Semester 2 2023

ATAR course examination

Question/Answer booklet

**Year 11 ATAR COMPUTER SCIENCE AECCS**

Surname:

Other names:

WA student number (if known)

SIDE Teacher: Mark Rotondella

SIDE Student Coordinator:

**Supervisor’s declaration**

I declare that this examination paper has been completed by the student named above. The time and resource restrictions have been observed and the student has NOT accessed notes, texts, reference books, the internet, a computer, a calculator or a mobile phone unless otherwise specified. I understand that breaches of the examination rules could lead to an examination paper being cancelled or having an examination mark significantly lowered.

Supervisor’s name:

Signature: Date:

**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

***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 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 | 20 | 20 | 70 | 79 | 40 |
| Section Two:  Extended answer | 4 | 4 | 110 | 118 | 60 |
|  |  |  |  | **Total** | 100 |

## Instructions to candidates

1. The rules for the conduct of the Western Australian Certificate of Education ATAR course examinations are detailed in the *Year 12 Information Handbook 2023: Part II*. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in the spaces provided in this Question/Answer booklet. A blue or black pen should be used. 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. Additional working space pages at the end of this Question/Answer booklet are for planning or continuing an answer. If you use these pages, indicate at the original answer, the page number it is planned/continued on and write the question number being planned/continued on the additional working space page.

# Section One: Short answer 40% (79 marks)

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

Supplementary pages for the use of planning/continuing your answer to a question have been 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.

1. **(3 marks)**

State **three** activities that occur in the investigate stage of the Framework for development:

One:

Two:

Three:

1. **(4 marks)**

Carl has started working in a small accounting firm. Upon logging in to his workstation for the first time he has been asked to create a new password. His choice for a password was his birthdate – 12june84.

* 1. Identify **two** issues with the selected password. (2 marks)

One:

Two:

* 1. Suggest a secure password that Carl should use and outline the reasons your choice is more secure. (2 marks)

Suggested password:

Reason:

1. **(4 marks)**

Briefly outline the following networking protocols and identify its associated layer within the DoD TCP/IP model.

DNS (Domain Name System)

Layer:

TCP (Transmission Control Protocol)

Layer:

1. **(2 marks)**

Convert the binary number 10110010 into decimal. Ensure you show your working out in the area below.

|  |
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Answer:

1. **(2 marks)**

Describe the purpose of a data dictionary.

1. **(2 marks)**

Outline **one** advantage and **one** limitation of using global variables over local variables.

Advantage:

Limitation:

1. **(3 marks)**

State the key characteristics for each of the following programming data types.

Integer:

Float:

Boolean:

1. **(6 marks)**

Identify and describe the **two** methods for cracking substitution ciphers (from the syllabus).

Method one:

Description:

Method two:

Description:

1. **(6 marks)**

Consider the following algorithm to work out the meal prices for group bookings at a restaurant.

INPUT (group\_num)

IF group\_num >= 5 AND group\_num < 10 THEN

per\_head\_price = 18

ELSE IF group\_num >=10 THEN

per\_head\_price = 15

ELSE

per\_head\_price = 20

END IF

* 1. State the set(s) of values for the variable *group\_num* that could be used to check the code for accuracy. (2 marks)

* 1. The algorithm uses a selection control structure. Rewrite the code using a case statement. (4 marks)

1. **(3 marks)**

Explain how social engineering, specifically phishing, can be used to compromise the security of a system.

1. **(4 marks)**

Julia is developing a new brain training game. She plans to release the game shortly but is unsure about which licensing methodology to use for her code.

Outline **one** advantage and **one** disadvantage for the use of each of the following types of software licenses in this situation.

Propriety

Advantage:

Disadvantage:

Open Source

Advantage:

Disadvantage:

1. **(3 marks)**

Validity and accuracy are two fundamental aspects of data quality in any database system. These concepts, though related, are not synonymous and can sometimes be misaligned.

Explain the concepts of data validity and data accuracy.

1. **(5 marks)**
   1. Expand the acronym, API. (1 mark)

* 1. Describe the purpose of an API. (2 marks)

* 1. Outline the process a software developer would take to make use of an API. (2 marks)

1. **(2 marks)**

Write a simple algorithm using pseudocode to demonstrate **one** example of making use of meaningful variable names.

1. **(4 marks)**

The 'Stuxnet' worm that was discovered in 2010 was one of the first instances of a cyber weapon being used to cause physical damage to infrastructure. It specifically targeted and disrupted Iran's nuclear program, representing a major milestone in the evolution of cyber warfare capabilities.

* 1. Describe the characteristics of a worm. (2 marks)

One of the key aspects of the ‘Stuxnet’ worm was the inclusion of multiple exploits for zero-day vulnerabilities.

* 1. Outline the meaning of a zero-day vulnerability. (2 marks)

1. **(6 marks)**

The following is a Book table related to a bookstore.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BookID** | **BookTitle** | **AuthorName** | **AuthorDOB** | **PublisherName** | **PublisherAddress** |
| 1 | War and Peace | Leo Tolstoy | 1828-09-09 | Penguin | 100 Pacific Hwy, North Sydney NSW 2060 |
| 2 | Anna Karenina | Leo Tolstoy | 1828-09-09 | Penguin | 100 Pacific Hwy, North Sydney NSW 2060 |
| 3 | 1984 | George Orwell | 1903-06-25 | Penguin | 100 Pacific Hwy, North Sydney NSW 2060 |
| 4 | Brave New World | Aldous Huxley | 1894-07-26 | HarperCollins | 201 Elizabeth St, Sydney NSW 2000 |
| 5 | Island | Aldous Huxley | 1894-07-26 | HarperCollins | 201 Elizabeth St, Sydney NSW 2000 |
| 6 | Moby-Dick | Herman Melville | 1819-08-01 | HarperCollins | 201 Elizabeth St, Sydney NSW 2000 |
| 7 | Moby-Dick | Herman Melville | 1819-08-01 | HarperCollins | 102 Elizabeth St, Sydney NSW 2000 |
| 8 | The Old Man and the Sea | Ernest Hemingway | 1899-07-21 | Random House | 100 Pacific Hwy, North Sydney NSW 2060 |
| 9 | The Sun Also Rises | Ernest Hemingway | 1899-07-21 | Random House | 100 Pacific Hwy, North Sydney NSW 2060 |

Outline each of the following data anomalies including an example for each using data from the Book table above.

Insert anomaly:

Update anomaly:

Delete anomaly:

1. **(3 marks)**

State **one** physical difference (regarding the address structure) and **two** functional differences between IPv4 vs IPv6 addresses.

Physical difference:

Functional difference one:

Functional difference two:

1. **(8 marks)**

The following algorithm is used to work out the overall average lap time for a runner on a running track. All times are inputted and calculated in seconds.

time\_total = 0

INPUT (num\_laps)

FOR count = 1 TO num\_laps

INPUT (lap\_time)

time\_total = time\_total + lap\_time

END FOR

avg\_lap\_time = seconds\_total/num\_laps

* 1. Complete the trace table below to ensure the accuracy of the algorithm.   
     Use the test data: *num\_laps* = 4 and *lap\_time* = 54, 52, 56, 68. (5 marks)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **num\_laps** | **count** | **lap\_time** | **time\_total** | **avg\_lap\_time** |
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* 1. State the type of error that a trace table is most effective in finding. (1 mark)

* 1. Describe the concept of stepping through a coded solution. (2 marks)

1. **(3 marks)**

Explain the concept of penetration testing including who benefits from this type of test.

1. **(6 marks)**

Write a simple algorithm for each of the following situations:

Calculate the final grade of a student based on the marks of two exams. The final grade is the average of the two exam grades.

Given a day of the week, check if it is a weekend (Saturday or Sunday). Output appropriately if the day is a weekday or a weekend.

**End of Section One**

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# Section Two: Extended answer 60% (118 marks)

This section contains **four** questions. You must answer **all** parts to the question. Write your answers in the spaces provided.

Supplementary pages for the use of planning/continuing your answer to a question have been 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.

ScootAround is an emerging electric scooter rental service operating in all capital cities and regional centres. The company provides an efficient and environmentally friendly transportation alternative to residents and visitors alike, offering convenient access to scooters via a mobile application. They are a low-cost alternative to their competitors and provide scooters for a base rate of $1.50 and then a flat rate of $5 per hour used.

As the company experiences rapid growth, it is faced with challenges in effectively managing data, network infrastructure, and security practices, requiring comprehensive IT solutions to enhance operational efficiency and user experience.

You've been hired by ScootAround to propose a comprehensive upgrade to their current systems that will address these issues.

ScootAround saves information about their rentals in a Rental table.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RentalID** | **CustomerName** | **Phone** | **City** | **ScooterID** | **RentalDate** | **RentalDuration** | **Cost** | **ServiceDate** | **ServiceType** |
| 1 | John Dadovich | 0423154646 | Sydney | 101 | 1/7/2023 | 2 | 10 | 10/7/2023 | Routine |
| 2 | John Dadovich | 0423154646 | Sydney | 102 | 5/7/2023 | 1 | 5 | 12/7/2023 | Repair |
| 3 | Jane Masterton | 0411231133 | Sydney | 101 | 6/7/2023 | 3 | 15 | 10/7/2023 | Routine |
| 4 | Bob Johnson | 0401214799 | Sydney | 103 | 7/7/2023 | 2 | 10 | 9/7/2023 | Repair |
| 5 | Bob Johnson | 0401214799 | Sydney | 101 | 2/7/2023 | 1 | 5 | 10/7/2023 | Routine |
| 6 | Jane Masterton | 0411231133 | Sydney | 102 | 3/7/2023 | 2 | 10 | 12/7/2023 | Repair |
| 7 | John Dadovich | 0423154646 | Sydney | 103 | 4/7/2023 | 1 | 5 | 5/7/2023 | Routine |
| 8 | Amy Lee | 0431542315 | Perth | 104 | 8/7/2023 | 2 | 10 | 15/7/2023 | Routine |
| 9 | Mark Gayson | 0422179489 | Perth | 105 | 9/7/2023 | 3 | 15 | 16/7/2023 | Repair |
| 10 | Amy Lee | 0431542315 | Perth | 106 | 2/7/2023 | 1 | 5 | 14/7/2023 | Routine |
| 11 | Mark Gayson | 0422179489 | Perth | 107 | 3/7/2023 | 2 | 10 | 13/7/2023 | Routine |
| 12 | Anna Brown | 0423115512 | Melbourne | 108 | 4/7/2023 | 3 | 15 | 15/7/2023 | Repair |
| 13 | Anna Brown | 0423115512 | Melbourne | 110 | 1/7/2023 | 2 | 10 | 15/7/2023 | Repair |
| 14 | Sam Wilson | 0415115564 | Melbourne | 111 | 5/7/2023 | 1 | 5 | 16/7/2023 | Routine |
| 15 | Sam Wilson | 0415115564 | Melbourne | 110 | 6/7/2023 | 3 | 15 | 14/7/2023 | Routine |

Scooters are purchased for a fixed location and do not travel between cities.  
Scooters can only have one service each day.

1. **(34 marks)**
   1. The data in the Rentals table is not normalised. Outline the requirements for the data to be in each of the following forms of normalisation. (3 marks)

1NF:

2NF:

3NF:

* 1. Describe the purpose of a relational database management system (RDBMS).   
      (2 marks)

* 1. Create an ERD using crow’s feet notation in the space on the next page for the data in the Rental table. Data should be normalised to Third Normal Form (3NF).  
       
     Ensure you include all entities, relationship cardinalities (using appropriate notation) and all key fields. **Non-key fields are not required**. (15 marks)

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| Planning: anything written on this page will **not** be marked. |
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ScootAround want a way to quickly identify the last routine service date for each of their scooters so they can arrange which scooters are up for their next routine service.

* 1. Write an SQL statement that will provide a list of the most recent routine services performed on each of the scooters. It should return the following:
* Scooter identifier
* Scooter city
* Date of the most recent routine service performed on the scooter (5 marks)

The service type for the service conducted on scooter 108 on 15/7/2023 was incorrectly recorded as "Repair" in the database. It was a routine service.

* 1. Write an SQL statement to correct this error in the database. (4 marks)

Hint: Use the format yyyy-mm-dd when inputting a date into your SQL statement.

* 1. As ScootAround continues to expand its operations and acquire new customers, it becomes more critical than ever to safeguard the sensitive customer information stored in the company's databases. They have decided to encrypt data in their database.
     1. Outline **three** additional security measures ScootAround could consider implementing to restrict unauthorised access to ScootAround's customer data.  
         (3 marks)

One:

Two:

Three:

* + 1. Describe why is it important for ScootAround to regularly backup their data.  
        (2 marks)

1. **(31 marks)**
   1. ScootAround's headquarters exists across four floors of a building in the Melbourne CBD. The infrastructure to run the app is stored in the basement with a database server and an application server. The ground floor has a reception desk with one desktop computer. There is also a waiting room on this floor for visitors to the office where visitors can access free Wi-Fi. The tech support department is situated on the first floor with four desktop computers and a wired network printer. The top floor houses the research and development (R&D) team who are constantly working on new, classified technology for the scooters and the technology behind them. The R&D team has three desktop workstations and a dedicated, private file server where they save all relevant information about their advances.

Some additional information regarding the network:

* Due to the size of the floors in the building, there is one dedicated switch to cater for devices on each floor.
* One router provides access the internet.
* A firewall is used.
* The ground floor and first floor devices operate on the same network.
* Due to the sensitivity of the intellectual property, the R&D team is on a separate network and has its own firewall.
* As data is constantly being served to the database and application servers, they are also on a different network.

Draw a network diagram in the area on the next page to represent the ScootAround headquarters network infrastructure. You must use appropriate Cisco icons for all devices. (17 marks)

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| Planning: anything written on this page will **not** be marked. |

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* 1. State **three** differences between a router and a switch. (3 marks)

One:

Two:

Three:

ScootAround uses a combination of UTP cabling, fibre optics, and wireless connectivity in their office.

* 1. Outline **one** advantage for the use of each media type and state **one** location that each would be useful from the scenario described. (6 marks)

**UTP**

Advantage:

Location:

**Fibre Optic**

Advantage:

Location:

**Wireless**

Advantage:

Location:

* 1. The R&D File Server is given the following IP address details: (2 marks)
* IP address – 172.16.100.1
* Subnet mask – 255.255.0.0

ScootAround’s network administrators have secured their system to only allow devices on the same network to be able to communicate with the File Server.

Provide **one** valid IP address (on the same network) and **one** invalid IP address (from a device on a different network).

**Valid**

IP address:

Subnet mask: 255.255.0.0

**Invalid**

IP address:

Subnet mask: 255.255.0.0

* 1. Explain the role of the firewall in the scenario. (3 marks)

1. **(23 marks)**

ScootAround knows that keeping their new designs and customer details safe is very important and have decided to implement encryption in several systems within their organisation.

* 1. Describe the purpose of encryption. (2 marks)

* 1. ScootAround has a confidential maintenance update for its new scooter model. To prevent the information from being intercepted, the R&D team decides to encrypt the message using a simple substitution cipher. The team decides on a Caesar cipher using a shift of 4.

Encrypt the following message using this cipher. (3 marks)

New Design Complete

* 1. Another type of cipher is the Vigenère cipher. Explain how this polyalphabetic cipher could be used to encrypt a message. (3 marks)

* 1. Identify and briefly outline **three** types of malware that could pose a threat to ScootAround's network and data security. (6 marks)

One:

Outline:

Two:

Outline:

Three:

Outline:

* 1. Describe what a Denial of Service (DoS) attack is and outline how it could affect ScootAround. (3 marks)

DoS Attack:

How it could affect ScootAround:

* 1. Outline the concept of IP spoofing. (2 marks)

* 1. In the context of ScootAround, describe how the business could implement measures to comply with the following Australian Privacy Principles (APPs). (4 marks)

Australian Privacy Principle 1: Open and transparent management of personal information.

Australian Privacy Principle 11: Security of personal information.

1. **(30 marks)**

ScootAround promote themselves as a low-cost alternative to their competitors. The scooter usage cost is calculated using a one-off ‘unlock fee’ (currently $1.50) and then $5 (hourly\_rate) per hour used by the rider.

ScootAround uses a rewards system to encourage frequent rentals. Riders can progress up through the levels of the reward system based on how many hours they have spent using the scooters. Riders benefit from discounts on future rides based on the level they have achieved.

|  |  |  |  |
| --- | --- | --- | --- |
| **Level Achieved** | **Time spent on the scooters** | **Ride Discount** | **Unlock fee discount** |
| Bronze | 0-30 hours | No discount | No discount |
| Silver | Over 30 – 50 hours | 25% discount | No discount |
| Gold | Over 50 hours | 25% discount | No unlock fee |

“Gold" members benefit from having the unlock fee waived completely. For both "Silver" and "Gold" members, the rental component (not including the unlock fee) is reduced by 25% as a bonus. The cost for a rental is calculated as follows:

rental\_cost = unlock\_fee (if applicable) + current\_ride\_time \* hourly\_rate.

* 1. Write a function (*CalcCost*) in pseudocode that calculates the cost (cost) for the current ride based on the time (current\_ride\_time), the reward level for the user (reward\_level) and the current unlock fee (unlock\_fee) and hourly rate (hourly\_rate) for the scooters. These are set as constants in the main module so they can be easily adjusted if the price structure of the scooters increases. (7 marks)

FUNCTION CalcCost ( )

END CalcCost

The number of hours for each ride a rider has taken is stored in an array (ride\_times).

* 1. Write a module in pseudocode that receives the array (ride\_times) and the time for the current ride (current\_ride\_time).

It should:

* Add the current ride time to the array
* Calculate the total accumulated ride times (adding up all the values in the ride\_times array)
* Determine the reward level of the rider
* If the rider has progressed up to a new level, output a message congratulating the rider
* Send the array (ride\_times) and the reward level (reward\_level) back to the calling module   
   (10 marks)

MODULE UpdateRideTimes ( )

END UpdateRideTimes

* 1. Your programming team has started to develop the main module for the program but needs your help to finish. The algorithm should prompt the user to input the time for the new ride in hours (current\_ride\_time) and then use the module and function from the previous parts of this question to update the ride times array, determine the rewards level and ride cost. It should output the cost to the user. It should also allow for multiple rides to be added to the array.

Complete the algorithm for the main module using pseudocode in the area below.   
 (8 marks)

MODULE Main

unlock\_fee = 1.50

hourly\_rate = 5

reward\_level = “Bronze”

ride\_times = []

END Main

* 1. Create a structure chart for the entire program in the area below. (5 marks)

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**End of Examination**

**Question number:**

**Question number:**

**Supplementary page**

**Question number:**

**Supplementary page**

**Question number:**