Government of South Australia

SACE Board of SA

External Examination 2012

2012 INFORMATION TECHNOLOGY

ATTACH SACE REGISTRATION NUMBER LABEL TO THIS BOX

Monday 5 November: 1.30 p.m.

Time: 2 hours

Pages: 32
Questions: 9

Examination material: one 32-page question booklet
one SACE registration number label

Approved dictionaries, notes, and calculators may be used.

Instructions to Students

1. You will have 10 minutes to read the paper. You must not write in your question booklet or use a calculator during this reading time but you may make notes on the scribbling paper provided.

2. This paper is in two parts:

   Part A: Core Topics (Questions 1 to 4)
   Answer ***all*** questions in the spaces provided in this question booklet.

   Part B: Option Topics (Questions 5 to 9)
   Answer ***two*** questions in the spaces provided in this question booklet.

3. The allocation of marks and the suggested allotment of time are as follows:

Part A	70 marks	70 minutes
Part B	50 marks	50 minutes
Total	120 marks	120 minutes

4. Attach your SACE registration number label to the box at the top of this page.

STUDENT'S DECLARATION ON THE USE OF CALCULATORS

By signing the examination attendance roll I declare that:

- my calculators have been cleared of all memory
- no external storage media are in use on these calculators.

I understand that if I do not comply with the above conditions for the use of calculators I will:

- be in breach of the rules
- have my results for the examination cancelled or amended
- be liable to such further penalty, whether by exclusion from future examinations or otherwise, as the SACE Board of South Australia determines.

PART A: CORE TOPICS (Questions 1 to 4)

(70 marks)

*Answer **all** questions in this part in the spaces provided. You should spend about 70 minutes on this part.*

1. Top Events Management is organising a festival, in which artists, performers, and comedians will perform at several locations. The company hires people to sell tickets at booths located in the city centre. Each booth is equipped with computers that are used to process the sale of tickets to customers, many of whom have attended previous events. The computers are linked to a central server, which stores appropriate software and data. Customers can choose from many events on each day of the festival.

   (a) Using the scenario above, give an example of *each* of the following components:

   - people
   - procedures
   - software
   - hardware
   - data.

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____ (5 marks)

   (b) State the aim of the information system.

   _____

   _____ (1 mark)

(c) At one of the booths, Bob sells tickets to Sally for a festival event featuring a comedian, George Hansom. Sally uses her credit card to pay for the tickets.

(i) During the process of selling the tickets to Sally, Bob receives information on his computer screen about the sale. Describe *one* possible output that Bob might receive from the information system.

_____

_____ (1 mark)

(ii) When the sale is complete, the information system produces a ticket. State *four* items of data that would be shown on the ticket.

_____

_____

_____

_____ (2 marks)

(iii) Some time after Sally leaves the booth, she receives a text message from Top Events Management stating that her tickets are no longer valid because George Hansom became ill after last night's performance, leading to the cancellation of the rest of his scheduled performances.

(1) State the data that the organisation would need to retain to be able to inform customers when a performance is cancelled.

_____

_____

_____ (2 marks)

(2) Suggest *two* possible reasons why the procedure to keep information up to date in this system did not prevent the tickets being issued to Sally.

_____

_____

_____

_____ (2 marks)

(d) Suggest *one* statistical outcome that could be included in the information system to help in the planning and organisation of future festivals.

_____

_____

_____ (1 mark)

TOTAL: 14 marks

2. The vending machine shown in the diagram below dispenses drinks. It has an embedded processor, a digital display, and a keypad. A customer chooses a drink by keying the appropriate code, which is displayed with the price, and may cancel a mistake by hitting the 'cancel' button. The machine accepts both notes and coins and delivers change in coin. A robotic arm collects the chosen drink from a shelf, delivers it to the collection point below, and returns to rest position.

(a) Sophie, a customer, chooses a drink that costs $3.20 and inserts two $2 coins.

(i) Identify the inputs.

_____

_____ (2 marks)

(ii) Suggest *three* messages that will appear on the digital display.

(1) _____

(2) _____

(3) _____ (3 marks)

(iii) Suggest *two* processes that will occur.

(1) _____

_____

(2) _____

_____ (2 marks)

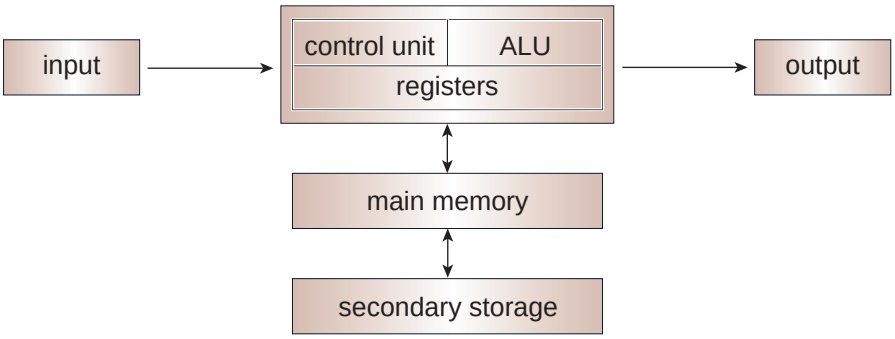
(b) The robotic arm collects the drink Sophie has chosen and delivers it to the collection point. State whether the instructions for the path of the arm are stored, and justify your answer.

_____

_____

_____ (2 marks)

(c) A block diagram of an embedded processor is shown below.



(i) Explain why secondary storage is needed for the embedded processor in the vending machine.

_____

_____

_____ (2 marks)

(ii) Explain the role of *each* of the following components in the embedded processor during the process of the machine accepting money and calculating the amount of change due:

- control unit
- ALU
- registers
- main memory.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ (6 marks)

(d) (i) The machine uses only $1, 50c, and 20c coins when it gives change. Suggest why this is the case.

_____

_____ (1 mark)

(ii) The transaction stops and the machine displays a message. Suggest what processing has occurred in the machine.

_____

_____

_____

_____ (2 marks)

(e) Outline how the Internet could be used to help automate the management of the machine.

_____

_____

_____

_____ (2 marks)

TOTAL: 22 marks

3. Ella studies at university in Brisbane but is currently overseas in Singapore. She needs to access her files, which are stored on a server at her university. The university allows students access to a virtual private network (VPN), which Ella can use to download or upload her files from or to an internal file server.

(a) (i) Outline *three* reasons why the university might use this technology to allow students access.

_____

_____

_____

_____

_____

_____ (3 marks)

(ii) Describe the processes of the VPN that allow Ella's computer to connect to the internal file server.

_____

_____

_____

_____ (2 marks)

(b) (i) While Ella's computer is connected to the VPN, a phone call interrupts her and she leaves her computer for a time. When she returns to access the VPN, she finds that her computer has been disconnected from it. Identify what has caused the disconnection.

_____

_____ (1 mark)

(ii) State the advantage to Ella of her computer becoming disconnected from the VPN.

_____

_____ (1 mark)

(iii) Outline *two* other likely advantages to Ella of being able to access the internal file server through the VPN.

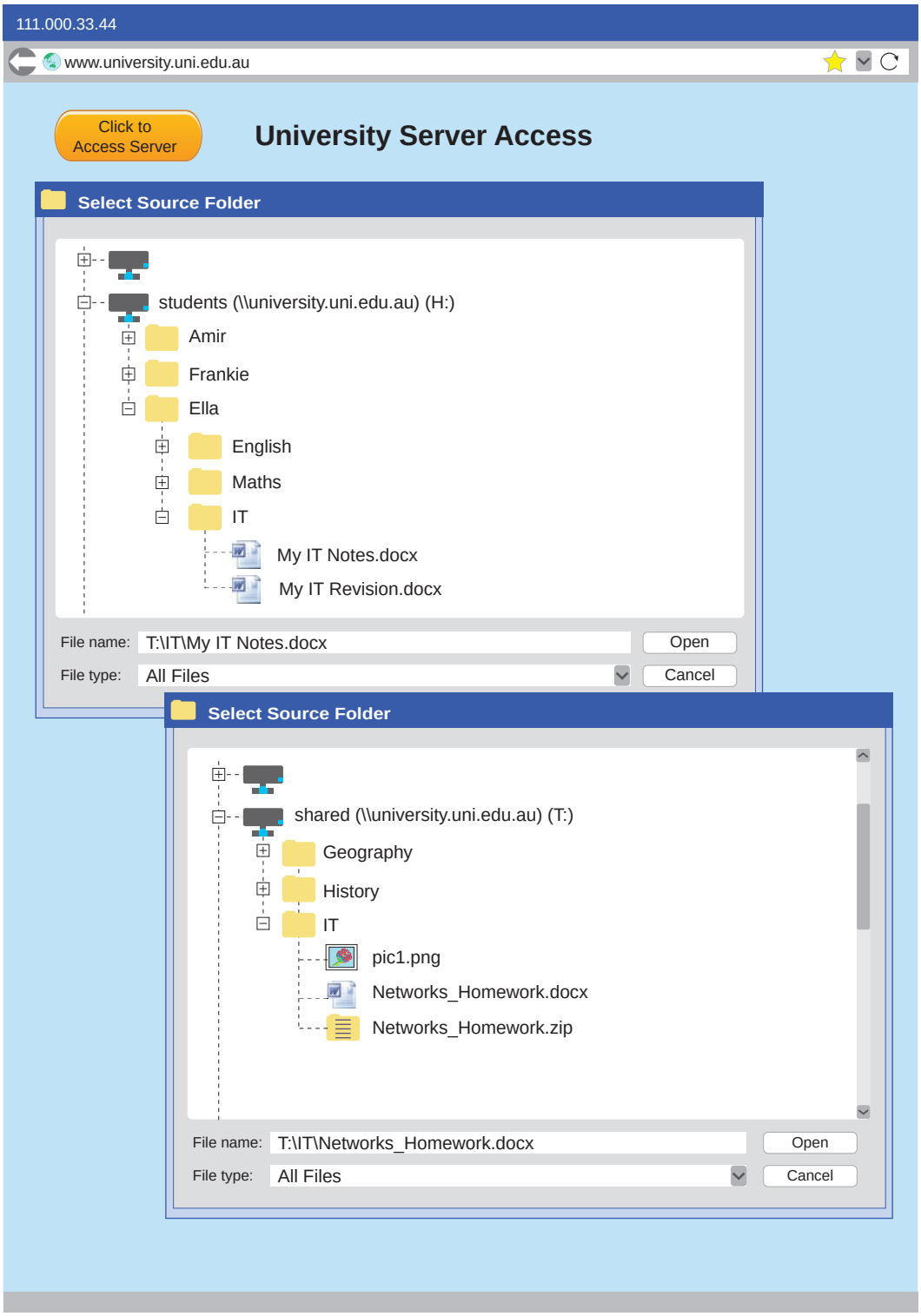
_____

_____

_____

_____ (2 marks)

(c) Ella's browser displays the resources that she can access while her computer is connected to the VPN, as shown.



(i) Explain the function of the Network Operating System (NOS) when it responds to Ella's request to download a file.

_____

_____

_____

_____ (2 marks)

(ii) State the protocol that would be used to retrieve the 'Networks_Homework' document.

_____ (1 mark)

(iii) Ella has selected the 'Networks_Homework' document to download from the university server. Describe how TCP/IP prepares Ella's document for transmission over the Internet.

_____

_____

_____

_____

_____

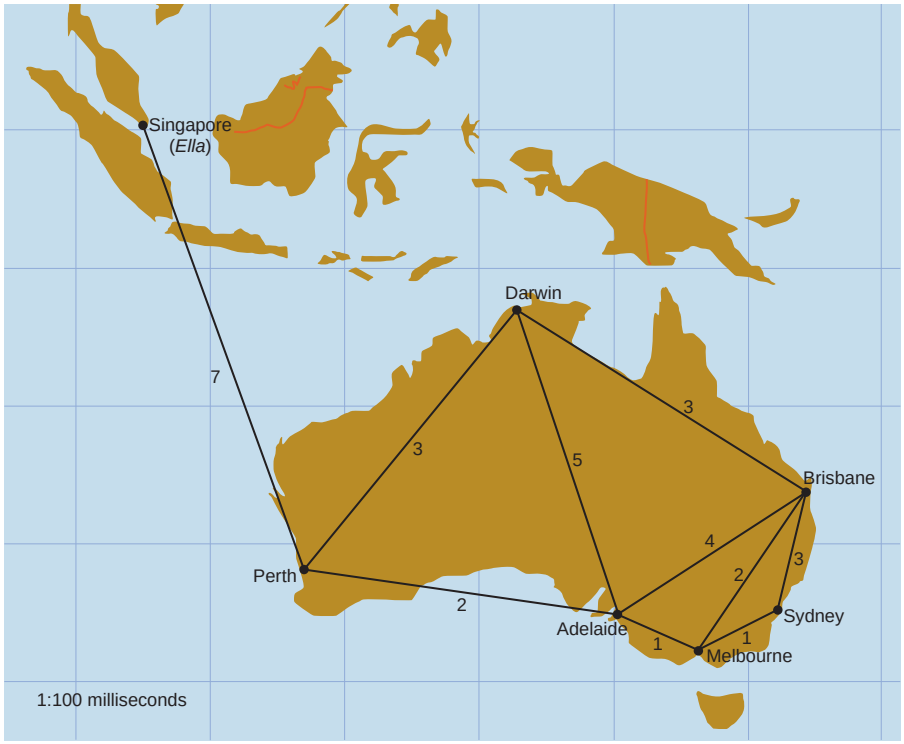
_____ (4 marks)

(d) The communication medium between Singapore and Perth is an optical fibre cable that lies on the ocean floor. State another medium that could be used to transmit the packets to Australia.

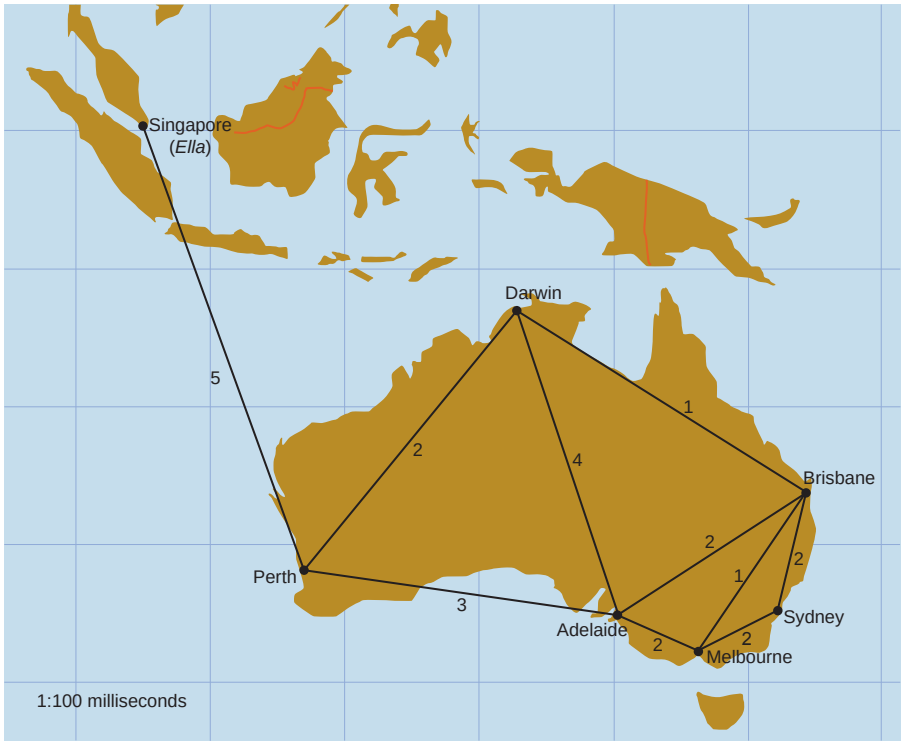
_____ (1 mark)

(e) The images below show the Internet connection while Ella is using the network at the times shown. All the possible paths that data packets can take from Ella's computer in Singapore to various cities in Australia are shown in the diagram below. The lines between cities indicate the path segments data packets can take, while the numbers indicate the time taken to travel along each segment. Each number represents 100 milliseconds.

7/10/2012 9:05:23



7/10/2012 9:05:57



(i) Explain why the numbers shown along the path segments are different in the two images shown on page 12.

(2 marks)

(ii) A router in Darwin receives packets at different times, as shown. Outline the factors involved in the router determining the next segment the data packets should take.

(3 marks)

(f) Explain how TCP ensures that Ella's computer has received the 'Networks_Homework' document.

(4 marks)

TOTAL: 26 marks

4. A business is considering whether to stop using tapes and local servers and start using 'cloud computing' as a storage solution. Discuss how this change may affect employees and the business.

(8 marks)

TOTAL: 8 marks

PART B: OPTION TOPICS (Questions 5 to 9)

(50 marks)

*Choose **two** of the following questions and write your responses in the spaces provided. You should spend about 50 minutes on this part.*

RELATIONAL DATABASES

5. *Read the following scenario*.

ABC Car Rentals uses a relational database system to keep track of the hire of cars by customers. The database system needs to take into account the following principles:

- Cars are hired for a number of days.
- To meet customer demand, the business stocks a number of popular models.

The table below shows some of the data that may be stored in this database system.

Licence Number	*Customer Name*	*Phone*	*Date*	*Days hired*
L80066	Sam ROBERTSON	4268 3139	Fri 13/1/06	2
L80242	Alex LUCAS	4384 4217	Mon 24/3/08	5
L81783	Chris WASHINGTON	4270 5928	Thu 24/4/08	4
L88410	Lee BETTRIDGE	4212 4396	Fri 9/10/09	1
L80066	Sam ROBERTSON	4268 3139	Thu 25/3/10	3
L88410	Lee BETTRIDGE	4212 4396	Fri 8/10/10	2
L81783	Chris WASHINGTON	4270 5928	Fri 22/4/11	3
L80066	Sam ROBERTSON	4268 3139	Fri 5/10/12	3
L88410	Lee BETTRIDGE	4212 4396	Fri 5/10/12	3

(a) With reference to the data above, explain why this data should be stored in two tables.

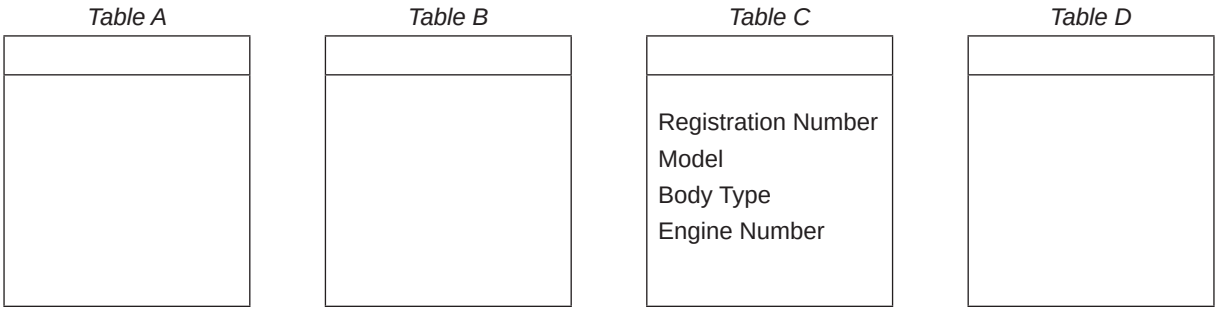
_____

_____

_____

_____ (2 marks)

The following partly completed table relationship diagram shows some of the tables in which data can be efficiently stored.



(b) The following questions refer to *Table A and B* in the table relationship diagram above. In the diagram:

(i) Add table names and fields to *Tables A and B* to store the data efficiently.

(2 marks)

(ii) Add fields to *Tables A and B*, to allow communication with the customer and to complete a hiring when a vehicle is returned.

(2 marks)

(iii) Mark the field that will identify a customer.

(1 mark)

(iv) Link *Tables A and B* by adding an appropriate field to *Table B*, showing the relationship.

(1 mark)

(c) *Table C* stores data associated with each car.

(i) Add *two* fields to *Table C*.

(1 mark)

(ii) Mark the field that will identify a car.

(1 mark)

(iii) Link *Table C* to *Table B* by adding an appropriate field to *Table B*, showing the relationship.

(1 mark)

(d) (i) A composite key may be appropriate in the transaction table. List below the fields that would form the composite key.

_____

_____ (1 mark)

(ii) Explain what the composite key prevents being stored in the database.

_____

_____ (1 mark)

(e) To meet customer demand for many cars of the same model, *Table D* is required. Name *Table D* and link it to another table by adding appropriate fields, showing the relationship.

(3 marks)

(f) Using code or otherwise, construct a query that produces a list of cars hired in the current year, showing customer details and including a calculated field to display the full charge for the hires, with the output in appropriate order.

_____

_____

_____

_____

_____

_____

_____ (5 marks)

(g) Explain how a business can ensure the ethical use of data stored in its database.

_____

_____

_____

_____

_____

_____

_____ (4 marks)

TOTAL: 25 marks

APPLICATION PROGRAMMING

6. *Read the following scenario*.

City Bikes loans three types of bicycle to customers: basic, mountain, and tandem. The cost of hiring the bikes is based on an hourly rate, with a basic bike costing $10 per hour, a mountain bike costing $15 per hour, and a tandem bike costing $30 per hour. City Bikes is thinking about using a program to record the daily revenue it collects from loaning the bikes. The proposed program would be based on the following pseudocode.

```
Constant numberOfTypes = 3

Begin BIKE_RENTAL_REVENUE
    INITIALISE
    PROCESS_RENTALS
    DISPLAY_RESULTS
End BIKE_RENTAL_REVENUE

Begin INITIALISE
    bikeRate(1) = 30
    bikeRate(2) = 10
    bikeRate(3) = 15
    For counter = 1 To numberOfTypes
        bikeHours(counter) = 0
    Next counter

End INITIALISE

Begin PROCESS_RENTALS
    Input bikeType
    Do While bikeType <> 0
        Input hireHours

        bikeHours(bikeType) = bikeHours(bikeType) + hireHours
        charge = hireHours * bikeRate(bikeType) * hRate

        Input bikeType
    End While Loop
End PROCESS_RENTALS

Begin DISPLAY_RESULTS
    For index = 1 To numberOfTypes
        Display " Type of bike " + index + " hired out for " + bikeHours(index)
        & " hours"
    Next index

End DISPLAY_RESULTS
```

(a) Desk-check the pseudocode shown on the previous page, using the following test data. Some of the desk-check has been filled in.

Show the output resulting from the `DISPLAY_RESULTS` procedure.

2, 3, 3, 2, 2, 5, 1, 2, 3, 2, 2, 4, 3, 6, 0

bikeType	hireHours	bikeHours(1)	bikeHours(2)	bikeHours(3)	charge
		0	0	0	
2	3		3		30
3	2			2	30
2	5				

Output

(5 marks)

(b) The variable `bikeType` is used in the `PROCESS_RENTALS` procedure in the pseudocode on page 18. Suggest why this is a local variable.

_____

_____

_____ (1 mark)

(c) Draw a circle around *only* those lines in the pseudocode on page 18 that are an example of *each* of the following control structures. If more than one line of code is used for a control structure, circle *all* of the relevant lines. Write the name of the control structure next to *each* circle.

(i) Fixed loop.

(1 mark)

(ii) Non-fixed loop.

(1 mark)

(d) Identify the type of non-fixed loop used in the pseudocode on page 18.

_____ (1 mark)

(e) (i) Below, write pseudocode for a procedure that will apply a 10 per cent discount if a customer hires a bike for more than 4 hours.

_____

_____

_____

_____

_____

_____ (3 marks)

(ii) Indicate in the pseudocode on page 18 where this procedure would be executed, labelling its position as D1.

(1 mark)

(f) (i) City Bikes wants the program to calculate the total revenue the business earns in one day. Write *three* lines of pseudocode below to achieve this.

TR1: _____

TR2: _____

TR3: _____ (3 marks)

(ii) Indicate in the pseudocode on page 18 where each of these lines would be executed, by labelling each of the positions as TR1, TR2, and TR3.

(3 marks)

(iii) Is the variable used to hold the value of the calculation for the total revenue a local or global variable? Justify your answer.

_____

_____

_____

_____ (2 marks)

(g) Explain recommended practices and conventions that may be included in a program when pseudocode is developed into program code.

_____

_____

_____

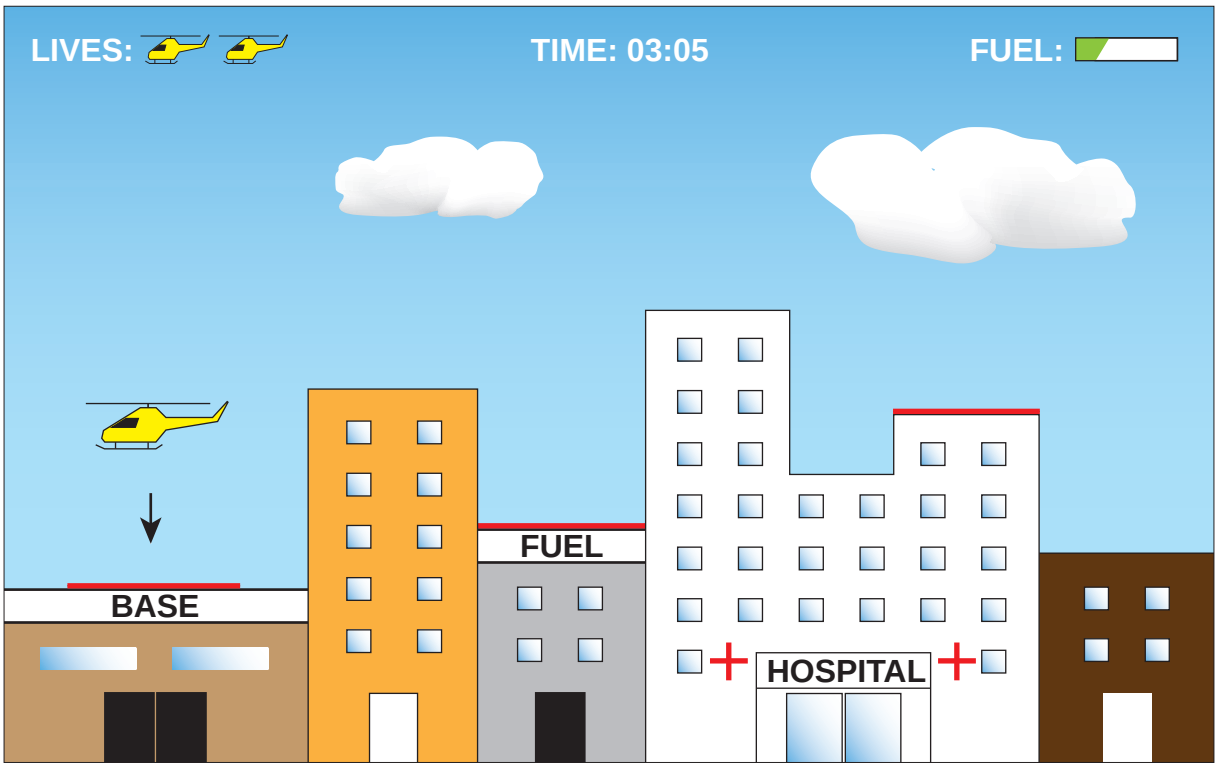
_____ (4 marks)

TOTAL: 25 marks

MULTIMEDIA PROGRAMMING

7. *Read the following scenario.*

The user interface shown below has been designed for an online game, *City Emergency*, in which players fly a helicopter, and land it in a number of locations in the city.



(a) Outline what modifications to the images, audio, and user interaction would need to be considered to adapt this interface for use on a mobile device, such as a smartphone.

Images: _____

_____

_____

Audio: _____

_____

_____

User interaction: _____

_____

_____ (3 marks)

(b) A user of this multimedia application successfully navigates the helicopter to the fuel station. Below, write code or otherwise, so that the fuel gauge on the top right-hand side of the screen is incremented until the fuel gauge shows that the tank is full.

_____

_____

_____

_____

_____

_____

_____

_____ (4 marks)

(c) How can interactive multimedia systems such as the *City Emergency* game engage and simulate real-world choices and actions?

_____

_____

_____

_____

_____

_____ (2 marks)

(d) (i) Outline how vector animation works.

_____

_____ (1 mark)

(i) Outline how vector animation affects the transportation of data over the Internet.

_____

_____ (1 mark)

(e) In the *City Emergency* game, the top three players are JHJ, GAH, and AEK. Their scores are 900, 700, and 500, respectively. The algorithm that determines a high-score table is:

```
Begin DISPLAY_RESULTS
get playerName
get playerScore

If playerScore > playerArrayScore[1] Then
    playerArrayScore[1] = playerScore
    playerArrayName[1] = playerName
End If

For index = 1 to 2
    Begin
        If playerArrayScore [index] > playerArrayScore [index+1] Then
        //Move the score
            tempScore = playerArrayScore[index+1]
            playerArrayScore [index+1] = playerArrayScore[index]
            playerArrayScore[index] = tempScore
        //Move the name
            tempName = PlayerArrayName [index+1]
            PlayerArrayName [index+1] = PlayerArrayName [index]
            PlayerArrayName [index] = tempName
        End If
End For
End DISPLAY_RESULTS
```

(i) Desk-check the pseudocode shown on the previous page, using the following data for consecutive games. Some of the desk-check has been filled in.

Show the output resulting from the DISPLAY_RESULTS procedure.

TXR, 750, WMW, 550, ACE, 990

playerName	playerScore	playerArrayName(1)	playerArrayName(2)	playerArrayName(3)	playerArrayScore(1)	playerArrayScore(2)	playerArrayScore(3)	tempName	tempScore
		AEK	GAH	JHJ	500	700	900		

Output

(6 marks)

(ii) Using code or otherwise, write an algorithm for a function that would display the new results.

(4 marks)

(f) Explain how compression optimises data transfer while providing security.

_____

_____

_____

_____

_____

_____

_____

_____ (4 marks)

TOTAL: 25 marks

WEBSITE PROGRAMMING

8. *Read the following scenario*.

A photography company is developing a website to enable customers to upload photographs for a collage and submit an order. The proposed user interface is shown below.

(a) Outline *two* problems with the functionality of the proposed interface, and explain how you would solve each of them.

Problem 1: _____

Solution: _____

_____

Problem 2: _____

Solution: _____

_____ (4 marks)

(b) Identify a CSS attribute used in the interface above.

_____

_____ (1 mark)

(c) Using code or otherwise, write an algorithm below for a function that would calculate and output the cost for the collage shown on page 27.

_____

_____

_____

_____ (4 marks)

(d) The website allows the user to add further collages.

(i) Outline a solution that would allow this to occur.

_____

_____ (1 mark)

(ii) Write code, or otherwise, that calculates the final total cost of the order.

_____

_____

_____

_____ (2 marks)

(e) (i) Write code, or otherwise, to form the 'Add another collage' button as shown on page 27.

_____

_____

_____

_____ (2 marks)

(ii) Suggest a function that would be required before the current page is refreshed, and state its purpose.

Function: _____

Purpose: _____

_____ (2 marks)

(iii) Suggest a function that would be required to keep track of the cost of a collage before the page is refreshed.

_____ (1 mark)

(iv) Suggest a function that would be required when the page is refreshed.

_____ (1 mark)

(f) In the space below, sketch a layout of a web page that shows how multiple collages in a customer's order could be displayed before checkout. Label and describe the outputs.

(3 marks)

(g) Explain the likely impact on the photographer's business of providing its collage-creation service online to customers.

_____

_____

_____

_____

_____

_____

_____

_____

_____ (4 marks)

TOTAL: 25 marks

DYNAMIC WEBSITES

9. *Read the following scenario*.

Exciting Travel arranges minibus tours to local tourist destinations. The company has a website that allows customers to view and book tours. The code for one page on the company's website is shown below.

```
1   <html>
2   <head>
3       <title>MBO</title>
4       <link rel="stylesheet" href="includes/mbm.css" type="text/css" />
5   </head>
6   <body>
7       <div id="container">
8           <div id="header">
9               <h1>Exciting Travel  - Tours for November, 2012</h1>
10      </div>
11      <div id="content">
12          <div id="navigation">
13              <ul>
14                  <li><a href="about.php">About us</a> </li>
15                  <li><a href="tours.php" class="current">Tour Selected</li>
16                  <li><a href="calendar.php">Bookings</a>      </li>
17              </ul>
18          </div>
19          <div id="tourslist">
20              <?php do { ?>
21              <h2><?php echo $rsTours['tour_name']; ?></h2>
22              <p><?php echo $rsTours['tour_description']; ?></p>
23              <p><strong>Price: </strong><?php echo $rsTours['tour_price'];
24               ?></p>
25              <p><img src="images/<?php echo $rsTours['tour_image']; ?>"
26              width="225" height="143" border="0" /></p>
27          <?php } while ($rsNav = mysql_fetch_assoc($nav_query)) ?>
28          </div>
29      </div>
30      <div id="footer"> <p> &copy; 2012 Exciting Travel <span
31      class="search">Search this site:      <input type="text" size="10"
32      name="query" id="query">
33  </span> </p>
34  </div>
35  </div>
36  </body>
37  </html>
```

(a) The code shown on the previous page provides the static and dynamic content for the Exciting Travel tour sales page. Below, sketch the page as it would be marked up by the browser.

(5 marks)

(b) Identify the static and dynamic elements shown on the sales page.

Static: _____

_____

_____

Dynamic: _____

_____

_____ (4 marks)

(c) Write code, or otherwise, for the query that would select the dynamic data for the sales page.

_____

_____

_____

_____

_____

_____ (5 marks)

(d) Identify the server-side software that the website's service provider requires to host the site, and outline the function of this software.

Software: _____

Function: _____

_____ (4 marks)

(e) (i) Identify which lines of the code on page 30 would *not* be visible to a customer who opened the source code of the sales page in a web browser.

_____

_____ (1 mark)

(ii) Explain why the lines of code you identified in part (e)(i) would not be visible.

_____

_____

_____

_____ (2 mark)

(f) Explain recommended practices for the maintenance of Exciting Travel's website.

_____

_____

_____

_____

_____

_____

_____

_____ (4 marks)

TOTAL: 25 marks