Government of **Western Australia**
School Curriculum and Standards Authority

ATAR course examination, 2021

Question/Answer booklet

COMPUTER SCIENCE

Please place your student identification label in this box

WA student number: In figures | | | | | | | | | |

In words _____

_____

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time: three hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer booklet
Source booklet

Number of additional answer booklets used (if applicable): ☐

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: up to three calculators, which do not have the capacity to create or store programmes or text, are permitted in this ATAR course examination, Mathomat and/or Mathaid and/or any system flowchart template

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of examination
Section One Short answer	24	24	70	98	40
Section Two Extended answer	4	4	110	124	60
				Total	100

Instructions to candidates

1. The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2021: Part II Examinations*. Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in this Question/Answer booklet. Wherever appropriate, fully labelled diagrams, tables and examples should be used to illustrate and support your answers.

3. You must be careful to confine your answers to the specific questions asked and to follow any instructions that are specific to a particular question. Where no specific instructions are given, you should feel free to use a range of formats to express your knowledge and understandings.

4. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

5. The Source booklet is not to be handed in with your Question/Answer booklet.

See next page

Section One: Short answer **40% (98 Marks)**

This section contains **26** questions. You must answer **all** questions. Write your answers in the spaces provided.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 70 minutes.

Question 1 **(5 marks)**

There are four change-over methods used in the implementation stage of the system development life cycle (SDLC): direct cut, phased, parallel and pilot.

(a) Outline the following change-over methods. (2 marks)

Direct cut: _____

_____

_____

Phased: _____

_____

_____

(b) A hospital has developed a new heart-rate monitoring system. The old system gathers critical data about patients, but is time-consuming to use; the new system will collect all data instantly. It is vital that there be no interruption to the collection of the data during the changeover period.

Given this scenario, recommend which change-over method would be best suited to ensure there is no interruption to data collection. Justify your recommendation. (3 marks)

_____

_____

_____

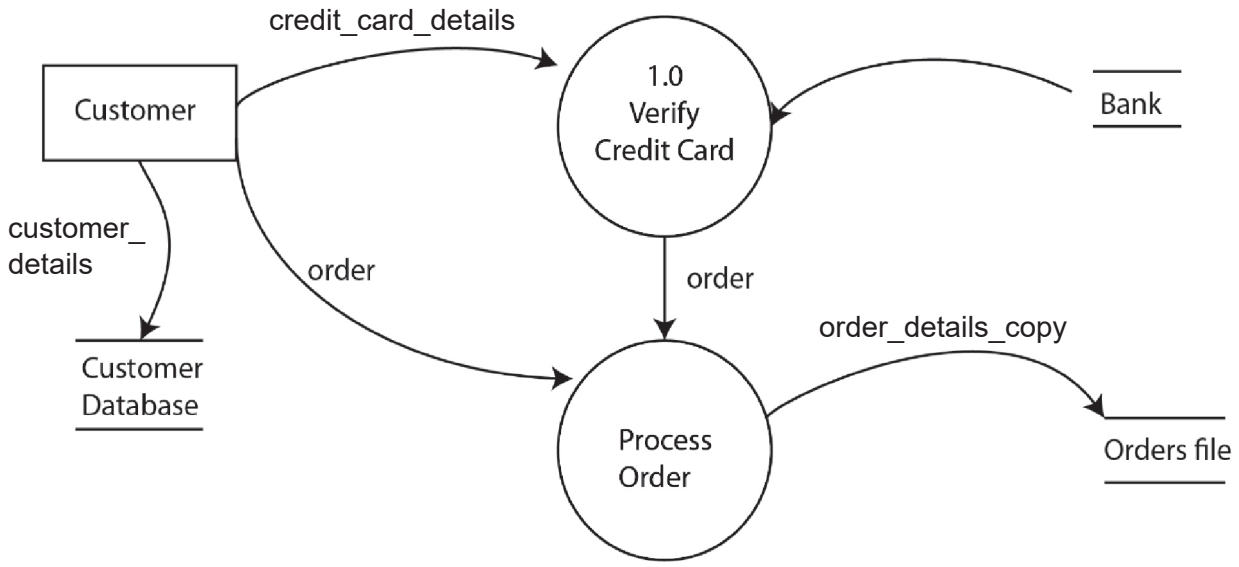
_____

_____

_____

Question 2 **(4 marks)**

A mail order company takes orders from customers by telephone. Customers must pay for their goods by credit card. The sales operator verifies the customer's credit card number with the bank. The operator then processes the order and stores the customer's details in the customer datastore. The following data flow diagram (DFD) is constructed poorly.



The diagram above contains at least four errors. Identify **four** errors and number them on the diagram. Describe in the table below why each is an error. Ensure the number corresponds to the number identified on the diagram.

1	
2	
3	
4	

Question 3 **(2 marks)**

While Dan was installing a new printer in his office, a message appeared on his monitor saying that the printer driver files were being updated.

Describe the role of drivers in a computer system.

See next page

Question 4 **(3 marks)**

A hospital is upgrading its computer network system. There are several computers that are obsolete as their specifications are out of date. However, their hard drives contain confidential information about patients. Australian Privacy Principle 11 states that an entity must take reasonable steps to destroy personal information collected.

Describe a method for the secure disposal of data that would be appropriate for these computers.

See next page

Question 5 **(4 marks)**

Data integrity in a database can be divided into three categories: referential integrity, domain integrity and entity integrity.

(a) Outline the meaning of each of the following. (2 marks)

Referential integrity: _____

_____

_____

Entity integrity: _____

_____

_____

(b) Describe how data integrity can improve the process of database management. (2 marks)

_____

_____

_____

_____

_____

Question 6 **(6 marks)**

Describe each of the following types of program errors, using an example.

Syntax error: _____

Logical error: _____

Run-time error: _____

Question 7 **(3 marks)**

(a) Outline the purpose of platform virtualisation. (1 mark)

(b) Describe the process of storage virtualisation. (2 marks)

Question 8 **(7 marks)**

The spreadsheet below shows projects being worked on by employees. Each department may have many employees, but an employee works for only one department.

Proj Code	Project Name	Budget	Employee First Name	Employee Surname	Hourly Rate	Dept Code	Dept Name
1	Online Learning	$50 000	Bob	Wilson	$45.00	D001	IT
1	Online Learning	$50 000	Nikita	Saw	$60.00	D002	CLT
1	Online Learning	$50 000	Ahmed	Khan	$85.00	D004	Admin
2	Sport System	$30 000	Bob	Wilson	$45.00	D001	IT
2	Sport System	$30 000	Nikita	Saw	$60.00	D002	CLT
2	Sport System	$30 000	Ling	Chan	$72.00	D005	Finance
2	Sport System	$30 000	Harry	Greats	$90.00	D003	Phys Ed
3	HR Database	$10 000	Ahmed	Khan	$85.00	D004	Admin
3	HR Database	$10 000	Mike	Jones	$72.00	D005	Finance
3	HR Database	$10 000	Clara	Smith	$120.00	D001	IT
4	Wireless upgrade	$70 000	Bob	Wilson	$45.00	D001	IT
4	Wireless upgrade	$70 000	Ling	Chan	$72.00	D005	Finance

(a) Define ‘delete anomaly’ and use the data above to give an example of a delete anomaly. (2 marks)

(b) Define ‘update anomaly’ and use the data above to give an example of an update anomaly. (2 marks)

See next page

(c) Normalise the data to 3rd normal form (3NF). (3 marks)

- You need only show the relations and fields in your answer, not the actual data.
- You may need to create additional fields.

The Project table has been done for you.

PROJECT(ProjCode, ProjectName, Budget)

Question 9 **(7 marks)**

(a) State **one** advantage and **one** disadvantage of the following system development methodologies. (4 marks)

Iterative – rapid application development (RAD)

Advantage	Disadvantage

Linear – waterfall/cascade

Advantage	Disadvantage

(b) A small business wants to develop an online ordering system for its website. It has a limited budget and needs the ordering system as soon as possible because it is losing customers to competitors.

Determine which system development methodology would be best suited to this scenario. Justify your choice. (3 marks)

Question 10 **(11 marks)**

Refer to the following pseudocode to answer **all** parts of this question.

This algorithm accepts the quantity and cost of items purchased, and then calculates the GST and shipping cost for the items.

```
1   Module CalcCostOfItems(Qty, ItemCost, CostOfItems)
2       CostOfItems ← Qty * ItemCost
3   End Module
4
5   Module CalcGST (CostOfItems, GSTPayable)
6       GSTRate = 0.1
7       GSTPayable ← CostOfItems + (CostOfItems * GSTRate)
8   End Module
9
10  Module CalcShippingCost (TotalCost, ShippingCost)
11  // Will need to add code later
12  End Module
13
14  Module Main
15      TotalCost ← 0
16      Repeat
17          Input (Qty, ItemCost)
18          Call CalcCostOfItems (Qty, ItemCost, CostOfItems)
19          Call CalcGST (CostOfItems, GSTPayable)
20          TotalCost ← TotalCost + GSTPayable
21          Output (“Do you want to add another item and its quantity? (Y/N)”)
22          Input (Response)
23      Until Response = “N”
24
25      Call CalcShippingCost (TotalCost, ShippingCost)
26      Output (ShippingCost)
27  End Module
```

See next page

(a) Identify the line which contains a constant. (1 mark)

(b) Lines 10 to 12 in the pseudocode has // *Will need to add code later*. Apart from modularisation, identify the type of programming concept this represents. (1 mark)

(c) Describe the purpose of the type of concept you identified in part (b). (2 marks)

(d) Draw a structure chart to represent the communication between the modules. (7 marks)

Question 11 **(4 marks)**

Complete the table below to identify the missing layer names and descriptions of the DoD TCP/IP model.

Layer name	Description
	Defines the protocols that enable the user to interact with the network, including data representation, encoding and dialog control.
Transport	
	Responsible for end-to-end delivery, responsible for reliability, flow control and re-transmission.
Network	

Question 12 **(4 marks)**

The following is an example of the data for an array named StudentList.

StudentList

	Nikita	Ahmed	Harry	Ling	…..	Clara
Name	0	1	2	3	…..	19

Given the array contains the names of 20 students, use the space below to write an algorithm in pseudocode to **output** the names of the students in **reverse** order.

See next page

Question 13 **(2 marks)**

Fibre optic cable is available in either single-mode or multi-mode. Outline the characteristics of each mode.

Single-mode: _____

_____

Multi-mode: _____

_____

Question 14 **(7 marks)**

Examine the following algorithm that accepts a number of sales amounts and calculates the total sales amount.

```
TotalSales ← 0
NumSales ← 0
Input (SalesAmount)
While SalesAmount > 0
        NumSales ← NumSales + 1
        TotalSales ← TotalSales + SalesAmount
        Input (SalesAmount)
End While
```

(a) Complete the trace table for the algorithm using the following test data: (4 marks)

25, 10, 5, 0

SalesAmount	SalesAmount >=0?	NumSales	TotalSales
		0	0

(b) Rewrite the algorithm so that it uses a test last (repeat until) loop. (3 marks)

See next page

Question 15 **(3 marks)**

Describe the role of the registers and system clock within the fetch-execute cycle.

Question 16 **(3 marks)**

'Online storage is the only disaster recovery tool a company should use.'

Outline why this statement is incorrect and identify **two** other tools that could be used by a company to protect its data in the event of a disaster.

See next page

Question 17 **(3 marks)**

(a) Compare the different structure of an IP4 address with an IP6 address as shown below. (2 marks)

IP4 address	IP6 address
192.14.17.10	3FFE:0000:0000:0001:0200:F8FF:FE75:50DF

(b) Outline why IP6 has been introduced alongside IP4. (1 mark)

Question 18 **(3 marks)**

There are a number of different error-checking methods available in network communication.

(a) Outline how a parity bit provides a means of error detection in network communication. (1 mark)

(b) Complete the first column in the table below with the correct parity bits for a transmission using **even** parity. (2 marks)

Parity Bit							
	1	0	0	1	0	1	1
	0	1	1	1	0	0	0

Question 19 **(2 marks)**

Students are using their wireless notebooks to complete their work in a classroom. They will need to connect wirelessly to a printer to print their answers at the end of the lesson.

Describe how CSMA/CA operates in the above scenario.

Question 20 **(2 marks)**

802.3 is the standard for ethernet wired networks and 802.11x is the standard for ethernet wireless networks.

Outline why standards such as these are important in the development of network devices and software.

Question 21 **(3 marks)**

The introduction of a new system involves evaluation and maintenance once the system is implemented.

Describe the evaluation and maintenance stage of the systems development life cycle (SDLC) and provide **one** example of an activity undertaken in this stage.

See next page

Question 22 **(4 marks)**

(a) Identify which processor in the PC systems below is likely to process instructions more efficiently. Justify your answer. (2 marks)

Processor X:	Intel® Core™ i7 processor (3.8 - 5.0 GHz, quad core)
Processor Y:	Intel® Core™ i5 (2.9 - 4.7GHz, dual core)

(b) Describe the difference between distributed and sequential processing on how they process instructions. (2 marks)

Question 23 **(3 marks)**

A company has decided to deliver its products online to international customers. It has employed you as a project manager to determine whether this is a viable business decision. You choose to conduct a feasibility study.

Outline the purpose of a feasibility study using **two** components associated with this process.

See next page

Question 24 **(3 marks)**

Data mining can be used to discover or identify similar patterns in transaction data for a given time period.

(a) Identify an example of how this process could be used by a supermarket business. (1 mark)

(b) Outline a legal and an ethical consideration that the supermarket business needs to be aware of. (2 marks)

End of Section One

See next page

Section Two: Extended answer **60% (124 Marks)**

This section has **four** questions. Answer **all** questions. Write your answers in the spaces provided.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 110 minutes.

Refer to the Source Booklet to answer Questions 25 to 28.

Question 25 **(33 marks)**

(a) Complete a context diagram below for the EmergWA system outlined on page 2 of the Source booklet. (8 marks)

(b) Draw a Level 0 Data Flow Diagram (DFD) for the EmergWA system. (15 marks)

See next page

Question 25 (continued)

(c) Debriefing is an important process that needs to occur after each incident. Use the information below to draw a Level 1 Data Flow Diagram (DFD) for the debrief process.

- Once the incident is over, a debrief process commences. EmergWA asks volunteers to record a written debrief of the event after the danger has passed, in order to keep checks on the wellbeing of the volunteers and to reflect on their performance.
- The debriefs are stored in the new Debriefs datastore.
- These can be requested by the incident controller if required. (7 marks)

(d) EmergWA is concerned that the debriefing process might be ignored by some volunteers once the incident is completed. Recommend and identify **one** data gathering technique that could be used to understand the incident. (3 marks)

See next page

Question 26 **(35 marks)**

Refer to the image of the Database Dashboard available to volunteers in the Source booklet on page 3.

(a) Using Chen's notation, draw an Entity Relationship (ER) diagram that represents this part of the database.

Include the following:

- names of all primary keys
- names of all foreign keys
- relationships
- cardinality.

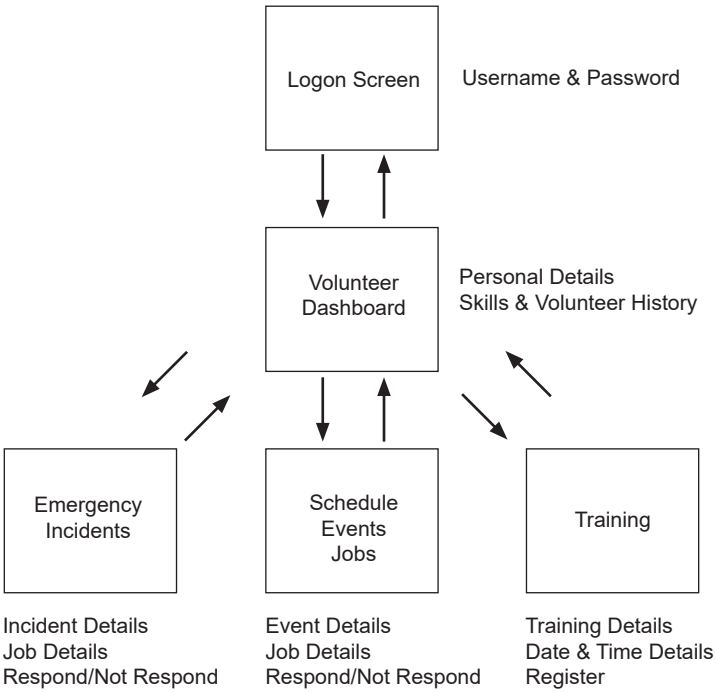
Your diagram will need to resolve all many-to-many relationships. (23 marks)

See next page

Question 26 (continued)

(b) EmergWA volunteers have to logon to a desktop to access their dashboard. The Chief Information Officer is keen to create a mobile application (app) that volunteers can use to check for emergency incidents, upcoming events and jobs. This would make it easier for volunteers to respond to requests.

The navigation structure for the new application is shown below, and includes key information that needs to be on the screens.



(i) Design the visual interface for the following screens on page 25:

- Emergency Incidents
- Training

Ensure that you include at least **four** different aspects over the two screens that assist the volunteers in using the system. (4 marks)

See next page

Emergency Incidents Screen

Training Screen

(ii) Explain how the features and components you included in the design of the visual interface will enhance the user experience. (3 marks)

See next page

Question 26 (continued)

(c) Describe **two** factors that can affect the development and success of the EmergWA mobile application (app). (2 marks)

One: _____

_____

Two: _____

_____

(d) On launch, the app will ask volunteers to agree to a code of conduct before loading the main screen.

Explain how the use of a code of conduct protects both EmergWA and the volunteers using the system. (3 marks)

_____

_____

_____

_____

_____

_____

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See next page

Question 27 **(25 marks)**

The Headquarters of EmergWA is located in a two-storey building. The main ICT room is located on the second floor, and includes a secure server room and office space for ICT technicians.

The router in the main server room has 6 x Gigabit Ethernet ports and 1 x 10 Gigabit Fibre Ethernet port. A modem will connect to the Internet and a firewall will provide security for incoming data traffic to the router. The email, web and database servers will connect directly to the router so that a second firewall can be implemented for security. Each floor has a 48-port switch that will allow connection of network equipment such as photocopiers and desktop computers. These switches will connect to the core switch in the main server room.

The main backbone (connections between router and core switch) of the network will be fibre optic, whilst the remainder of the network will be Gigabit Ethernet. Each floor will have two wireless access points to allow wireless devices access to network resources.

(a) Use the CISCO network diagrammatic conventions to represent the topology for the network described in the scenario. Draw a topology diagram on page 29, indicating where fibre optic cable/s and ethernet cable/s will be used. Ensure that your diagram is labelled clearly. (15 marks)

See next page

Topology diagram

See next page

Question 27 (continued)

(b) Describe why fibre optic cable would be used for the backbone of the network. (2 marks)

(c) Describe how the firewalls can ensure the security of the EmergWA network. (2 marks)

When an emergency, such as a bushfire, occurs, a mobile command centre housed in a caravan is used for communication between the headquarters and the volunteer crews. If the emergency is in a remote location, cellular communication is used. However, this system is not always reliable.

(d) Describe a transmission media that would work better in remote areas. (3 marks)

The volunteers assisting in an emergency all wear personal protection equipment (PPE) that has an RFID tag sewn into the collar so that they can be tracked if they become lost in a remote location.

(e) Identify what RFID is and outline how it works. (3 marks)

See next page

Question 28 **(31 marks)**

Refer to the information in the Source booklet on pages 4 and 5 to answer this question.

(a) Write an algorithm in pseudocode to complete Module *GetType* to ensure that only a valid vehicle type is entered. The message 'Incorrect type code, try again' should be displayed if the user inputs an invalid type code. (5 marks)

(b) Write an algorithm in pseudocode to complete Module *GetRate*. Your algorithm should use a case structure to determine the Rate/kg payable. (5 marks)

See next page

Question 28 (continued)

(c) Describe how the parameter *Type* is used in Module *GetType* and Module *GetRate*. Include information on value parameter and reference parameter in your answer. (2 marks)

(d) All modules are called by the *Module Main*. Write the Module Main below. Include all variables and parameter passings. The *TotalPayable* needs to be calculated and output at the end of the module. (19 marks)

Module main:

End module

End of questions

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Supplementary page

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