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

ATAR course sample examination one

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	78	40
Section Two Extended answer	4	4	110	105	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: Part II Examinations*. Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens. 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% (78 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 **(4 marks)**

Describe **two** external network threats.

One: _____

_____

_____

_____

Two: _____

_____

_____

_____

Question 2 **(3 marks)**

Complete the table below by identifying a characteristic of each data type listed.

Date type	Characteristic
Integer	A whole number without fractions or decimals
Float	
String	
Boolean	

Question 3 **(4 marks)**

Describe each of the following types of data integrity.

Domain integrity

Referential integrity

See next page

Question 4 **(4 marks)**

The table below contains data about a Sports System project being worked on by the employees.

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 the term ‘delete anomaly’ and, from the table above, identify an example of a delete anomaly. (2 marks)

(b) Define the term ‘update anomaly’ and, from the table above, identify an example of an update anomaly. (2 marks)

See next page

Question 5 **(13 marks)**

A public transport system needs to determine which passengers are eligible for discounted fares based on age and student status.

(a) Write Boolean logical expressions to test each of the following:

- the variable 'age' stores the age in years of a passenger
- the variable 'student' stores a Boolean value indicating whether the passenger is a student.

Your Boolean expression should resolve as true for passengers who are either:

- younger than 18
- older than 65
- a student. (3 marks)

A public transport system's software stores and accesses passenger data in objects.

(b) Outline **two** differences between a 'class' and an 'object'. (2 marks)

One: _____

Two: _____

(c) Write the pseudocode for a 'Passenger' class. The Passenger class has an identification number, name, date of birth and credit as private attributes.

Your constructor should:

- accept name and date of birth as parameters
- generate a new ID using a function called 'get_new_id'
- set credit to have a value of zero.

Include a stub for a method called 'get_age' which has no parameters and always returns 18. (8 marks)

See next page

Question 6 **(3 marks)**

Explain how social engineering (phishing) can be used to gain unauthorised access to a network, despite technical security measures being present.

See next page

Question 7 **(4 marks)**

Refer to the following Python code fragment to answer all parts of this question.

```
1   cipher = input("Enter cipher: ").upper()
2   ALPHABET = 'ABCDEFGHIJKLMNOPQRSTUVWXYZ'
3
4   for key in range(len(ALPHABET)):
5     decrypted = ''
6     for character in cipher:
7       if character in ALPHABET:
8         num = ALPHABET.find(character)
9         num = num - key
10        if num < 0:
11          num = num + len(ALPHABET)
12        decrypted = decrypted + ALPHABET[num]
13      else:
14        decrypted = decrypted + character
15    print(f"Key: {key}: {decrypted}")
```

The above code fragment includes a breakpoint set at line 8.

(a) Describe how a breakpoint debugging technique helps programmers identify errors in code. (2 marks)

(b) Referring to the content of line 8 in the code fragment above, outline why a breakpoint is a more comprehensive debugging option than using print statements. (2 marks)

See next page

Question 8 **(3 marks)**

Explain how a network switch uses MAC addresses to determine to which physical port a particular incoming data packet should be directed in order to reach its intended connected device.

Question 9 **(6 marks)**

Complete the missing information in the table below of Open Systems Interconnection (OSI) layers:

OSI layer	Role of the layer	Example network component hardware or protocol
7. Application	End user application protocols	
6.	Formatting of data, encryption and decryption	SSL
5. Session	Manages connections between endpoints	NetBios
4. Transport	Ensures data arrives as expected	
3.	Routing packets, determining best path	Routers
2. Data link		Switches
1.	Sends data using signals, such as electricity or visible light	Cables

See next page

Question 10 **(4 marks)**

Define the role of each of the terms in the acronym 'ACID' as it applies to databases.

Atomicity: _____

_____

Consistency: _____

_____

Isolation: _____

_____

Durability: _____

_____

Question 11 **(2 marks)**

Define the role of 'red team' and 'blue team' as they relate to penetration testing.

Red team: _____

_____

Blue team: _____

_____

Question 12 **(2 marks)**

State **one** different activity to be carried out by a member of the red team and the blue team.

Red team: _____

_____

Blue team: _____

_____

See next page

Question 13 **(4 marks)**

Justify the use of symmetric encryption in creating an asymmetric connection to a website.

Question 14 **(1 mark)**

Line number	Pseudocode
1	INPUT(username)
2	INPUT(password_hash)
3	stored_hash = retrieve_hash_from_database(username)
4	IF stored_hash == password_hash THEN
5	OUTPUT(“Signing you in…”)
6	ELSE
7	OUTPUT(“Sign in details incorrect”)
8	END IF

Identify a program control structure used in the pseudocode in line 4 above.

See next page

Question 15 **(5 marks)**

(a) Describe how data is sent through a network using packets. (2 marks)

(b) State a purpose of the 'protocol' section of the packet. (1 mark)

(c) Describe the concept of subnetting. (2 marks)

See next page

Question 16 **(2 marks)**

Describe the purpose of issuing a network 'ping' command with respect to network troubleshooting and performance management.

Question 17 **(4 marks)**

Discuss why a binary search would be a more suitable algorithm to use than a linear search algorithm.

Question 18 **(2 marks)**

Outline why it is important to use live test data including a sufficiently large volume of test data (load testing) before completing a software development project.

See next page

Question 19 **(2 marks)**

State **two** actions that organisations need to take in order to adhere to data security in relation to the Australian Privacy Principle 11 (APP11) of the *Privacy Act of 1988*.

Question 20 **(3 marks)**

Explain **one** ethical implication when using data mining techniques.

Question 21 **(3 marks)**

Explain a difference in characteristics between ‘one-dimensional’ and ‘two-dimensional’ arrays.

End of Section One

See next page

Section Two: Extended answer **60% (105 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 22 and 24.

Question 22 **(23 marks)**

Refer to pages 2 and 3 of the Source booklet to answer the following questions.

(a) Using variables in the table of the source booklet, create a program control structure that tests if the centre of the puck is within the goal zone and prints either “true” or “false”
(5 marks)

(b) Write a Python function called 'insert_new_high_score' that accepts the following:

- a two-dimensional array of 10 existing, sorted high scores and player's initials stored as three character strings
- an integer containing the player score entry to the 'high_scores' table.

Your function must determine whether the new score is high enough to include in the list, and if so, must insert the score and initials into the appropriate locations in the array.

Your function must return a two-dimensional array of the top 10 sets of high scores and initials. You may not make use of any external libraries. (12 marks)

See next page

Question 22 (continued)

(c) Assume your code works well, but you have decided to write a series of unit tests. Describe a purpose of unit tests when writing code. (2 marks)

(d) Given the example data structure in the source booklet for representing the sample high score array, list **four** new score values you would use as test data and state a reason why you have selected each of their values. (4 marks)

One:

Two:

Three:

Four:

This page has been left blank intentionally

See next page

Question 23 **(35 marks)**

Pointed Nostalgia's global game-matching service allows players to compete with other players who own the same game. Such competitions are called matches.

Refer to the following information about the game-matching service to answer this question:

- each player has a username that can be changed once per month
- each player can own multiple games
- a match is created when two or more players join the same instance of a game
- each match has only one winner.

Current database designs have designated the username attribute as the primary key for the user's table.

(a) Given the information above, outline a reason why it would be better to use a unique integer 'PlayerID' attribute that cannot be changed as the primary key instead of the username. (2 marks)

See next page

(b) Create an entity relationship (ER) diagram using crow's foot notation showing the tables necessary to store data about matches on Pointed Nostalgia's game-matching service. Resolve any many to many relationships and show only key attributes. (18 marks)

See next page

Question 23 (continued)

(c) Each game has a GameID, Title, Price and MaxPlayers. Complete the data dictionary below for the attributes in the Games table. (6 marks)

Element name	Data type	Size/format	Description	Constraint
GameID	Integer	4, Autoincrement		Unique
Title		64	Title of game	Not null
Price		3,2	Price of game	
MaxPlayers		2		Minimum of 1

(d) Write a query using SQL to create the Games table.
Note: you do not need to enforce custom constraints such as 'minimum of 1'. (4 marks)

See next page

(e) Write a query using SQL to return all player usernames with matches recorded for the game with a GameID of 7. (5 marks)

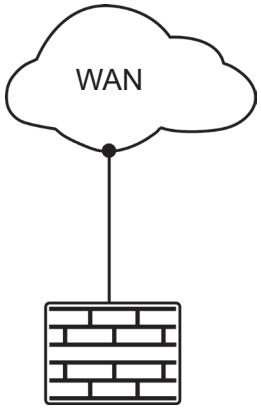
See next page

Question 24 **(27 marks)**

Refer to the information on page 4 of the Source booklet to answer the following questions.

(a) Complete the network diagram showing the proposed Pointed Nostalgia network using CISCO conventions. Desktops may be represented using a single symbol with an address range given to their network, as indicated for the developers' network. Label each component to show what it is and which network it belongs to. Allocate appropriate IP addresses to each end point device. Wireless clients do not need to be included.

(16 marks)



Some players using Pointed Nostalgia's games have been reporting a lag and slow play when engaging in multiplayer matches. ICT support have requested that these players run a traceroute back to the multiplayer servers.

(b) Describe the use of a traceroute for evaluating performance and/or troubleshooting across multiple networks. (2 marks)

(c) You have been asked to determine whether transmission control protocol (TCP) or user datagram protocol (UDP) would be a better choice of protocol for Pointed Nostalgia's new online turn-based strategy game. Compare UDP and TCP protocols and justify a selection of one over the other for this specific game. (4 marks)

(d) Describe private IPv4 addressing and explain why it exists. (5 marks)

See next page

Question 25 **(20 marks)**

(a) Describe how SQL Injection can put a database at risk. (2 marks)

(b) Identify how you would mitigate an SQL Injection as a network security threat. (1 mark)

Upon further inspection, it turns out an attacker has already exploited the vulnerability prior to your resolution and gained access to Pointed Nostalgia's users database. Given the company has a turnover of more than $3 million per year, management is worried that this may constitute a notifiable data breach.

(c) Describe what a notifiable data breach is and outline **four** actions that the company must take in response. (6 marks)

Description:

One:

Two:

Three:

Four:

See next page

(d) As a result of the data breach, the company is tightening its security processes and setting up several solutions. Describe how each of the following security solutions help to prevent or mitigate future attacks. (6 marks)

Using a virtual private network for all remote workers

Access control lists

User training

(e) Identify **one** early method of encryption and describe its weaknesses. (3 marks)

See next page

Question 25 (continued)

When implementing some methods of encryption, you have the option of using either 128 bits or 256 bits for the key.

(f) State **one** advantage and **one** disadvantage of using a smaller number of bits for an encryption key. (2 marks)

Advantage: _____

_____

Disadvantage: _____

_____

End of questions

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____

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