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

ATAR course examination, 2020

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	21	21	70	90	40
Section Two Extended answer	4	4	110	109	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 2020: 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% (90 Marks)**

This section contains **21** 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 **(2 marks)**

State **one** reason why linear and iterative system development methodologies are both similar and different.

Similar: _____

_____

_____

Different: _____

_____

_____

Question 2 **(2 marks)**

Describe the role of open systems in database interconnectivity.

_____

_____

_____

_____

Question 3 **(3 marks)**

State **three** advantages of modularisation in the writing of software programs.

One: _____

_____

Two: _____

_____

Three: _____

_____

Question 4 **(3 marks)**

Explain the difference between full backups and incremental backups used in disaster recovery.

_____

_____

_____

_____

_____

_____

See next page

Question 5 **(8 marks)**

The components of the central processing unit (CPU) are the:

- arithmetic logic unit (ALU)
- control unit
- registers
- program counter
- system clock
- data, address and control bus.

Draw a diagram illustrating how these components are connected.

See next page

Question 6 **(2 marks)**

Processors with multiple cores are now widely used in computers because of the improved performance they offer. Describe how multiple cores offer improved system performance over single core processors.

Question 7 **(2 marks)**

Describe how an operating system manages memory.

Question 8 **(2 marks)**

State **two** advantages for employees of a standard operating environment (SOE).

One:

Two:

Question 9 **(6 marks)**

Describe **three** legal obligations of developers when they are creating new software.

One:

Two:

Three:

Question 10 **(4 marks)**

Describe the following factors that affect the development of software:

- user needs
- technical specification.

User needs:

Technical specifications:

Question 11 **(3 marks)**

Provide an example of each of the following simple data types used in programming. The first has been done for you.

Data Type	Example
Character	C
Integer	
Real (floating point number)	
Boolean	

Question 12 **(10 marks)**

Below is an extract from a table currently used in a doctor's surgery.

Name	DOB	Address	Appt 1 Date/ Time	Doctor	Appt 2 Date/ Time	Doctor	Appt 3 Date/ Time	Doctor
Poppy Lee	23/06/95	2 Thor Rd, FLOREAT, 6011	09/11/20 10.30 am	Hannah Chen	12/12/20 9.15 am	Jonathan King	13/12/20 9.15 am	Jonathan King
Marcus Martin	12/10/99	5 Cross St, ILUKA, 6012	07/10/20 4.20 pm	Hannah Chen	02/11/20 3.20 pm	Hannah Chen	03/11/20 8.45 am	Hannah Chen
Chris Williams	06/04/87	3 Sydney St, HOVEA, 6015	05/10/20 8.45 am	James Seth	15/11/20 4.10 pm	James Seth	12/12/20 9.15 am	James Seth

(a) Using information from the table above, explain data redundancy. (2 marks)

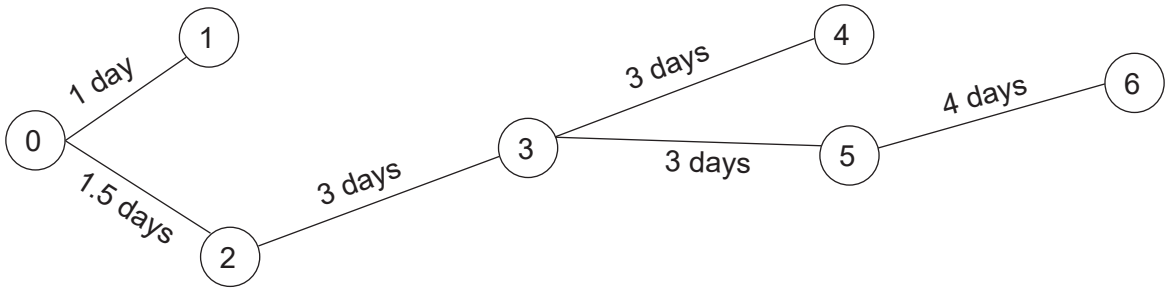
See next page

(b) Normalise the data from the table on page 8 to 3NF. Identify the entities, primary and foreign keys. (8 marks)

See next page

Question 13 **(3 marks)**

Consider the diagram below.



(a) Describe how this diagram assists a manager in executing a project. (2 marks)

(b) The diagram includes the critical path. Using this information, state how long the project will take to finish. (1 mark)

Question 14 **(5 marks)**

Consider the code below.

```
FUNCTION GetLicence (age)
licence ← False
IF age >= 16 THEN
        licence ← True
ELSE
        licence ← False
GetLicence ← licence
END FUNCTION

MODULE Main
LPlates ← False
age ← 0
INPUT (age)
LPlates ← GetLicence (age)
IF LPlates = True THEN
        OUTPUT('You are old enough to have L plates')
ELSE
        OUTPUT('You are not old enough to have L plates')
END MODULE Main
```

(a) Identify a parameter in the function. (1 mark)

(b) Identify a local variable in the module. (1 mark)

(c) Apart from good programming practice (declaring a variable before use), describe why LPlates does not need to be set to False at the beginning of the module. (2 marks)

(d) Identify the output in the module if the number 16 is input. (1 mark)

See next page

Question 15 **(2 marks)**

Describe **one** way in which convergence has influenced the development of mobile devices.

Question 16 **(6 marks)**

Different database architectures have different strengths and weaknesses.

(a) Describe **one** difference between centralised and distributed databases. (2 marks)

(b) State **one** example of where a distributed database would have an advantage over a centralised database. (1 mark)

(c) Consider a distributed database. Multiple clients each keep a local working copy of a database that is written back periodically to a master central copy. Using an example, explain **one** problem with this method. (3 marks)

See next page

Question 17 **(6 marks)**

Describe the role of the following devices in network communications:

- repeaters
- bridge
- network interface card.

repeaters

bridge

network interface card

Question 18 **(9 marks)**

Network security often uses some form of authentication as the first level of protection.

(a) List **two** advantages of using passwords to ensure the security of networks. (2 marks)

One: _____

_____

Two: _____

_____

(b) List **two** disadvantages of using passwords to ensure the security of networks. (2 marks)

One: _____

_____

Two: _____

_____

(c) List **two** other methods that could be used to authenticate a user to a networked computer. (2 marks)

One: _____

_____

Two: _____

_____

(d) Phishing is a popular strategy used to compromise the security of networks. Using an example, explain how phishing works. (3 marks)

_____

_____

_____

_____

_____

_____

_____

See next page

Question 19 **(6 marks)**

Several factors influence the performance of a network, including data collisions and bandwidth.

(a) Describe how data collisions affect network performance. (2 marks)

(b) State **one** way in which data collisions can be reduced in an Ethernet network. (1 mark)

(c) Describe the concept of bandwidth and its effect on performance. (2 marks)

(d) If a communications channel has a bandwidth of 10 Mbps, how long will it take to transmit a 25-megabyte file (assuming 8 bits to a byte)? (1 mark)

See next page

Question 20 **(3 marks)**

Using an example, explain the ethical implications of the use of data mining.

Question 21 **(3 marks)**

Explain the difference between source code, byte code and executable code.

End of Section One

See next page

Section Two: Extended answer **60% (109 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.

Question 22 **(35 marks)**

Refer to the Source booklet to answer Question 22.

(a) In developing the system solution for Carpark Services, describe the following stages of the systems development life cycle (SDLC) and provide an example of an activity in each stage as it relates to the project. (6 marks)

Preliminary analysis: _____

_____

_____

_____

_____

Design: _____

_____

_____

_____

_____

Implementation: _____

_____

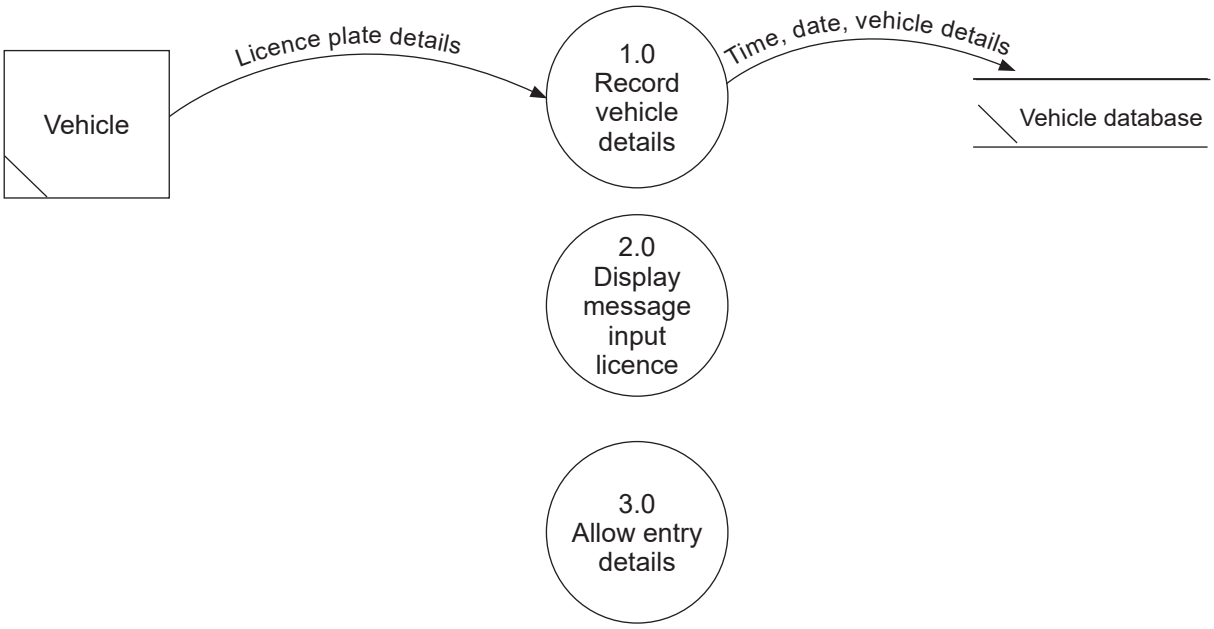
_____

_____

_____

Question 22 (continued)

(b) Complete the level 0 Data Flow Diagram (DFD) for Carpark Services. (29 marks)



Question 23 **(20 marks)**

Carpark Services is using an online database system to track the entry and exit of cars in its carparks. The following information has been provided to you by Carpark Services.

- Many cars can use one carpark.
- One car can visit many different carparks.
- Many cars can visit the same carpark multiple times on the same day.
- One car can incur many parking costs.
- One car is fitted with one licence plate number (Rego_ID).

(a) Using Chen's notation, draw an Entity Relationship (ER) diagram that includes the following:

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

You need to resolve all many-to-many relationships. (13 marks)

Question 23 (continued)

(b) Refer to your ER solution in part (a) and write a query using Structured Query Language (SQL) that will display the Rego_ID, entry and exit time of cars that were parked for three hours or more, and have been charged more than $10 for parking.

- Rego_ID
- Entry_time
- Exit_time
- Actual_Cost (4 marks)

(c) Using the above as an example, explain the difference between 2NF and 3NF. (3 marks)

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See next page

Question 24 **(23 marks)**

The Carpark Services system must ensure that any car registration plate that is scanned and stored is error-free. To assist in preserving data integrity the following must be included.

- The car park uses a check digit computed from each scanned car registration plate.
- When a ticket is issued, the software on the machine calculates the check digit and stores it.
- When a car registration plate is re-scanned on exit, its check digit is calculated and checked against the number stored.
- If the two check digits are not equal, then the driver is asked to use the phone to call for assistance.

The check digit is calculated using the following algorithm.
A car registration plate has the format 1AAA NNN (e.g. 1EWW 123). Take the last three digits of a car registration plate and call this the registration number or RN.

- Take the hundreds digit of the RN and multiply by 1.
- Take the tens digit of the RN and multiply by 3.
- Take the ones digit of the RN and multiply by 7.

The check digit is calculated from the sum of the three values above. If the sum is less than 10, then the check digit is the sum. If the sum is 10 or more, then the check digit should be calculated as the sum modulo 10.

To assist with this calculation, use the supplied library function MOD(x, y) which returns the integer remainder after x is divided by y. For example, if the sum of the three numbers was 25, MOD(25,10) returns a remainder of 5, i.e. 2 x 10 = 20 with 5 remaining. Therefore, the check digit would be 5.

Assume that the registration number is stored in an array called RN[], with RN[0] being the hundreds digit.

```
BEGIN
1 Hundreds ← 0
2 Tens ← 0
3 Ones ← 0
4 Hundreds ← RN[0]
5 Tens ← RN[1] * 3
6 Ones ← RN[2] * 7
7 Sum ← Hundreds + Tens + Ones
8 CheckDigit ← MOD(Sum, 10)
END
```

See next page

(a) Using the pseudocode on page 22, complete the trace table below to calculate the check digit for the RN '123'. (8 marks)

Line#	Hundreds	Tens	Ones	Sum	CheckDigit
1					
2					
3					
4					
5					
6					
7					
8					

(b) When a ticket is issued, it is time-stamped with a marker that is the time in minutes since the system was started. Write a function to calculate the time (in minutes) spent by a customer in the car park. Use the ticket issue time as a parameter. Assume that there is a library function you can use, called NOW(), that returns the current time in minutes since the system was started. (6 marks)

See next page

Question 24 (continued)

(c) Using the information below, write a function to calculate the cost of a ticket, given the time spent in the car park. You may wish to use the function you defined in part (b) on page 23 to help you.

- The first hour is free.
- The second hour is a single charge of $5.
- Between 3–24 hours (inclusive) the cost is $3 per hour (including the first two hours). After 24 hours, there is a single charge of $100.

Assume that there is a library function you can use, called INT(), that returns the integer part of a real (floating point) number. For example, INT(0.5) returns 0 (zero), INT(1.0) returns 1 and INT(2.9) returns 2. Remember that there are 60 minutes in an hour.

(9 marks)

See next page

Question 25 **(31 marks)**

The Carpark Services system network will have Licence Plate Recognition (LPR) technology working through the cameras that will detect and scan the licence plates of vehicles entering and exiting the car park.

Upon entry, once the data is captured, signals are sent wirelessly to the microcontroller to open the barrier gate. The vehicle details are stored in the database on the server.

Upon exit, the customer will input the licence plate into the self-serve payment machine which will display the cost. The customer will pay using a credit card or mobile phone and these details will be verified by the appropriate bank.

Once payment is accepted, the customer drives to the barrier gate where the licence plate will be scanned by the LPR technology and checked with the payment details stored in the server. If successful, signals will be sent wirelessly to the microcontroller and the barrier gate will open.

(a) Draw the network diagram for the Carpark Services system which incorporates a payment machine. Include the following network devices and components: Router, Switch, Firewall, Modem, Server, Wireless Access Point. (13 marks)

See next page

Question 25 (continued)

(b) Describe **two** methods that can be used to ensure the security of the Carpark Services network. (4 marks)

(c) For Carpark Services to be able to store its information in the cloud, it requires the use of the Department of Defence (DoD) transmission control protocol/internet protocol (TCP/IP) model. Identify and describe the **four** layers of DoD (TCP/IP), using examples from Carpark Services. (12 marks)

See next page

(d) Describe how checksums can be used to assure the integrity of the Carpark Services wireless network traffic. (2 marks)

End of questions

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____

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