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

COMPUTER SCIENCE

ATAR course examination 2024

Marking key

Marking keys are an explicit statement about what the examining panel expect of candidates when they respond to particular examination items. They help ensure a consistent interpretation of the criteria that guide the awarding of marks.

Section One: Short answer **40% (108 Marks)**

Question 1 **(2 marks)**

Write the expected output for the following Python code:

```
def count_numbers():
    print("Let's count!")
    max_count = 5
    for number in range(max_count):
        print(num)
    print("Finished counting!")

count_numbers()
```

Description	Marks
Correct first & last print output	1
Correct loop output (0–4)	1
Total	**2**

Answers could include:

```
Let's count!
0
1
2
3
4
Finished counting!
```

Question 2 **(9 marks)**

(a) Using an example, explain a difference between a primary key and a foreign key in a relational database. (3 marks)

Description	Marks
Explains a difference between a primary key and a foreign key in a relational database, with an example	3
Describes a difference between a primary key and a foreign key in a relational database, with an example	2
States a fact about the difference between a primary key and a foreign key in a relational database, with an example	1
Total	**3**

Answers could include:

A primary key is a unique identifier for each record in a database table, ensuring that no two records have the same primary key value, and it cannot be null.

A foreign key is a field in one table that uniquely identifies a relationship to another table. It refers to the primary key or a unique key in the first table. For example, if there is another table called 'Enrolments,' which records the courses that students are enrolled in, the 'StudentID' column in this table would be a foreign key that references the 'StudentID' in the 'Students' table.

Accept other relevant answers.

(b) Describe **one** effect of not having primary keys in tables in a relational database. (2 marks)

Description	Marks
Describes an effect of not having a defined primary key in a table	2
States an effect of not having a defined primary key in a table	1
Total	**2**

Answers could include:

Without a primary key, a table in a database may have duplicate rows, making data not uniquely identifiable. This can lead to issues with data integrity and challenges in maintaining relationships between tables. Retrieving and updating specific records becomes problematic, and setting referential integrity constraints is impossible, potentially leading to loss of data.

Accept other relevant answers.

Question 2 (continued)

(c) Describe **two** factors that influence data integrity in a relational database. (4 marks)

Description	Marks
For each factor (2 x 2 marks)	
Describes a factor that influences data integrity	2
Identifies a factor that influences data integrity	1
Total	**4**
Answers could include: Data integrity in a relational database ensures the accuracy, consistency, and reliability of the data throughout its lifecycle: • referential integrity • domain integrity • entity integrity • outliers (cleaning).	
Accept other relevant answers.	

Question 3 **(6 marks)**

(a) List the most suitable data type for each column listed below: (2 Marks)

Description	Marks
ID as text	1
English as Float	1
Total	**2**
Accept other relevant answers.	

(b) Write an SQL query to calculate the average results for each student (identified by ID) across their four subjects. The output should group the results by ID and have two columns: ID and AverageResults. (4 marks)

Description	Marks
Correct syntax for SQL query SELECT	1
Correct average calculation	1
Correct syntax for SQL query FROM Results	1
Correct use of Group By	1
Total	**4**
Answers could include: SELECT ID, (Math + Physics + English + Science) / 4 AS AverageResults FROM Results GROUP BY ID;	
Accept other relevant answers.	

Question 4 **(2 marks)**

Describe a zero day vulnerability.

Description	Marks
Describes a zero day vulnerability	2
Makes a general statement about zero day vulnerability	1
Total	**2**

Answers could include:

A zero day vulnerability is a flaw in software that is unknown to the vendor until it's exploited, unlike other threats which are known and typically have patches available or defences against. Zero day threats are particularly dangerous because there are no defences ready at the time of discovery when it is exploited.

Accept other relevant answers.

Question 5 **(4 marks)**

Write a function named APPLY_DISCOUNT which takes an input membership_level as a string (e.g. “Bronze”) representing the customer’s membership status. The function should determine the discount percentage based on the membership level as follows:

- No membership (Null): No discount
- Bronze membership: 5% discount
- Silver membership: 10% discount
- Gold membership: 15% discount

The function should return the discount as a decimal value, using a selection statement based on the membership_level.

Description	Marks
Correct function declaration (FUNCTION keyword, name and parameter) with END FUNCTION keyword	1
Correct use of SELECT CASE or IF Statement with relevant END keyword	1
Correct assignment of discount values	1
Return the discount value	1
Total	**4**

Answers could include:

```
FUNCTION APPLY_DISCOUNT(membership_level: STRING)
   DECLARE discount AS REAL
   CASE OF membership_level
      CASE "Null"
         discount = 0.00
      CASE "Bronze"
         discount = 0.05
      CASE "Silver"
         discount = 0.10
      CASE "Gold"
         discount = 0.15
      DEFAULT
         discount = 0.00
   END CASE
   RETURN discount
END FUNCTION
```

Alternate answer:

```
FUNCTION APPLY_DISCOUNT(membership_level: STRING)
   DECLARE discount AS REAL
   IF membership_level == "Bronze" THEN
      discount = 0.05
   ELSE IF membership_level == "Silver" THEN
      discount = 0.10
   ELSE IF membership_level == "Gold" THEN
      discount = 0.15
   ELSE
      discount = 0.00
   END IF
   RETURN discount
END FUNCTION
```

Accept other relevant answers.

Question 6 **(5 marks)**

(a) Describe a scenario where an insertion sort would work faster than a selection sort. (2 marks)

Description	Marks
Describes a scenario where an insertion sort would work faster than a selection sort	2
Makes a statement about an insertion sort	1
Total	**2**

Answers could include:

Insertion sort inserts a number to the right position one at a time.
Selection sort scans all numbers and finds the right number for the given position.

Best case insertion sort is therefore O(n) for already sorted numbers, whereas best case for selection sort is still $O(n^2)$ because it still has to scan all numbers to check the number for its locations.

The example case would be 1, 2, 3, 4, 5; insertion sort will do 4 comparisons and finish, while selection sort will perform 4 + 3 + 2 + 1 = 10 comparisons.

Accept other relevant answers.

(b) Explain why a selection sort is generally slower than an insertion sort. (3 marks)

Description	Marks
Explains why a selection sort is generally slower than an insertion sort	3
Describes why a selection sort is generally slower than an insertion sort	2
Makes a statement about selection sort or insertion sort	1
Total	**3**

Answers could include:

Selection sort scans all numbers and find the right number for the given position regardless of the number order, it has a fixed number of operations to perform with respect to the total number of items to sort.

Insertion sort on the other hand can have less number of operations if the numbers are already in sorted order, so selection sort will at best case have the same number of operations with the insertion sort.

Accept other relevant answers.

Question 7 **(5 marks)**

(a) Encrypt the message “this is a secret message”. (1 mark)

Description	Marks
IGVP VP O PRHCRI ERPPOBR	1
Total	**1**

(b) Decrypt the message “FKIGVFB VP NCRR”. (1 mark)

Description	Marks
NOTHING IS FREE	1
Total	**1**

(c) Explain **one** weakness of a substitution cipher. (3 marks)

Description	Marks
Explains a weakness of a substitution cipher	3
Describes a weakness of a substitution cipher	2
Makes a general comment about a weakness of a substitution cipher	1
Total	**3**
Answers could include: This cipher is weak against frequency analysis attack. This is because it only uses transposition to implement the cipher.	
Accept other relevant answers.	

Question 8 **(4 marks)**

(a) Describe how a system might authenticate data being sent across a network. (2 marks)

Description	Marks
Describes how a system might authenticate data sent across a network	2
Makes general comment about how a system might authenticate data sent across a network	1
Total	**2**
Answers could include: A public key (asymmetric encryption) can be used to authenticate data sent over the network. This is done by encrypting the data using your own private key, where the receiver can decrypt the data using the sender's public key.	
Accept other relevant answers.	

(b) Describe a potential external network security threat of the method described in part (a). (2 marks)

Description	Marks
Describes a potential external network security threat	2
Makes a general comment about a potential external network security threat	1
Total	**2**
Answers could include: This method may be compromised if a man-in-the-middle attack is performed in the network, unable to validate the identity of the sender and receiver.	
Accept other relevant answers.	

Question 9 **(2 marks)**

Describe **one** way developers ensure that their software addresses inclusivity issues.

Description	Marks
Describes a way that a developer ensures that their software addresses inclusivity issues	2
Identifies a way that a developer could ensure that their software addresses inclusivity issues	1
Total	**2**

Answers could include:

Incorporate language support features in their software, which allows users to select their preferred language. This can be achieved through multi-language user interfaces and providing translation capabilities. By doing so, developers address language barriers and make the software accessible to a broader audience, demonstrating a commitment to cultural inclusivity.

Gender inclusivity – use gender-neutral language in examples
Cultural/Racial inclusivity – use a variety of ethnicities in photos
Ability inclusivity – represent awareness of disability in some examples
Sexual preference inclusivity – use language that is supportive of LGBTQI+ people

Accept other relevant answers.

Question 10 **(3 marks)**

Explain why a software developer should be responsible for addressing ergonomic issues in software design.

Description	Marks
Explains why a software developer should be responsible for addressing ergonomic issues in software design	3
Describes why a software developer should be responsible for addressing ergonomic issues in software design	2
Makes a general comment on the responsibility to address ergonomic issues in software design	1
Total	**3**

Answers could include:

Responsibilities of the software developer is to ensure that the ergonomics focuses on making software user-friendly, reduces repetitive motions or eyestrain and enables movements of users to promote comfort and efficiency.
Software can be designed with adjustable text sizes and screen brightness settings to prevent eye strain, offering users a way to customise their visual experience for better comfort during prolonged use.

Accept other relevant answers.

Question 11 **(6 marks)**

(a) Outline **three** advantages of this approach in terms of mitigating data breach attacks. (3 marks)

Description	Marks
For each advantage (3 x 1 mark)	
Outlines an advantage	1
Total	**3**
Answers could include: • in case of data breach, patient data is safe from the attack as they are not on the hospital system • patient information is only accessed by doctors and other approved personnel and physically impossible to access data otherwise • it is more secure against insider attacks (e.g., malicious hospital workers) than keeping the data in hospital system (i.e. limited time to access data) • even if the key is leaked, data is inaccessible unless the USB is compromised.	
Accept other relevant answers.	

(b) Outline **three** disadvantages of this approach, in terms of mitigating data breach attacks. (3 marks)

Description	Marks
For each disadvantage (3 x 1 mark)	
Outlines a disadvantage	1
Total	**3**
Answers could include: • doctors require patient physically visiting the hospital to evaluate the patient results (usability) • patient may lose the USB and has no back up (usability) • patients may not follow security regulations/guideline of the hospital (security) • this approach lacks layered security, where a USB could be stolen, which can be used to perform cryptanalysis to steal the cipher credentials (security) • malicious doctor may tamper data, which may be used wrongly by other doctors. (ethics) • a patient's USB could be stolen and used by a malicious user (e.g. to get subscriptions) (ethics).	
Accept other relevant answers.	

Question 12 **(6 marks)**

Write the above algorithm in Python programming language and name the function 'step_counter'.

Description	Marks
Correct function structure (name, parameters)	1
Correct looping condition	1
Correct odd and even checks	1
Correct computation for each odd and even	1
Correct step calculation	1
Correct return	1
Total	**6**

Answers could include:

```
def step_counter(num):
    steps = 0
    while num != 1:
        if num % 2 == 0:
            num //= 2
        else:
            num = num * 3 + 1
        steps += 1
    return steps
```

Accept other relevant answers.

Question 13 **(11 marks)**

(a) Define a class named 'Animal' that has attributes 'name', 'age' and 'habitat.' (3 marks)

Description	Marks
Correct class definition for Animal	1
Proper constructor (__init__) definition with parameters	1
Correct initialisation of all attributes using self.x	1
Total	**3**

Answers could include:

```
class Animal:
    def __init__(self, name, age, habitat):
        self.name = name
        self.age = age
        self.habitat = habitat
```

Accept other relevant answers.

(b) Define a class named 'Bird' that inherits from the 'Animal' class and adds one new attribute called 'wing_span.' (3 marks)

Description	Marks
Correct subclass definition for Bird that inherits from Animal	1
Correct use of super() to call the superclass constructor or use of BaseClass	1
Correctly sets the wing_span attribute	1
Total	**3**

Answers could include:

```
class Bird(Animal):
    def __init__(self, name, age, habitat, wing_span):
        super().__init__(name, age, habitat)
        self.wing_span = wing_span
```

Accept other relevant answers.

(c) Write a new method, 'display_details', that will print each of the **four** attributes to display their values. (3 marks)

Description	Marks
Definition of display_details method has self as an input parameter	1
display_details method refers to all attributes as self.x	1
display_details method outputs all attributes including wing_span	1
Total	**3**

Answers could include:

```
def display_details(self):
    print(f"Name: {self.name}")
    print(f"Age: {self.age}")
    print(f"Habitat: {self.habitat}")
    print(f"Wing Span: {self.wing_span} metres.")
```

Accept other relevant answers.

(d) Instantiate a 'Bird' object with all the attributes listed above and display its details. (2 marks)

Description	Marks
Creation of Bird instance with correct attributes and output	1
display_details method checks for correct handling of string formatting	1
Total	**2**

Answers could include:

```
# Instantiation of Bird object
parrot = Bird("Parrot", 5, "Tropical Rainforest", 0.25)

# Display the details of the bird
parrot.display_details()
```

Accept other relevant answers.

Note: comments not required in student answer.

Question 14 **(3 marks)**

State which **three** of the above Boolean expressions are equivalent.

Description	Marks
States a correct expression	1
Total	**3**

Answers could include:

1, 3 and 5 are equivalent.

Question 15 **(6 marks)**

Identify **two** of the four properties of the acronym ACID and describe a role of each in database transactions.

Description	Marks
For each ACID property (2 x 1 mark)	
Identifies an ACID property	1
Subtotal	**2**
For each ACID property (2 x 2 marks)	
Describes the role of the ACID property in relation to database transactions	2
Makes a general comment about the role of the ACID property in relation to database transactions	1
Subtotal	**4**
Total	**6**

Answers could include:

Atomicity
Atomicity ensures that database transactions are treated as indivisible units, which means that all operations within a transaction must be completed successfully for the transaction to be committed. If any operation fails, the entire transaction is rolled back. This is crucial for maintaining data integrity because it prevents partial data updates that could leave the database in an inconsistent state.

Consistency
Consistency ensures that a data entry is valid, maintaining the predefined rules, such as unique keys, foreign keys, and other constraints. This property is vital for ensuring that all data follows the same rules and constraints, which guarantees the reliability of the database operations.

Isolation
Isolation ensures that transactions are securely separated from each other until they are complete. This prevents concurrent transactions from interfering with each other.

Durability
Durability guarantees that once a transaction has been committed, it will remain so, even in the event of a system crash or power failure.

Accept other relevant answers.

Question 16 **(6 marks)**

Describe each of the anomalies listed below and provide an example of each from the tables above. (Assume the database does not enforce referential integrity.)

Description	Marks
For each anomaly (2 x 2 marks)	
Describes an anomaly	2
Makes a general comment about an anomaly	1
Subtotal	**4**
For each anomaly (2 x 1 mark)	
Provides an example of the anomaly	1
Subtotal	**2**
Total	**6**

Answers could include:

Insert anomaly
A new student, Alice, needs to be added to the Students table, but she has not yet enrolled in any courses. Due to the database design requiring a CourseID (as it is a foreign key), Alice's information cannot be inserted into the Students table without assigning a course to her, which she has not chosen yet.

Delete anomaly
The records of students who were enrolled in "Science" (such as Liam Brown, StudentID 3) will still exist in the Students table with a CourseID of 103. However, since the corresponding record in the Courses table has been deleted, these students' records will contain an invalid or orphaned CourseID. Without a related record in the Courses table, queries and reports that join the Students table with the Courses table will fail to find a match for these students. This can lead to incomplete or incorrect results in data retrieval, reporting, and analysis.

Accept other relevant answers.

Question 17 **(6 marks)**

List **two** good programming practices that could be chosen and describe why each was chosen.

Description	Marks
For each good programming practice (2 x 1 mark)	
Lists a good programming practice	1
Subtotal	**2**
For each good programming practice (2 x 2 marks)	
Describes why it has been chosen	2
Makes a general comment about programming practice	1
Subtotal	**4**
Total	**6**

Answers could include:

- validate input before processing
  - can prevent errors arising from wrong inputs.
- a clear and uncluttered mainline
  - maintainability is improved and code reuse/sharing.
- one logical task per subroutine
  - reduces the complexity of the code and improve reusability.
- use of stubs
  - can obtain consistent results to make test writing easier.
- appropriate use of control structures and data structures
  - reduces complexity and improves the efficiency of the code.
- writing for subsequent maintenance
  - improves maintainability.
- version control
  - the ability to review and rollback to previous version if issues are faced. A point of reference.
- regular backup
  - same as version control.
- recognition of relevant social and ethical issues
  - improves societal and ethical aspects of the software. e.g., filtering racial slurs or languages.
- exception handling
  - provides improved maintainability and potential issues are captured/logged for easier troubleshooting.
- functions are able to return a single data structure or value
  - reduces the complexity of the code.

Accept other relevant answers.

Question 18 **(5 marks)**

Write a Python function named count_absences that takes a two-dimensional array attendance_record as an argument. This function should count and return the total number of absences (False values) that the student has accumulated over the week.

The function should count the number of **False** values in the array and output the total count.

Description	Marks
Correct call of the function with Array as Parameter	1
Correct function definition with parameter	1
Correct iteration through two-dimensional array	1
Accurate counting of False values in the array	1
Correct output of total absences	1
Total	**5**

Answers could include:

```
def count_absences(attendance_record):
    absence_count = 0
    for day in attendance_record:
        absence_count += day.count(False)
    return absence_count

# Array Not required in student answer
attendance_record = [
    [True, False, True, True, False],  # Monday
    [True, True, True, True, True],    # Tuesday
    [False, True, False, True, True],  # Wednesday
    [True, True, True, True, False],   # Thursday
    [True, False, True, True, True]    # Friday
]

# function call and output required in student answer
absence_count = count_absences(attendance_record)
print("Total Absences This Week:", absence_count)
```

Accept other relevant answers.

Question 19 **(3 marks)**

Explain a role of a domain name system (DNS) in relation to accessing web pages on the internet.

Description	Marks
Explains a (DNS) in relation to accessing web pages on the internet	3
Describes a (DNS) in relation to accessing web pages on the internet	2
Makes a general comment about a (DNS)	1
Total	**3**

Answers could include:

- DNS matches domain names with corresponding IP addresses
- crucial for users to access websites with easy-to-remember names, instead of numerical IP addresses
- structured in a hierarchical system to efficiently resolve names
- includes security protocols to prevent spoofing and ensure users reach the intended site

Accept other relevant answers.

Question 20 **(4 marks)**

Identify a role of a router and a switch. Indicate which layer of the Department of Defence (DoD) transmission control protocol/internet protocol (TCP/IP) model they typically operate on.

Description	Marks
Role (2 x 1 mark)	
Identifies a role of a router and switch	1
Subtotal	**2**
Layer (2 x 1 mark)	
Indicates the layer	1
Subtotal	**2**
Total	**4**
Answers could include: Router: Role – IP routing, directs traffic between networks Layer – Internet Switch: Role – MAC addressing, manages traffic within network Layer – Network	
Accept other relevant answers.	

Question 21 **(10 marks)**

(a) Write a Python function called find_book_title that takes two parameters: library, a dictionary of books, and isbn_search, the ISBN provided by the user. (5 marks)

Description	Marks
Function correctly accepts a dictionary and an ISBN as parameters	1
Function successfully searches for the ISBN in the dictionary	1
Function accurately retrieves and returns the book title if the ISBN is found	1
Function provides an appropriate response if the ISBN is not found	1
Correct return	1
Total	**5**

Answers could include:

```
def find_book_title(library, isbn_search):
    if isbn_search in library:
        return library[isbn_search]['title']
    else:
        return "ISBN not found in the library."
```

Accept other relevant answers.

(b) Write a Python function named validate_isbn that takes one parameter: isbn_search, a string containing the ISBN entered by the user. (5 marks)

Description	Marks
Function correctly accepts an ISBN as a parameter	1
Function checks if the ISBN contains only numeric characters	1
Function verifies the length of the ISBN is 10 or 13 characters	1
Function returns True for valid ISBNs	1
Function returns False for invalid ISBNs	1
Total	**5**

Answers could include:

```
def validate_isbn(isbn_search):
    if isbn_search.isdigit() and (len(isbn_search) == 10 or len(isbn_search) == 13):
        return True
    else:
        return False
```

Accept other relevant answers.

Section Two: Extended answer **60% (87 Marks)**

Question 22 **(25 marks)**

Refer to the information on Page 2 and 3 of the Source booklet to answer part (a).

The Equipment booking system has been moved online and an example of the duplicate tutor data set is provided to you.

(a) Using the data from the WA Children's Art Institute's tutor data set, answer parts (i) and (ii).

(i) Explain the purpose of normalising the data to 1st Normal Form (1NF). (3 marks)

Description	Marks
Explains the purpose of normalising the data to 1st Normal Form (1NF)	3
Describes the purpose of normalising the data to 1st Normal Form (1NF)	2
Makes a general comment about normalising the data to 1st Normal Form (1NF)	1
Total	**3**
Answers could include: So that each record must have a primary key, the data in each field (column) must be atomic (names are split into first and last name), and there were no repeating groups to be eliminated.	
Accept other relevant answers.	

(ii) Explain the purpose of normalising the data from 1st Normal Form (1NF) to 2nd Normal Form (2NF). (3 marks)

Description	Marks
Explains the purpose of normalising the data from 1st Normal Form (1NF) to 2nd Normal Form (2NF)	3
Describes the purpose of normalising the data from 1st Normal Form (1NF) to 2nd Normal Form (2NF)	2
Makes a general comment about normalising the data from 1st Normal Form (1NF) to 2nd Normal Form (2NF)	1
Total	**3**
Answers could include: To remove partial dependencies where the non-key fields are functionally dependent on only part of the primary key. Each table follows the rules of 1NF. In the Invoice table, each non-key attribute (i.e., InvoiceDate, TutorID, ProductID, Quantity) is fully functionally dependent on the primary key (InvoiceID). There are no partial dependencies since there is no composite primary key.	
Accept other relevant answers.	

(iii) Normalise the data to 3rd Normal Form (3NF). (5 marks)

Description	Marks
Third Normal Form (3NF)	
Creation of four tables	1
Primary keys identified in each table	1
Foreign Keys identified and labelled	1
All non-key attributes listed	1
Quantity moved to Invoice_Product	1
Total	**5**
Answers could include: 3NF Tutor (<u>TutorID</u>, FirstName, LastName, Email, PhoneNumber, City) Invoice (<u>InvoiceID</u>, InvoiceDate, TutorID (FK)) Invoice_Product (<u>InvProductID</u>, InvoiceID (FK), ProductID (FK), Quantity) Product (<u>ProductID</u>, ProductName, UnitPrice)	
Accept other relevant answers.	

(b) Write an SQL statement to add the details of the new room to the RoomsTable. It will be the third room in Building 2 and the room is named 'Monet'. (4 marks)

Description	Marks
INSERT command	1
Use of RoomsTable for insertion	1
VALUES	1
Correct values RoomID, RoomName, Building	1
Total	**4**
Answers could include: INSERT INTO RoomsTable (RoomID, RoomName, Building) VALUES ('RM-005', 'Monet', 'Building 2');	
Accept other relevant answers.	

Question 22 (continued)

(c) Write an SQL query to display a count of bookings for each room, using an alias NumberOfBookings. (4 marks)

Description	Marks
SELECT statement including FROM and correct table name	1
COUNT Function	1
GROUP BY RoomID	1
alias AS NumberOfBookings	1
Total	**4**

Answers could include:

```
SELECT RoomID, COUNT(*) AS NumberOfBookings
FROM RoomTableBookings
GROUP BY RoomID;
```

Accept other relevant answers.

(d) Write an SQL query to show the average duration for all bookings. Ensure the output displays the room name and the average duration in minutes. (6 marks)

Description	Marks
SELECT statement	1
RoomName in output (SELECT)	1
Uses aggregate function AVG	1
FROM RoomTableBookings	1
JOIN RoomsTable stating correct columns to join on	1
GROUP BY names correct columns	1
Total	**6**

Answers could include:

```
SELECT RoomsTable.RoomName, AVG(RoomTableBookings.Duration)
FROM RoomTableBookings
JOIN RoomsTable ON RoomTableBookings.RoomID = RoomsTable.RoomID
GROUP BY RoomsTable.RoomName;
```

Accept other relevant answers.

Question 23 **(19 marks)**

(a) Identify the most suitable IP version to use in the scenario. Explain your answer. (4 marks)

Description	Marks
Identification of an IP version	1
Subtotal	**1**
Explains why this version is suitable for a large number of devices	3
Describes why this version is suitable for a large number of devices	2
Makes a general comment on why this version is suitable for a large number of devices	1
Subtotal	**3**
Total	**4**
Answers could include: For the institute's Wi-Fi network, IPv6 is the preferable choice due to its advanced features that improve network functionality and security. IPv6 includes built-in security measures like mandatory support for IPsec, better suited for secure communications necessary in an educational environment. It also supports improved multicast and better routing capabilities over IPv4, making network management more efficient.	
Accept other relevant answers.	

(b) Identify and explain which protocol, transmission control protocol (TCP), or user datagram protocol (UDP) would be more suitable for the tutors to use. (4 marks)

Description	Marks
Identification UDP for most suitable protocol	1
Subtotal	**1**
Explains why this is more suitable for streaming live video	3
Describes why this is more suitable for streaming live video	2
Makes a general comment on why this is more suitable for streaming live video	1
Subtotal	**3**
Total	**4**
Answers could include: For the network's live video feeds, UDP is the better choice over TCP. UDP's speed makes it ideal for live video because it reduces delays, allowing for smoother streaming despite the occasional loss of picture quality.	
Accept other relevant answers.	

Question 23 (continued)

(c) Explain why the WA Children's Art Institute could consider the use of subnetting in their network. (4 marks)

Description	Marks
Explains the use of subnetting in WA Children's Art Institute's network	4
Describes subnetting in WA Children's Art Institute's network	3
Outlines subnetting	2
Make a general comment about subnetting	1
Total	**4**

Answers could include:

- subnetting divides a network into smaller, more manageable sections, using a subnet mask. This allows for the efficient allocation of IP addresses by designating a range of addresses to each subnet
- separate subnets could be created for the Admin and Student/tutor networks. This not only organises network traffic more effectively but also enhances security by keeping the two network types distinct, ensuring that users cannot access the main network resources
- subnetting each building allows for control over traffic flow, making it simpler to manage the network and enforce security policies.

Accept other relevant answers.

(d) When subnetting, routers can be included into a network. Describe **one** advantage and **one** disadvantage of including routers within a subnetted LAN. (4 marks)

Description	Marks
Describes an advantage	2
Outlines an advantage	1
Subtotal	**2**
Describes a disadvantage	2
Outlines a disadvantage	1
Subtotal	**2**
Total	**4**

Answers could include:

Advantage:
Using routers within a subnetted LAN can improve network performance by limiting broadcast traffic to each subnet. This isolation enhances security and management by segmenting different departments or functions within the network.

Disadvantage:
Implementing routers within a subnetted LAN can increase complexity and cost. Each subnet requires a router or routing interface, which can lead to higher expenses and more complicated network management.

Accept other relevant answers.

(e) Describe a potential network security threat with having a wireless network. State **one** mitigation strategy to address the identified issue. (3 marks)

Description	Marks
Potential issues	
Describes a potential network security threat with having a wireless network	2
Makes a general comment about a potential network security threat	1
Subtotal	**2**
Mitigation	
States a mitigation strategy to address the potential security issue	1
Subtotal	**1**
Total	**3**
Answers could include: Other unwanted devices/people/entities could receive the signal. If they are malicious, they can eavesdrop on the communication. To mitigate this issue, encryption can be used.	
Accept other relevant answers.	

Question 24 **(14 marks)**

(a) Outline **one** external network threat and describe **one** strategy to mitigate this threat. (3 marks)

Description	Marks
Network threat	
Outlines an external network threat	1
Subtotal	**1**
Mitigation strategy	
Describes a strategy to mitigate the external network threat	2
Identifies a strategy to mitigate the external network threat	1
Subtotal	**2**
Total	**3**
Answers could include: Man-in-the-middle attacks: Unauthorised interception of communication between tutor's personal device and the server storing student data. The hacker(attacker) can eavesdrop on and potentially alter communication, leading to unauthorised access to data. Mitigation: can implement SSL/TSL encryption to ensure that data transmitted between tutor's laptops and server is encrypted, making it difficult for an attacker to eavesdrop or gain access. Provide user training on use of data handling and security of device. Denial of Service Attacks (DOS): These aim to overwhelm the Institute's network resources, making them unavailable to tutors and potentially disrupting the educational process if tutors are unable to access data e.g. for marking etc. Mitigation: Implement network security measures such as firewalls and intrusion detection systems to identify and mitigate traffic anomalies.	
Accept other relevant answers.	

(b) Describe the required actions the WA Children's Art Institute should take in accordance with Australian Privacy Principle (APP 11) to ensure that this does not occur in the future. (2 marks)

Description	Marks
Describes the WA Children's Art Institute's required actions in accordance with APP 11 to ensure that this doesn't occur in the future	2
Makes a general comment about the WA Children's Art Institute's responsibility and required actions	1
Total	**2**
Answers could include: The WA Children's Art Institute must quickly assess the data breach risk according to the Privacy Act's APP11 and, if there's a serious harm or risk, notify the student and the Information Commissioner as required by the 2017 Notifiable Data Breaches Act. They should also review and improve data security practices to prevent such breaches.	
Accept other relevant answers.	

(c) Explain why symmetric encryption is generally preferred to asymmetric encryption for sending large amount of data. (3 marks)

Description	Marks
Explains why symmetric encryption is generally preferred to asymmetric encryption	3
Describes why symmetric encryption is generally preferred to asymmetric encryption	2
Makes a general comment about using symmetric encryption	1
Total	**3**

Answer could include:

Symmetric encryption is preferred for sending large amounts of data as it is generally faster than asymmetric encryption.

Symmetric encryption uses algorithms that use substitution, permutation and bitwise operations which are generally faster than the complex mathematical algorithms used in asymmetric encryption such as modular exponentiation.

Symmetric encryption also uses shorter keys compared to asymmetric encryption. This requires less computational power for encryption and decryption and therefore takes less time.

Accept other relevant answers.

(d) Explain how current best practice in common methods of encryption could benefit the WA Children's Art Institute. (3 marks)

Description	Marks
Explains how current best practice in common methods of encryption could benefit the WA Children's Art Institute	3
Describes how current best practice in common methods of encryption could benefit the WA Children's Art Institute	2
Makes a general comment about a current best practice in common methods of encryption	1
Total	**3**

Answers could include:

Current best practices for common methods of encryption involve using strong algorithms like AES (Advanced Encryption Standard) with an appropriate key length, typically 256 bits. For asymmetric encryption, RSA with a key size of at least 2048 bits is recommended. Secure protocols such as TLS (Transport Layer Security) should be implemented for data transmission over networks.

The WA Children's Art Institute, employing these encryption methods would protect sensitive data such as student records and tutor information from being accessed by unauthorised individuals. It ensures that even if the data is intercepted, it cannot be deciphered without the encryption key when the tutors are accessing data from home.

Accept other relevant answers.

Question 24 (continued)

(e) Explain the role of blue team vs red team in penetration testing. (3 marks)

Description	Marks
Explains the role of blue team vs red team in penetration testing	3
Describes the role of blue team vs red team in penetration testing	2
Provides a general statement about the role of penetration testing	1
Total	**3**

Answers could include:

The blue team represents the defenders or the internal security team of the organisation. Their primary role is to defend the network against cyberattacks and detect any suspicious activities.

The red team represents the attackers or the external security experts hired by the organisation. Their objective is to simulate real-world cyberattacks and exploit vulnerabilities within the network infrastructure. The red team conducts thorough assessments using various techniques such as social engineering, phishing, and network exploitation to identify weaknesses.

Accept other relevant answers.

Question 25 **(13 marks)**

(a) This algorithm operates on a map that is n by n in size. Explain how the Big O notation could be used to describe the complexity of this algorithm. (3 marks)

Description	Marks
Explain how the Big O notation could be used to describe the complexity of the algorithm	3
Describes how the Big O notation could be used to describe the complexity of the algorithm	2
Defines Big O notation	1
Total	**3**

Answers could include:

Big O notation is used to describe the complexity of an algorithm by showing how the runtime or space requirements grow with the input size. For the given algorithm on an n x n map, it performs a horizontal and vertical sweep. This means it checks each block in the map, resulting in an n x n or $O(n^2)$ complexity. The time it takes to find the treasure increases quadratically with the size of the map.

Accept other relevant answers.

Question 25 (continued)

(b) Write a function in pseudocode named find_treasure(start, treasure) that will determine the path to the treasure. The function takes **two** parameters: start and treasure. Both are lists containing **two** values representing the x and y coordinates on the grid map. Your function should return a string indicating the sequence of moves to find the treasure using the directions provided by the crystal ball. (10 marks)

Description	Marks
Correct structure and function name	1–2
Correct loop and condition(s)	1–2
Correct logic	1
Correct check conditions (IF)	1–4
Correct answer return	1
Total	**10**

Answers could include:

```
FUNCTION find_treasure(start, treasure):
    DECLARE ans AS STRING
    DECLARE tx, ty AS INTEGER
    DECLARE sx, sy AS INTEGER
    DECLARE found AS BOOLEAN
    SET ans TO ""
    SET tx TO treasure[0]
    SET ty TO treasure[1]
    SET sx TO start[0]
    SET sy TO start[1]
    SET found TO FALSE

    WHILE NOT found:
        IF sx < tx:
            ans = ans + "right"
            sx = sx + 1
        ELSE IF sx > tx:
            ans = ans + "left"
            sx = sx - 1
        ELSE IF sy < ty:
            ans = ans + "forward"
            sy = sy + 1
        ELSE IF sy > ty:
            ans = ans + "back"
            sy = sy - 1
        ELSE:
            ans = ans + "here"
            found = TRUE
        END IF
        ans = ans + " "
    END WHILE

    RETURN TRIM(ans)
END FUNCTION
```

Accept other relevant answers.

Question 26 **(16 marks)**

(a) Write the function for strategy_max in Python programming language. (12 marks)

def strategy_max(trees, move_ladder, time_limit):

Description	Marks
Keep track of the current time using a variable (e.g., timer)	1
List correctly sorted	1
Keep track of the total apples picked (e.g., total_apples)	1
Use the loop to capture repetitive actions	1
Use correct conditions to terminate the loop	1–2
Compute the time needed to pick apples	1–2
Compute the time needed to move the ladder	1
Select trees for apple picking	1–2
Return the total number of apples	1
Total	**12**

Answers could include:

```
def strategy_max(trees, move_ladder, time_limit):
    """strategy a to pick apples in the competition"""
    #sort the trees in descending order
    trees.sort(reverse=True)
    timer = move_ladder = 5
    total_apples = 0
    while timer < time_limit and len(trees) > 0:
        #pick the tree with the most apples
        apples = trees[0]
        #pick all apples
        total_apples += apples
        timer += apples/10
        #move to the next tree with the most apples
        timer += move_ladder
        #remove the tree from the list
        trees.pop(0)
    #returns the total number of apples picked
    return total_apples
```

Accept other relevant answers.

Question 26 (continued)

(b) Calculate the total number of apples the competitor would be able to pick in the competition. Explain why the “strategy_min” results in the total number of apples collected. (4 marks)

Note: that you do not need to write code for “strategy_min” to solve this question.

Description	Marks
Calculation of total number of apples	
Calculates the total number of apples as 65	1
Subtotal	**1**
Explanation	
Explains why the strategy_min results in the total number of apples	3
Describes why the strategy_min results in the total number of apples	2
States why the strategy_min results in the total number of apples	1
Total	**4**

Answers could include:

Using the “strategy_min”, the competitor will be able to pick 65 apples with the example given:

1. Move the ladder to the tree with 15 apples -> 5 minutes has passed.
2. Pick 15 apples, taking 1.5 minutes -> 6.5 minutes has passed.
3. Move the ladder to the tree with 20 apples -> 11.5 minutes has passed.
4. Pick 20 apples, taking 2 minutes -> 13.5 minutes has passed.
5. Move the ladder to the tree with 30 apples -> 18.5 minutes has passed.
6. Pick 30 apples, taking 3 minutes -> 21.5 minutes has passed.
7. Move the ladder to the tree with 40 apples -> 26.5 minutes has passed, so stop.
8. In total, picked 15 + 20 + 30 = 65 apples.

This outcome is because the competitor's "strategy_min" selects trees with the least number of apples first, which consumes more time for fewer apples, resulting in a lower total compared to "strategy_max". The answer should include that you are moving more frequently, wasting time by moving more than the strategy max.

Accept other relevant answers.

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Question 16 Paragraph 4 from: Marchis, A. (n.d.). *Interview Questions for Business Analysts and Systems Analysts: What is ACID in Database Design?*. Retrieved July, 2024, from https://www.modernanalyst.com/Careers/InterviewQuestions/tabid/128/ID/6526/What-is-ACID-in-Database-Design.aspx

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