw' is tapped, the image of a baby animal is displayed as a nine-piece jigsaw (Figure 5). The player activates a 'scatter' function to send the nine jigsaw pieces to random start positions outside the grid (Figure 6). The player then re-forms the image by moving each jigsaw piece into its correct place on the grid.

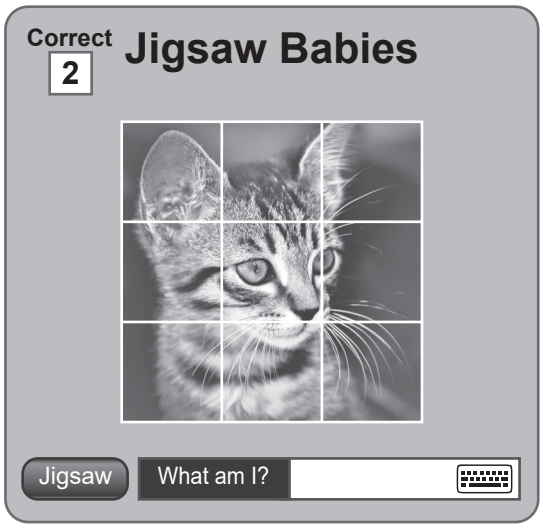


Figure 5

Figure 6

(a) Suggest *one* way in which the player could activate the scatter function.

_____

_____ (1 mark)

(b) With reference to Figure 6, outline *one* method by which the player might move the jigsaw pieces into place to re-form the image.

_____

_____

_____

_____ (2 marks)

Question 7 continues on page 20.

(c) The program for the multimedia application uses three arrays: `jigsawImage()`, `jigsawStart()`, and `gridImage()`.

The array `jigsawImage()` stores the nine jigsaw pieces in their correct order (see Figure 7).

The array `jigsawStart()` stores the randomised start positions of the jigsaw pieces. For example, `jigsawStart(1)` may store `jigsawImage(5)`.

The array `gridImage()` stores the positions of the jigsaw pieces as they are moved into the grid by the player while trying to re-form the image.

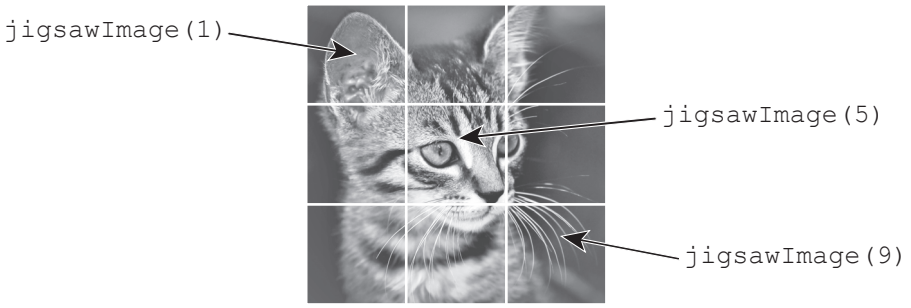


Figure 7

(i) Using pseudocode or otherwise, write an algorithm for a procedure, `checkGrid`, that will check each jigsaw piece in the `gridImage()` array, and will return each piece that is in the incorrect position to its randomised start position outside the grid.

```
BEGIN checkGrid




END checkGrid
```

(5 marks)

(ii) Using pseudocode or otherwise, write an algorithm for a procedure, `gridComplete`, that will do the following:

- run after `checkGrid`
- check whether or not the `gridImage()` array has been filled
- notify the player when the `gridImage()` array has been filled.

```
BEGIN gridComplete




END gridComplete
```

(4 marks)

(iii) Outline *two* advantages of using arrays to store the jigsaw pieces.

_____

_____

_____

_____ (2 marks)

(d) Explain why compression should be used for the jigsaw piece files.

_____

_____

_____

_____ (2 marks)

(e) Outline *one* method by which multimedia could be used to notify the player that a jigsaw piece has been moved to an incorrect position on the grid.

_____

_____

_____

_____ (2 marks)

(f) Once the image has been re-formed, the player types in the name of the baby animal and taps 'What am I?' to check their answer.

Discuss *one* method by which multimedia could be used to notify the player whether or not their answer is correct, *other than* your answer to part (e).

(2 marks)

(g) Suggest *three* ways in which multimedia applications such as *Jigsaw Babies* could have an impact on individuals and/or organisations such as schools.

(3 marks)

(h) Discuss how images used in children's multimedia applications are subject to social and cultural practices and values.

(2 marks)

OPTION TOPIC: WEBSITE PROGRAMMING

Question 8 (25 marks)

Read the following scenario.

The Brain-Ed website includes games that help people develop memory and thinking skills. One of these games is Concentration, in which the player and the computer take turns to find matching pairs of images on cards by turning over one card, then a second.

The Brain-Ed home page and the Concentration web page are shown in Figure 8 and Figure 9.

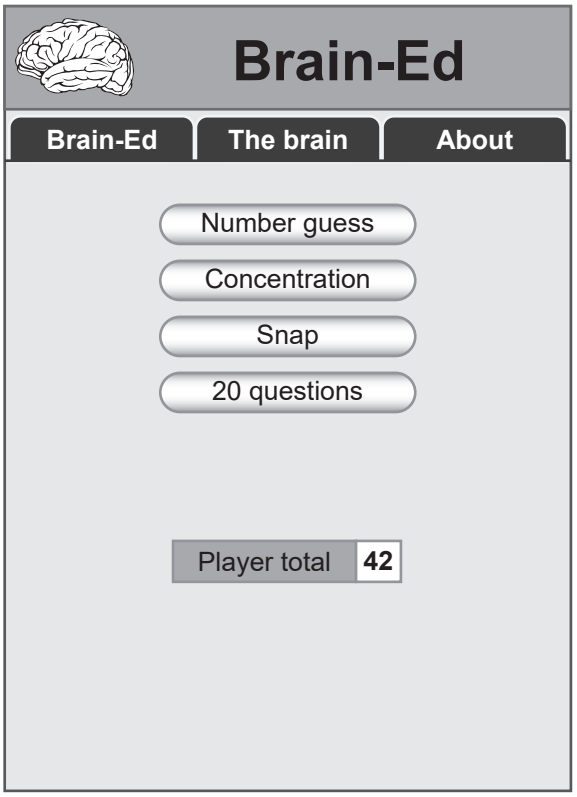


Figure 8

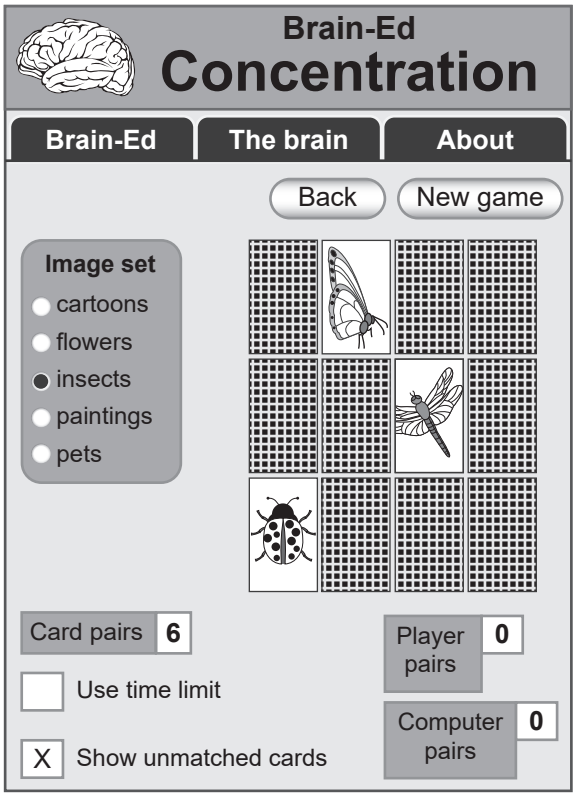


Figure 9

(a) Identify *two* ways of navigating from the Concentration web page to the Brain-Ed home page.

_____

_____

_____

_____ (2 marks)

Question 8 continues on page 24.

(b) Using examples, explain how a consistent style can easily be maintained across all of the web pages in the Brain-Ed website.

(3 marks)

Refer to Figure 9 on page 23.

(c) The player can customise the type of image shown on the cards (e.g. flowers or insects), using the 'Image set' radio buttons.

(i) Outline why radio buttons are used to select the card image options.

(2 marks)

(ii) Discuss the suitability of using a drop-down list (HTML <select> list) rather than radio buttons for this purpose.

(2 marks)

(iii) Suggest why checkboxes have been used for 'Use time limit' and 'Show unmatched cards', rather than radio buttons that group these options.

(2 marks)

(d) The player can choose the number of card pairs to display, which must be between 2 and 10.

(i) In the space below, use pseudocode or otherwise to write an algorithm that will:

- check whether or not a value has been entered, and if necessary display an appropriate alert
- check whether or not the value entered is a number between 2 and 10, and if necessary display an appropriate alert.

```
BEGIN cardPairs




END cardPairs
```

(3 marks)

(ii) Discuss *one* suitable input element that would eliminate the need for these error checks.

_____

_____

_____

_____ (2 marks)

(e) The variable `numPairs` stores the number of card pairs chosen for the game. When the player chooses an image set for a game, the card images are loaded into the `cardImages()` array. When the game begins, the card images are moved in a random order to the `gameImages()` array, which is then used to display the cards.

Using pseudocode or otherwise, write an algorithm that will randomly move the card images to the `gameImages()` array.

```
BEGIN shuffleCards




END shuffleCards
```

(4 marks)

(f) The games available on the Brain-Ed website incorporate images.

Discuss *one* legal issue or *one* ethical issue that developers need to consider when incorporating images in a website.

_____

_____

_____

_____

_____

_____ (3 marks)

(g) Discuss *one* technical issue that developers need to consider when incorporating images in a website.

_____

_____

_____

_____ (2 marks)

OPTION TOPIC: DYNAMIC WEBSITES

Question 9 (25 marks)

Read the following scenario.

The Greenhill Town Council manages many recreation sites including parks, tennis courts, and ovals. Residents of the council can book these sites, using the council's online booking system. Figure 10 shows the online booking system home page.

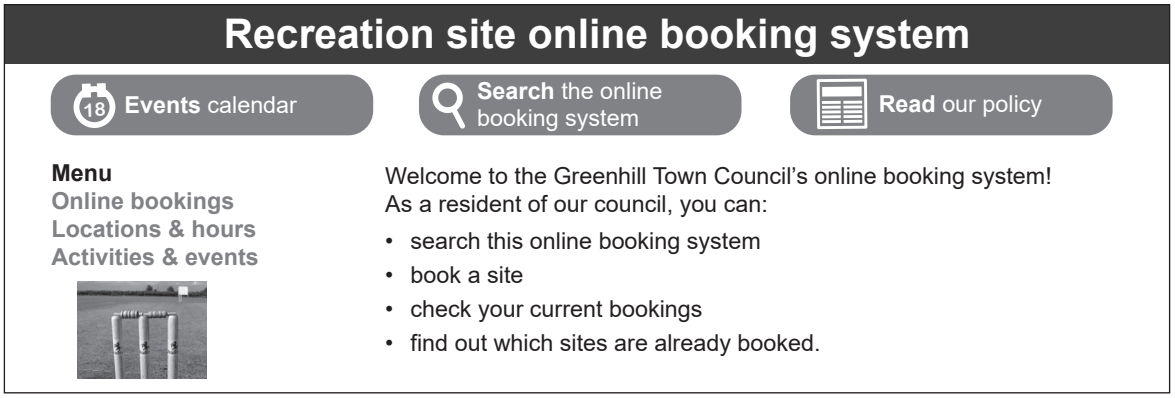


Figure 10

(a) The online booking system home page contains links to both dynamic pages and non-dynamic pages.

Identify *one* dynamic page and *one* non-dynamic page that this home page links to, and justify your answers.

(i) (1) Dynamic page: _____ (1 mark)

(2) Justification: _____

_____ (1 mark)

(ii) (1) Non-dynamic page: _____ (1 mark)

(2) Justification: _____

_____ (1 mark)

(b) Explain how browsers use HTML files and CSS files in order to display information.

_____

_____

_____

_____

_____

_____ (2 marks)

When searching the online booking system, a resident enters the term 'tennis court' in the search bar at the top of the screen. The result is shown in part in Figure 11.

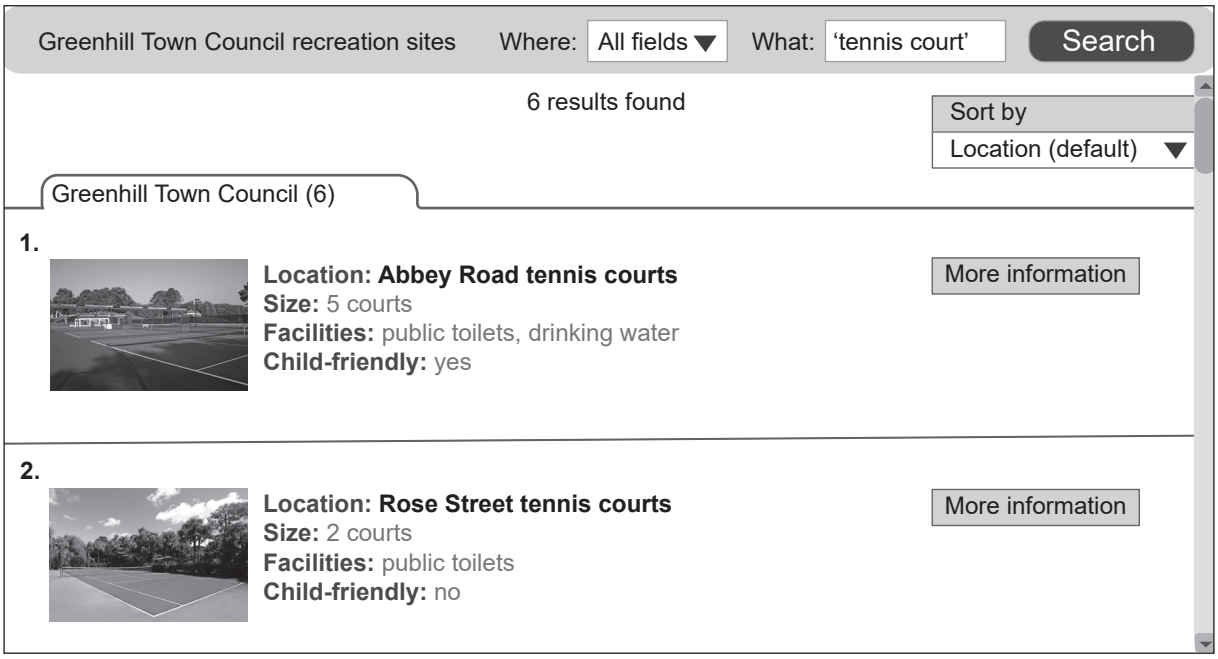


Figure 11

(c) This search bar is an HTML input form, which is used to query the database that stores the online booking system.

(i) Using pseudocode or otherwise, write an algorithm that could have been used to produce this HTML input form.

(3 marks)

(ii) Suggest *three* fields that would be present in the database that stores the online booking system.

_____

_____

_____ (3 marks)

(iii) Using structured query language (SQL) or otherwise, design a query that will process the request generated from the HTML input form shown in Figure 11.

(3 marks)

(iv) Explain how the program code (e.g. PHP or ASP) that contains the query that you designed in part (c)(iii) can use arrays to facilitate the retrieval of information.

(2 marks)

Figure 12 represents a resident connecting to the online booking system that is shown in Figure 11 on page 28.

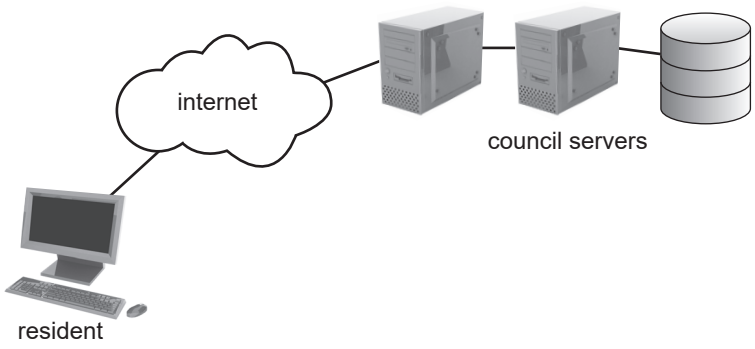


Figure 12

Source: adapted from © Farsh | Dreamstime.com (desktop computer and server)

(v) With reference to Figure 12, explain where the program code and the query that you designed in part (c)(iii) are processed.

(3 marks)

(d) Each resident has an online account containing information about the sites that they have booked.

Suggest *one* method of ensuring the privacy and security of each resident's online account.

_____

_____

_____

_____ (2 marks)

(e) This council manages a variety of recreation sites to cater for people of all ages and backgrounds.

Discuss *two* accessibility issues that need to be considered by the developers of this dynamic website.

_____

_____

_____

_____

_____

_____ (3 marks)