Government of South Australia

SACE Board of SA

External Examination 2015

2015 INFORMATION TECHNOLOGY

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SUPERVISOR CHECK

RE-MARKED

ATTACH SACE REGISTRATION NUMBER LABEL TO THIS BOX

Monday 9 November: 1.30 p.m.

Time: 2 hours

Pages: 30
Questions: 9

Examination material: one 30-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. A cinema chain uses an online ticket-selling system called 'Diggiticket'. Customers purchase a cinema ticket through the Diggiticket website, and receive a barcoded ticket via email or mobile application program. Customers present their barcoded ticket at the cinema to gain entry to the correct session.

   (a) Diggiticket is a computer-based information system.

   (i) State *one* benefit to the cinema chain of using this computer-based information system.

   _____

   _____ (1 mark)

   (ii) State *one* benefit to customers of using this computer-based information system.

   _____

   _____ (1 mark)

   (iii) Write the aim of this computer-based information system.

   _____

   _____ (1 mark)

   (b) State *one* example of each of the following elements as they relate to this computer-based information system.

   (i) People: _____

   _____ (1 mark)

   (ii) Hardware: _____

   _____ (1 mark)

   (iii) Software: _____

   _____ (1 mark)

(c) Describe *one* possible output of this computer-based information system, which is not outlined in the scenario, that would benefit the customer.

_____

_____

_____

_____ (2 marks)

(d) (i) Customers must create a user account in order to purchase tickets.

Outline the items of data, *other than* a username, that could be used to create an account.

_____

_____

_____

_____

_____ (2 marks)

(ii) How might this computer-based information system ensure that there are no duplicate accounts?

_____

_____

_____

_____ (2 marks)

(e) (i) Identify *one* statistical output that may be generated by this computer-based information system.

_____

_____ (1 mark)

(ii) Discuss how the output you identified in part (e)(i) can assist the cinema chain management in their planning.

_____

_____

_____

_____ (2 marks)

(iii) Identify *one* possible constraint that may prevent the output that you identified in part (e)(i) from being achieved.

_____

_____

_____ (1 mark)

(f) Security of stored data in this computer-based information system is important.

(i) Outline *why* the cinema chain management must secure customer data on their servers.

_____

_____

_____

_____ (2 marks)

(ii) Describe *how* the cinema chain management can secure customer data on their servers.

_____

_____

_____

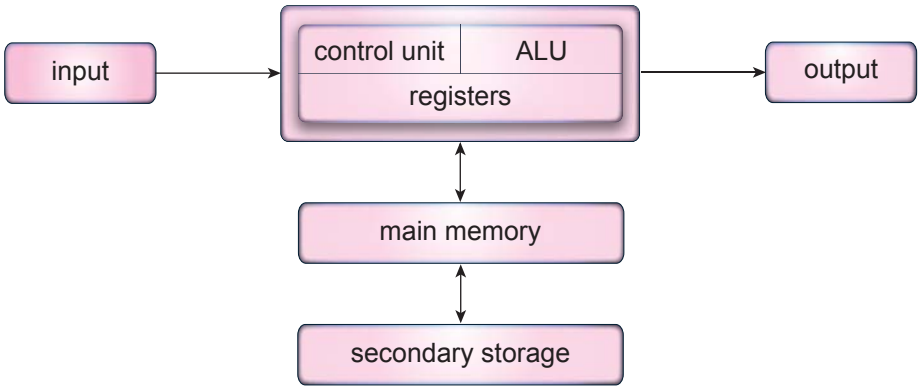
_____ (2 marks)

TOTAL: 20 marks

end of Question 1

2. Embedded processors are found in graphics calculators, where they perform calculations and draw graphs.

A block diagram of the embedded processor in a graphics calculator is shown below:



(a) Describe the role of each of the following components as the embedded processor in the graphics calculator performs a simple mathematical function.

(i) Registers: _____

_____

_____

_____ (2 marks)

(ii) Main memory: _____

_____

_____

_____ (2 marks)

(iii) ALU: _____

_____

_____

_____ (2 marks)

(b) Identify *one* input device for a graphics calculator.

_____

_____ (1 mark)

(c) Identify and discuss the most appropriate secondary storage medium for a graphics calculator.

_____

_____

_____

_____ (2 marks)

(d) Before a graphics calculator may be brought into a school examination room, its memory areas must be cleared.

Explain how the control unit coordinates the clearing of both the main memory and the secondary storage memory areas of a graphics calculator.

_____

_____

_____

_____

_____

_____

_____

_____ (4 marks)

(e) Discuss why graphics calculators that have network connectivity are not permitted in school examination rooms.

_____

_____

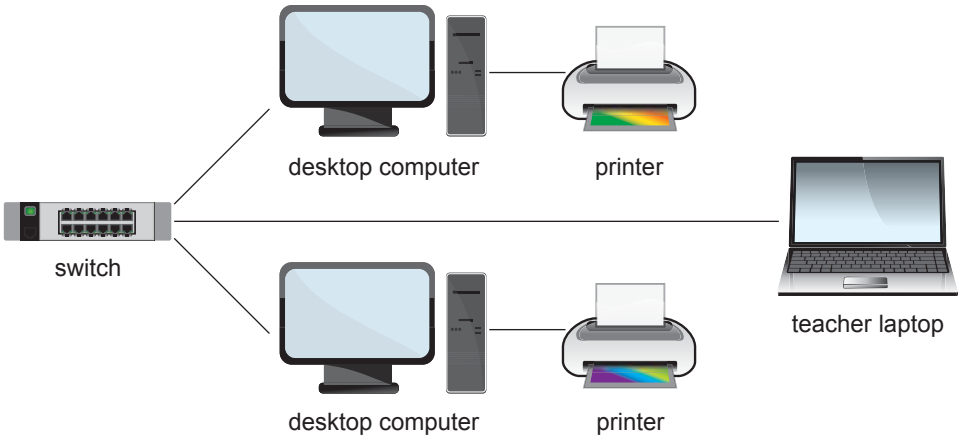
_____

_____ (2 marks)

TOTAL: 15 marks

end of Question 2

3. A primary school has a network of computers. Currently, all nodes in the local area network are cabled to a central switch. The network consists of two desktop computers, each with a printer, and one teacher laptop, as shown below:



(a) (i) Identify the type of network currently used within the school.

_____ (1 mark)

(ii) Identify and discuss *one* limitation of the teacher laptop when communicating with the printers on this network.

_____

_____

_____

_____ (2 marks)

(iii) Using an example, explain how each computer is uniquely identified on this network.

_____

_____

_____

_____ (2 marks)

The school would like to expand its network to allow staff and student personal computers to connect to the Internet.

(b) (i) Identify the most suitable type of Internet connection and the connection speed that would allow the school to have high-speed access to the Internet.

_____

_____ (2 marks)

(ii) Outline *one* limitation of the answer that you identified in part (b)(i).

_____

_____ (1 mark)

(iii) Discuss the role of a router in this process.

_____

_____

_____

_____ (2 marks)

(c) The school would like to build a server stack to offer network facilities to students.

(i) Identify and describe *three* possible services that the school could run on its server stack.

(1) _____

_____

_____ (2 marks)

(2) _____

_____

_____ (2 marks)

(3) _____

_____

_____ (2 marks)

(ii) Discuss an appropriate piece of hardware that the school could install in order to connect all student personal computers to the network.

_____

_____

_____

_____ (2 marks)

(iii) Other than by IP address, how can the network administrator identify individual devices on this network?

_____

_____ (1 mark)

(iv) Discuss how the network administrator can use the network operating system (NOS) to stop each student from connecting more than two devices to the network.

_____

_____

_____

_____ (2 marks)

(d) Passwords are an effective method of preventing unauthorised access to student accounts on the school's network.

Using examples, discuss the most appropriate combination of characters to use to create a secure password.

_____

_____

_____

_____

_____

_____ (3 marks)

(e) Discuss how a virtual private network (VPN) allows teachers to access networked school resources from anywhere that has an Internet connection.

_____

_____

_____

_____

_____

_____ (3 marks)

TOTAL: 27 marks

end of Question 3

4. Malware (**mal**icious soft**ware**) is software used to disrupt computer operation, gather sensitive information, or gain access to computer networks. Malware is commonly encountered on the Internet.

Discuss how computer users can prevent the intrusion of malware and thus improve the integrity of their personal computer.

(8 marks)

TOTAL: 8 marks

end of Question 4

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.*

OPTION TOPIC: RELATIONAL DATABASES

5. *Read the following scenario*.

Lecturers at ECAS University record student assessment results in a spreadsheet. Each lecturer maintains his or her own spreadsheet, and exports the spreadsheet data into ECAS University's central relational database management system.

The following sample data is taken from the spreadsheet of Mr O'Grady, a lecturer at ECAS University:

Name	*Email*	*Subject Code*	*Subject Name*	*Year Enrolled*	*Grade*	*Paid*
John Smith	jsmith@uni.edu.au	Stat210	Statistics	2015	Pending	FALSE
Jan Nguyen	jnguyen@uni.edu.au	Stat210	Statistics	2015	pending	TRUE
Jan Nguyen	jnguyen@uni.edu	Prog101	Programming	2014	Distinction	TRUE
Jan Nguyen	jnguyen@uni.edu.au	Prog101	Programming	2013	Fail	TRUE
Peter Franks	pfranks@uni.edu.au	Stat210	Statistics	2014	Distinction	TRUE

(a) When the spreadsheets are imported into the central relational database management system, names are stored in a single field.

Identify *one* potential issue with storing names in a single field when importing from the spreadsheet shown above.

_____

_____ (1 mark)

(b) Identify the data type for each of the following fields.

(i) Email: _____ (1 mark)

(ii) Paid: _____ (1 mark)

(c) With reference to normalisation principles, explain why the data collected by Mr O'Grady should not be stored in a single table.

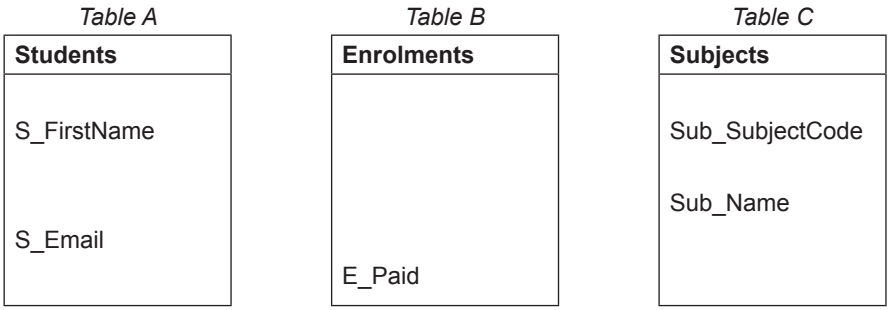
_____

_____

_____

_____ (2 marks)

(d) Below is a section of the table relationship diagram (TRD) for ECAS University's relational database management system.



(i) Complete the diagram above to include the following details.

(1) Appropriate primary key in *Table A*. (1 mark)

(2) Additional data fields required in *Table B*. (2 marks)

(3) Table relationships. (2 marks)

(ii) Two of the entities being stored are 'Students' and 'Subjects'.
Explain the relationship between these two entities.

_____

_____

_____

_____ (2 marks)

(iii) Discuss the role of *Table B* in the context of this table relationship diagram.

_____

_____

_____

_____ (2 marks)

(iv) A composite key can be formed from foreign keys within a transaction table.

Discuss why this form of composite key is not desirable in this context, and suggest a possible alternative.

_____

_____

_____

_____

_____

_____ (3 marks)

(e) ECAS University is producing a course guide that will contain information about the subjects offered. The information in the course guide is to be sorted in alphabetical order, according to subject name.

Design an appropriate query that will output this information.

(2 marks)

(f) The Board of ECAS University is interested in the total number of students enrolled for each year.

Design an appropriate query that will output the information that the Board requires.

(2 marks)

(g) Discuss how ECAS University's database developers can control database privileges for different user types.

_____

_____

_____

_____

_____

_____

_____

_____ (4 marks)

TOTAL: 25 marks

end of Question 5

OPTION TOPIC: APPLICATION PROGRAMMING

6. *Read the following scenario*.

Let's Swim is a swimming centre in the city. Entrance fees are based on the following categories:

A possible algorithm to process the number of people entering the swimming centre is presented below:

```
Cost(3, 6, 10)

Begin PROCESS_ENTRY

input EntryType(1, 2, 3 or 0 to end)

    while EntryType <> 0

        input Under16 (y/n)

        if Under16 = true then

                child(EntryType) = child(EntryType)+1

            else

                adult(EntryType) = adult(EntryType)+1

        end if

        input EntryType(1, 2, 3 or 0 to end)

    end while

End PROCESS_ENTRY
```

(a) Desk-check the algorithm shown on page 16, using the following data:

2, y, 1, n, 3, y, 3, y, 1, y, 1, n, 3, y, 0

EntryType	Under16	child()			adult()		
		1	2	3	1	2	3

(4 marks)

(b) In the algorithm on page 16, identify a variable that is an array structure.

_____ (1 mark)

(c) Discuss the advantages of using an array structure for this potential application.

_____

_____

_____

_____ (2 marks)

(d) Identify the most appropriate data type for the variable `Under16`.

_____ (1 mark)

(e) Identify the condition for the selection construct used within the algorithm on page 16.

_____ (1 mark)

(f) (i) Describe the type of error that may result if the number 4 is used as an input within this algorithm.

_____

_____

_____

_____ (2 marks)

(ii) Using code or otherwise, write an algorithm that will prevent this type of error from occurring.

(3 marks)

(g) For safety reasons, Let's Swim must have one lifeguard on duty for every fifteen people, or part thereof, who enter the swimming centre.

(i) Using code or otherwise, write an algorithm that will calculate the number of lifeguards who are required to be on duty.

(3 marks)

(ii) Using an arrow and a label, indicate in the original algorithm on page 16 where your answer to part (g)(i) would be executed.

(1 mark)

(h) Let's Swim would like to calculate the daily total entrance fees received.

Using code or otherwise, write an algorithm that will achieve this output.

(2 marks)

(i) Discuss how the program developers can design the application in order to reduce end-user error.

(5 marks)

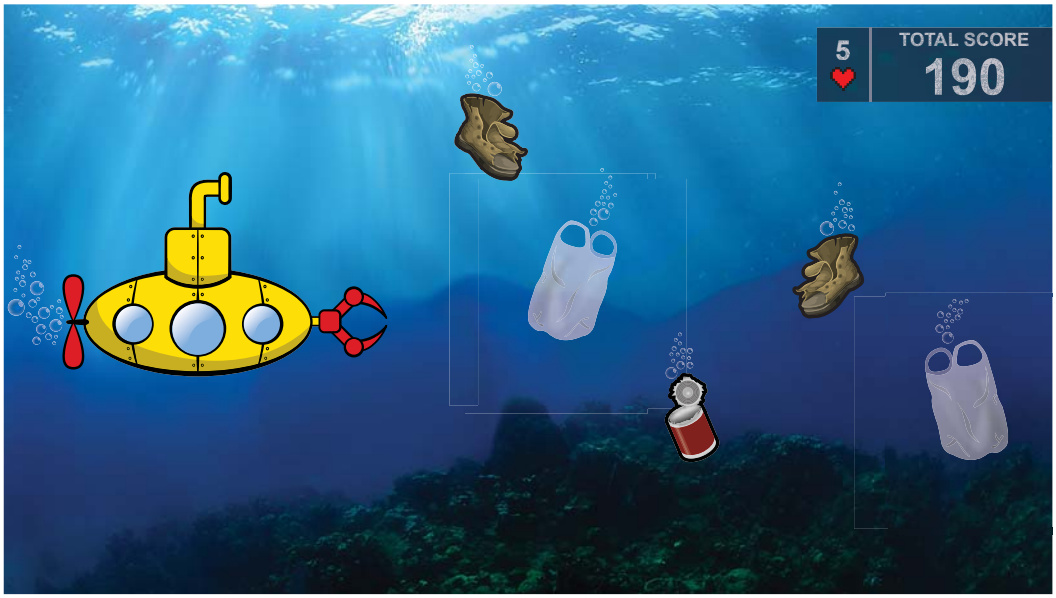
TOTAL: 25 marks

end of Question 6

OPTION TOPIC: MULTIMEDIA PROGRAMMING

7. *Read the following scenario.*

Underwater Collectors is a multimedia application that educates children about removing rubbish from the ocean. The multimedia developers have created a rich interface for desktop computers, as shown below:



(a) Outline the modifications to the audio output that would need to be made when adapting *Underwater Collectors* for various mobile devices, such as a smartphone device.

_____

_____

_____

_____ (2 marks)

(b) Currently, the submarine is controlled by a keyboard interface.

Outline *two* methods of controlling the submarine on a smartphone device, *other than* a keyboard interface.

(i) _____

_____ (2 marks)

(ii) _____

_____ (2 marks)

(c) Discuss how vector animation allows *Underwater Collectors* to be downloaded as a small-sized file.

_____

_____

_____

_____ (2 marks)

(d) Explain how the developers of *Underwater Collectors* can use codecs to provide compression and security.

_____

_____

_____

_____ (2 marks)

(e) The player's total score is incremented each time the submarine claw successfully collects an item of rubbish from the ocean. The submarine claw is able to collect the following items:

Item	*Points*
Old shoe	5
Tin can	10
Plastic bag	15

(i) Using code or otherwise, write an algorithm for a function that will determine whether or not the submarine claw has collected any of the items listed above and will increment the total score.

(4 marks)

(ii) Using code or otherwise, write an algorithm for a function that will randomly select one of these items and place it in a random position on the screen.

(6 marks)

(iii) Using an example, discuss how the developers can make the display of the total score more multimedia-rich.

_____

_____

_____

_____ (2 marks)

(f) Discuss how *Underwater Collectors* can encourage players to improve their real-world choices and actions.

_____

_____

_____

_____

_____

_____ (3 marks)

TOTAL: 25 marks

end of Question 7

OPTION TOPIC: WEBSITE PROGRAMMING

8. *Read the following scenario*.

GAM3_Z0N3 is a website with a range of games for children. At the home screen, players select a style of game to play (e.g. board games, puzzle games) and then select a specific game to play.

In the figures below, the player has selected the style 'dice games' and the specific game *Under Ten*:

Figure 1

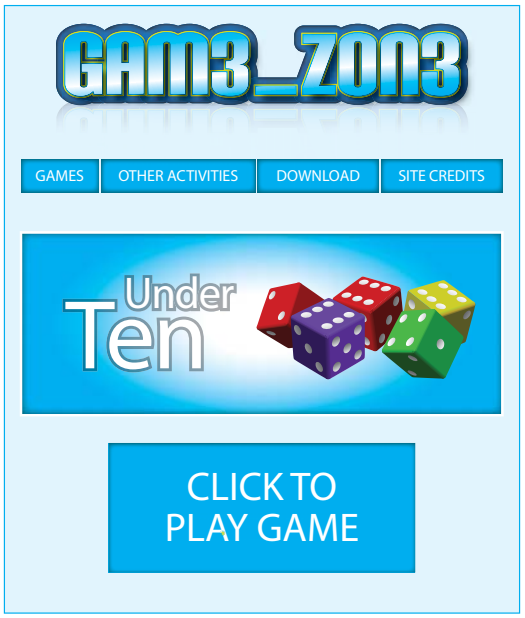


Figure 2

(a) Identify *two* forms of navigation on the home screen shown in Figure 1.

(i) _____

_____ (1 mark)

(ii) _____

_____ (1 mark)

(b) Discuss how the website developers use cascading style sheets (CSS) to create a consistent website style.

_____

_____

_____

_____

_____

_____ (3 marks)

Under Ten is a one-player dice-rolling game. Three standard six-sided dice are rolled and the player wins if the total score is under ten and loses if the total score is ten or over.

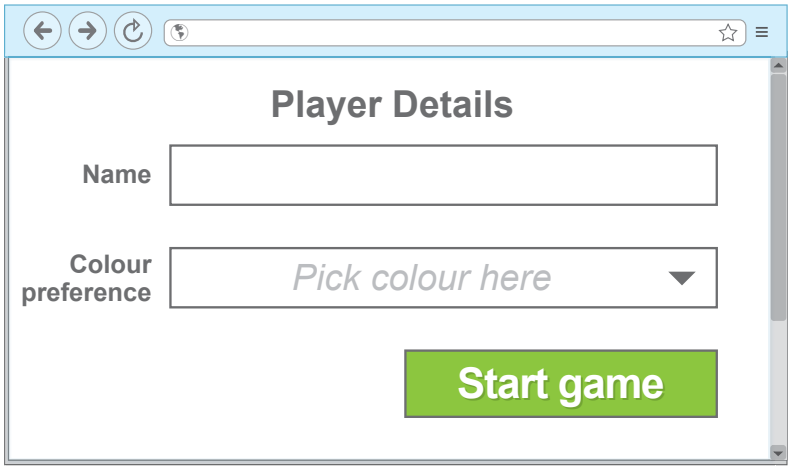
(c) Using code or otherwise, in the space below, write an efficient algorithm that will:

(i) generate *three* random dice numbers, (3 marks)

(ii) output the total score, and (2 marks)

(iii) show if the total score is greater than, equal to, or less than ten. (4 marks)

(d) When players open *Under Ten* for the first time, they are required to input their name and colour preference in the following page:



(i) Identify *two* form elements used within this page.

(1) _____

_____ (1 mark)

(2) _____

_____ (1 mark)

(ii) Using code, develop a CSS rule for *one* of the form elements used within this page.

(2 marks)

(iii) Explain how cookies can be used within this page to improve the experience for players of *Under Ten*.

_____

_____

_____

_____ (2 marks)

(e) Discuss the recommended practices that the development team should implement when managing the GAM3_Z0N3 website.

_____

_____

_____

_____

_____

_____ (3 marks)

(f) Explain why it is important for the website developers to test the GAM3_Z0N3 website across various browsers and platforms.

_____

_____

_____

_____ (2 marks)

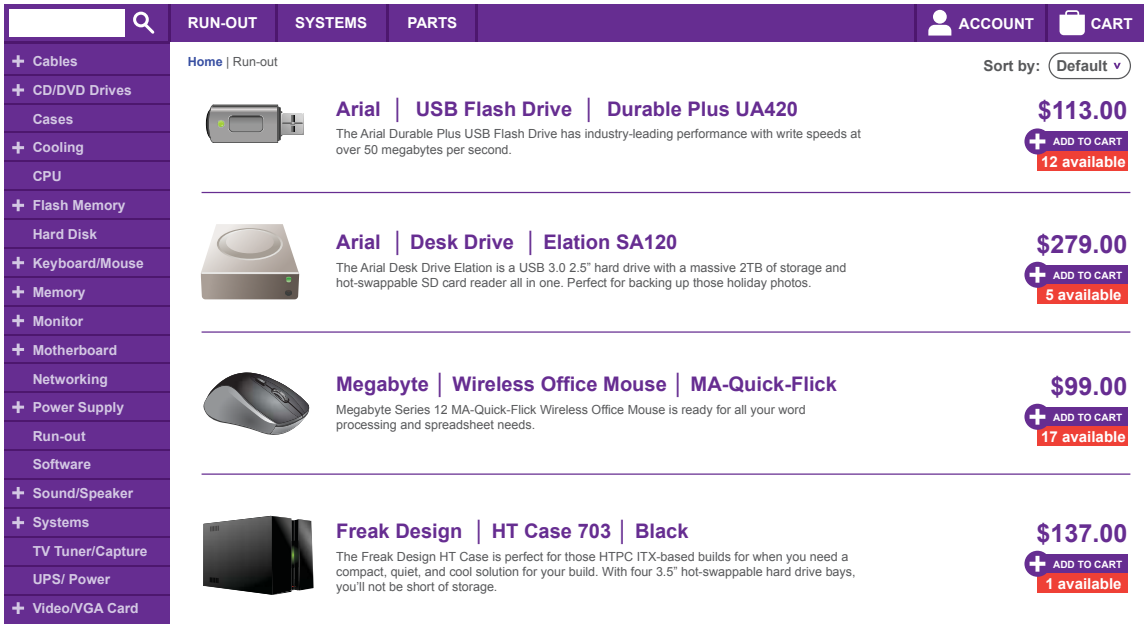
TOTAL: 25 marks

end of Question 8

OPTION TOPIC: DYNAMIC WEBSITES

9. *Read the following scenario.*

ZZZentali PC is a company that supplies computer parts to customers via the dynamic website shown below:



(a) Discuss *one* advantage to ZZZentali PC of using a dynamic website instead of a static website.

_____

_____

_____

_____ (2 marks)

(b) Explain *one* disadvantage to ZZZentali PC of using a dynamic website to conduct transactions over the Internet.

_____

_____

_____

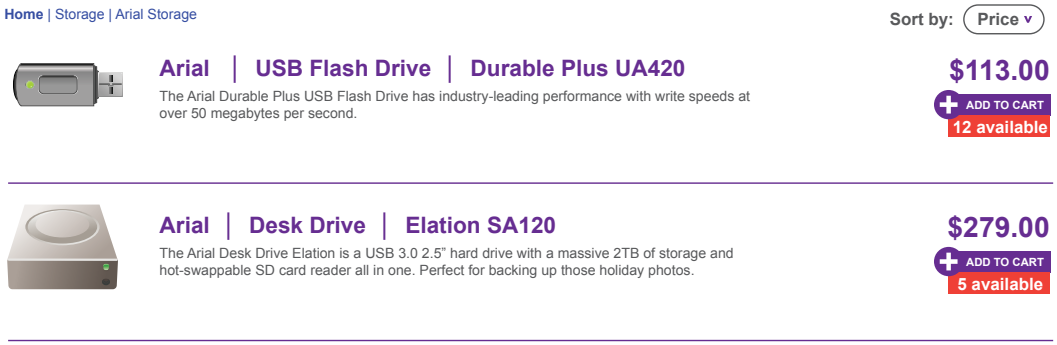
_____ (2 marks)

(c) Design and annotate an appropriate layout for the ZZZentali PC 'shopping cart' web page that will display customer selections, including the total cost.

(5 marks)

(d) The database storing the inventory is called 'Stock', and has field names such as 'Brand', 'Product Type', 'Item Type', 'Description', and 'Stock Quantity'.

(i) Design a query that will retrieve the data shown in the output below:



(5 marks)

(ii) Using code or otherwise, write a script that will count the number of results returned from the query that you designed in part (d)(i).

(2 marks)

(e) Customers must create an account in order to purchase items via the ZZZentali PC website. When creating an account, customers must use their email address as their username.

Discuss how a PHP script or an ASP script can be used to ensure the validity of each customer's username.

(4 marks)

(f) The 'request response cycle', which is used by dynamic websites, is responsible for the processing of web requests.

Discuss how the developers of the ZZZentali PC dynamic website can protect against 'code injections' and malicious scripts.

(5 marks)

TOTAL: 25 marks

end of Question 9