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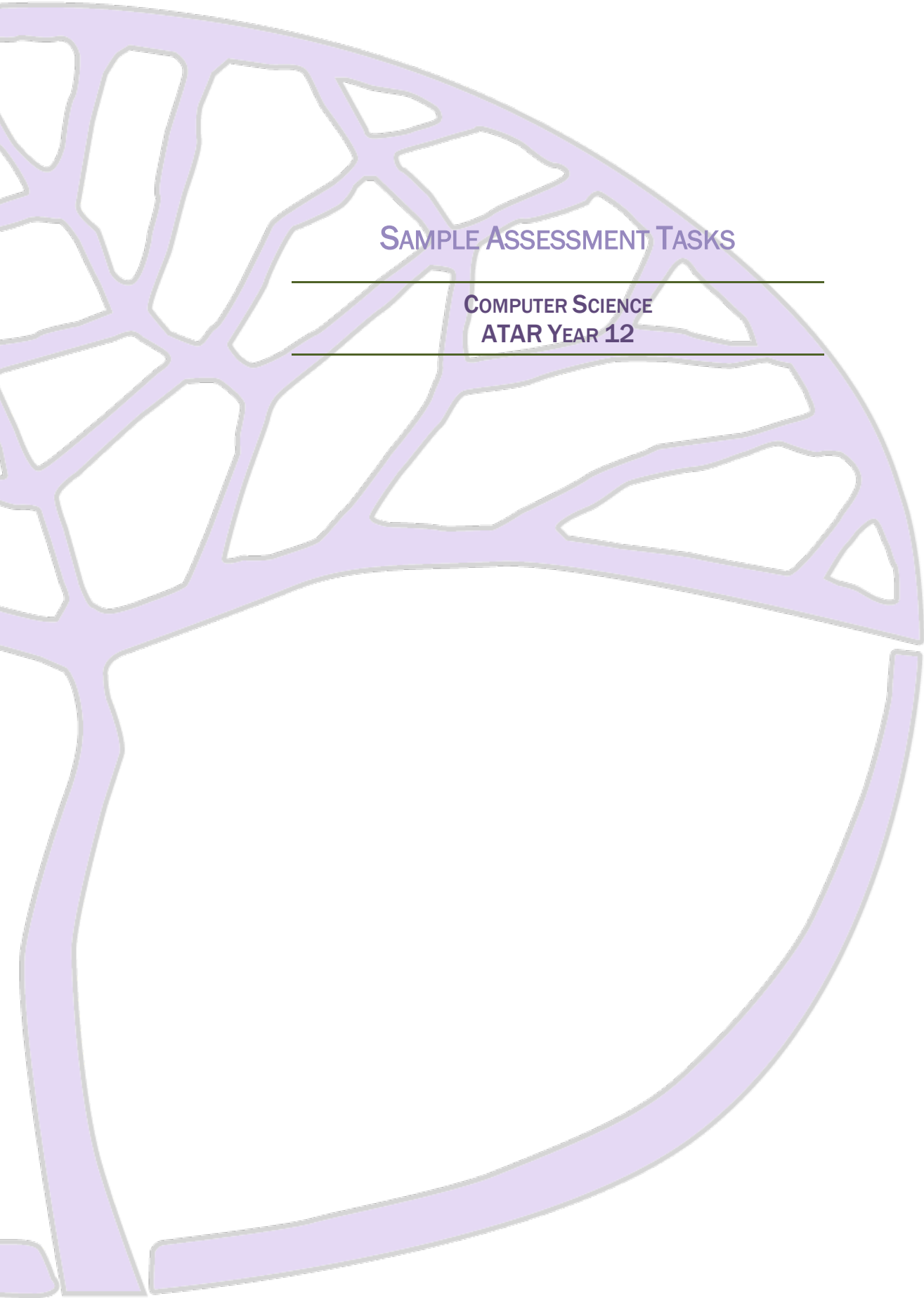**School Curriculum and Standards Authority**

SAMPLE ASSESSMENT TASKS

COMPUTER SCIENCE
ATAR YEAR 12

**Acknowledgement of Country**

Kaya. The School Curriculum and Standards Authority (the Authority) acknowledges that our offices are on Whadjuk Noongar boodjar and that we deliver our services on the country of many traditional custodians and language groups throughout Western Australia. The Authority acknowledges the traditional custodians throughout Western Australia and their continuing connection to land, waters and community. We offer our respect to Elders past and present.

Sample assessment task

Year 12 ATAR Computer Science

Task 2 - Unit 3

**Assessment type:**      Practical test

**Conditions:**      A 50-minute single lesson to complete the task

**Task weighting:**      5% of the school mark for this pair of units

_____

**Question 1** **(5 marks)**

The UV index describes daily risk relative to the intensity of the sun's UV radiation. If it's less than three, it's safe. If it's less than eight, protection is required. If it's eight and above, you shouldn't be out in the sun.

The program below requests the current UV rating for any city from an Application Programming Interface (API) and provides advice for users.

In the code provided, there is a syntax and a logic error. Correct those errors.

APIs are not always available due to server and network outages. Add an exception to this code to let the user know to try again later.

```
import requests

def main():
  location = input("Enter a city to check your UV: ")
  url = "https://wttr.in/{location}?format=%u\n"

  response = requests.get(url)
  uv = int(response.text)

  if uv <= 2
    print("You can safely enjoy being outside!")
  elif uv >= 7:
    print("Seek shade! Slip on a shirt, slop on sunscreen and slap
    on a hat!")
  else:
    print("Avoid being outside! Make sure you seek shade! Shirt,
    sunscreen, and hat are a must!")

main()
```

**Question 2** **(15 marks)**

A primary school teacher wants a program that provides students with 10 random multiplication questions. You must write this modular program.

When the program starts, it immediately shows the first question to the student. For example:

   What is 9 x 5?

The program will let the student know if they got the question right or wrong. For example:

   What is 9 x 5? 40

   That is incorrect

   What is 4 x 4? 16

   That is correct

Once the 10 questions have been asked, it should show how many questions the student got wrong and what they were, so the student can show the teacher. For example:

   There were 2 incorrect answers

   What is 9 x 5?

   What is 2 x 4?

Use a list to store the questions the user gets wrong.

You will need to import the random library:

```
import random
```

To generate random numbers use:

```
# returns a random number from 1 to 10
random.randint(1,10)
```

**Question 3** **(13 marks)**

You are provided with a youtube.csv file containing the top 10 YouTubers and the number of subscribers they have.

Read the file into a dictionary.

Output the key-value pairs.

MrBeast subscriber numbers are not correct! Update the dictionary adding 145000000 subscribers to MrBeast.

```
TSeries, 240000000

Cocomelon, 157000000

Sony India, 154000000

MrBeast, 0

PewDiePie, 111000000

Kids Diana Show, 110000000

Like Nastya, 105000000

Vlad and Niki, 96200000

WWE, 94400000

Zee Music, 94200000
```

**Question 4** **(17 marks)**

Create a Class called Student.

The Student class must have the following attributes: name, course name and an array for marks.

Create an instance of the Student class using the following details, name it student1:

```
"Mary", "Computer Science", [80, 90, 70, 85, 92, 88]
```

Create a method in the Student class to return the average mark for a student.

In main() use the student1 object to create the following output:

```
Mary's average mark in Computer Science is: 84%
```

Create a method that returns a student's highest mark. Call your method to output the following:

```
Mary's highest mark: 92
```

Add a method to the Student class to allow additional marks to be added to the marks array. Before adding the mark to the array, validate the mark value. Marks must be 0 to 100.

Create code in main() to have the end user enter 50 as a mark for Mary.

In main() output Mary's details again.

```
Mary's average mark in Computer Science is: 79%
```

Marking key for sample assessment Task 6 - Practical Test

**Question 1**

| Description | Marks |
|---|---|
| Correctly formats the try and except | 1 |
| Places the try and except in a logical place | 1–2 |
| Corrects the syntax error adding : after if uv <= 2 | 1 |
| Corrects the logic error adding = to uv >= 3 | 1 |
| **Total** | **/5** |

Example answer

```
import requests

def main():
  location = input("Enter a city to check your UV: ")
  url = "https://wttr.in/{location}?format=%u\n"
  try:
    response = requests.get(url)
    uv = int(response.text)
    print(response.text)
    if uv <= 2:
      print("You can safely enjoy being outside!")
    elif uv <= 7:
      print("Seek shade! Slip on a shirt, slop on sunscreen and slap on
      a hat!")
    else:
      print("Avoid being outside! Make sure you seek shade! Shirt,
      sunscreen, and hat are a must!")

  except:
    print("The website is down, try again later")

main()
```

**Question 2**

| Description | Marks |
|---|---|
| Modular design | 1 |
| Creates two random numbers | 1 |
| Calculates the answer | 1 |
| Outputs the question | 1 |
| Return/s utilised | 1 |
| Uses iteration | 1 |
| Iterates 10 times correctly | 1 |
| Checks user answer (right/wrong) | 1–2 |

| Description | Marks |
|---|---|
| Calculates the number of wrong answers | 1 |
| Initialises a list of wrong answers | 1 |
| Appends wrong answers to a list | 1 |
| Outputs how many wrong answers there were | 1 |
| Outputs all the wrong questions at the end | 1–2 |
| **Total** | **/15** |

Example answer

```
import random

# Define a global list to hold the problems that the user got wrong
wrong_problems = []

# Define a function to generate a random multiplication problem
def generate_problem(num1, num2):
    problem = f"What is {num1} x {num2}? "
    return problem

def generate_answer(num1, num2):
    return num1 * num2

# Define a function to run the multiplication practice session
def multiplication_practice():
    score = 0
    num_problems = 10
    for i in range(num_problems):
        num1 = random.randint(1, 10)
        num2 = random.randint(1, 10)
        problem = generate_problem(num1, num2)
        user_answer = int(input(problem))
        if user_answer == generate_answer(num1, num2):
            print("Correct!")
            score += 1
        else:
            print("Incorrect!")
            wrong_problems.append(problem)

    # Display the user's score and list of wrong problems
    print(f"Your score is {score} out of {num_problems}.")
    if wrong_problems:
        print("The following problems were answered incorrectly:")
        for problem in wrong_problems:
            print(problem)

# Main program loop
def main():
    multiplication_practice()

main()
```

**Question 3**

| Description | Marks |
|---|---|
| Correctly opens the given .csv file in READ mode, assigning it to an appropriate file object | 1–2 |
| Iterate correctly over each line in the file | 1 |
| **Subtotal** | **/3** |
| Successfully split at comma delimiters | 2 |
| Attempts to split at comma delimiters | 1 |
| **Subtotal** | **/2** |
| Successfully creates dictionary with provided data | 2 |
| Attempts to create dictionary with provided data | 1 |
| **Subtotal** | **/2** |
| Casts value as integer | 1 |
| Closes file or uses WITH | 1 |
| Returns dictionary | 1 |
| Output the dictionary in main() | 1 |
| Updates MrBeast value to 145000000 in dictionary | 1 |
| Output MrBeast key value pair | 1 |
| **Subtotal** | **/6** |
| **Total** | **/13** |

Example answer

```python
def read_youtube(filename):
    # Initialize an empty dictionary to hold the data
    youtube = {}
    # Open the CSV file and loop through each row
    file = open(filename, "r")
    for fline in file:
        flist = fline.split(",")
        key = flist[0]
        value = flist[1]
        youtube[key] = value

    file.close()
    return youtube

def main():
  filename = 'youtube.csv'
  youtube = read_youtube(filename)
  for channel, views in youtube.items():
      print(f"{channel}: {views}")
  youtube["MrBeast"] = 145000000
  print(f"MrBeast: {youtube['MrBeast']}")

main()
```

**Question 4**

| Description | Marks |
|---|---|
| One mark per element: | |
| Creates Student Class with attributes name and course name and marks as an array | 1–4 |
| Subtotal | /4 |
| Creates method in Student that calculates the average percentage | 2 |
| Attempts to create a method in Student that calculates the average percentage | 1 |
| Subtotal | /2 |
| Creates the instance of the student Mary | 1 |
| Subtotal | /1 |
| One mark per element: | |
| Outputs the object and correctly formats Mary's name, course name and marks percentage | 1–3 |
| Subtotal | /3 |
| Creates a method in Student to return the highest mark of a student | 2 |
| Attempts to create a method in Student to return the highest mark of a student | 1 |
| Subtotal | /2 |
| Successfully calls the highest mark method | 1 |
| Subtotal | /1 |
| Creates a constructor in Student that allows appending to the marks array | 3–4 |
| Attempts to create a constructor in Student that allows appending the marks array | 1–2 |
| Subtotal | /4 |
| One mark per rule of the validation: | |
| Validates the user input between 0 and 100 | 1–2 |
| Subtotal | /2 |
| Outputs Mary's details again with modified result | 1 |
| Subtotal | /1 |
| Total | /20 |

Sample output:

```
Mary's average mark in Computer Science is: 84%
You can't add marks less than 0 or more than 100
Enter a new mark for the first student: 150
You can't add marks less than 0 or more than 100
Enter a new mark for the first student: 50
Mary's highest mark: 92
Mary's average mark in Computer Science is: 79%
```

| Description | Marks |
| --- | --- |

Example answer

```python
class Student:
  def __init__(self, name, coursename, marks):
    self.name = name
    self.coursename = coursename
    self.marks = marks

  def add_marks(self, new_marks):
    if new_marks <= 100 and new_marks >= 0:
      self.marks.append(new_marks)
    else:
      print("You can't add marks less than 0 or more than 100")

  def average_marks(self):
    return sum(self.marks) / len(self.marks)

  def highest_mark(self):
    highest = 0
    for i in self.marks:
      if i > highest:
        highest = i
    return highest

def main():

    student1 = Student("Mary", "Computer Science", [80, 90, 70, 85, 92,
88])
    print(f"{student1.name}'s average mark in {student1.coursename} is:
{int(student1.average_marks())}%")
    new_mark = 150
    student1.add_marks(new_mark)
    new_mark = int(input("Enter a new mark for the first student: "))
    student1.add_marks(new_mark)
    print(f"{student1.name}'s highest mark: {student1.highest_mark()}")
    print(f"{student1.name}'s average mark in {student1.coursename} is:
{int(student1.average_marks())}%")

main()
```

Sample assessment task

Computer Science – ATAR Year 12

Task 5 – Unit 4

**Assessment type:** Theory test: Network communications and Cyber Security concepts

**Conditions**

Time for the task: 60 minutes in class

**Task weighting:** 5% of the school mark for this pair of units

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1.  Describe the purpose of the Open Systems Interconnection (OSI) Model.          (2 marks)

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2.  Describe one advantage and one disadvantage of the Open Systems Interconnection (OSI) Model
    compared to the Department of Defence (DoD) transmission control protocol/internet protocol
    (TCP/IP) model.                                                              (8 Marks)

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3. Identify the name of each missing layer of the Open Systems Interconnection (OSI) Model and describe **one (1)** role for each of the layers. (12 marks)

| 7. Application Layer | The role of the application layer is to interface with the user or application, and it is responsible for managing the communication protocols that the user or application will use to access the network. |
|---|---|
| 6. Presentation Layer | Adds an additional layer of formatting to the basic data from the application layer that is ready to be transmitted. It is responsible for data conversion and data encryption before transmission over the network. The layer compresses the data in a way that can be decompressed on the receiving end to save on bandwidth. |
| 5. | |
| 4. | |
| 3. | |
| 2. | |
| 1. Physical Layer | Responsible for the transmission and reception of the unstructured raw bit stream over a physical medium like copper wires, fibre-optic cables or wireless signals. The role of the physical layer is to establish and maintain the physical link between the devices that are communicating over the network. |

4.  Discuss how ping and traceroute can be used to evaluate network performance.          (5 marks)

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5. A diagram of a network is shown below
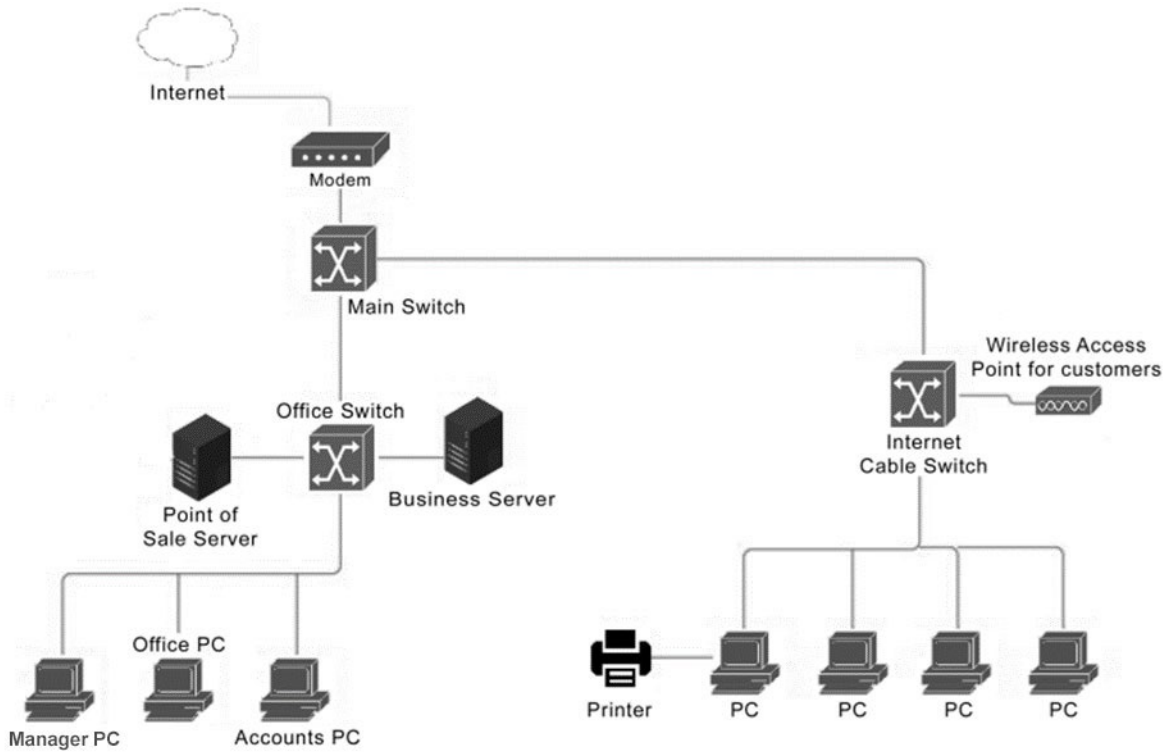


(a) Analyse the potential security issues in the network diagram with reference to security.

(4 marks)

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(b) Describe two issues in the network diagram with reference to performance.      (4 marks)

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(c) Outline one reason for how the network design makes the data vulnerable.　　　(1 mark)

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(d) Describe two security methods the network owners could implement to improve security.

(4 marks)

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6.　Explain the role of ethical hacking in improving network security.　　　(3 Marks)

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7.  With reference to IP addresses, explain IP spoofing.                    (3 Marks)

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**The Care Hospital**

A recent study was undertaken of a large number of healthcare industries into the processes and practices of data management used by providers. The study found that over the years, many healthcare industries have replaced traditional paper-based systems with online digital systems. The 'Internet of Things', (IoT), played a vital role in this context, with more healthcare data becoming digitised. Even with this rapid change of technology, it is believed that less than 6 per cent of the budget associated with a healthcare system is invested in its cybersecurity. Most healthcare organisations do not become aware of a security breach until months after it has happened, causing a massive concern regarding the privacy and security of all data. The Care Hospital was one of the hospitals considered in the study, and a brief synopsis of its digital practices is shown below.

The Care Hospital has been collecting and storing a large amount of patient data over the years. The hospital has just recently moved to a digital system from a paper-based system; however, staff were not offered any training or upskilling on the processing of data or in particular the security of data. The local server is located in the hospital's admission office next to the staff's computer station and hence is accessible to all staff. Access to data on the local server is protected by a single shared password, regardless of staff job roles. This room is not locked or secured.

All staff have access to a common, shared email address, which often receives phishing scams. Staff use their smartphones to carry out work emails. They no longer have personal computer stations. Instead, there are shared computer stations for staff, which are networked to allow online access to the server. Through the online access to the local server, all staff have access to patients' data on their smartphones. Personal and sensitive information, including patient details, disease diagnoses and procedures, is easily accessed online.

With the hospital's permission, staff take photos of medical records and search appointment schedules on their hospital-supplied smartphones. The smartphone's barcode scanning feature is also used by staff to verify the patient's identity via their identification band around their wrist and accordingly administer medication to the patient. This barcode feature has greatly reduced errors, potential harm to the patients and costs to the hospital. No formal training has been given to hospital staff on internet safety or security.

8. With reference to the information in the article, identify three security threats and explain a mitigation strategy to be incorporated to improve the organisation's cyber security.  (12 marks)

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9. Identify an early method of encryption and discuss your chosen encryption method against current best practices. (6 marks)

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**Total = 62 marks**

## Task 5 Unit 3 Marking key

1. Describe the purpose of the Open Systems Interconnection (OSI) model.

| Description | Marks |
|---|---|
| Describes the purpose of the Open Systems Interconnection (OSI) model | 2 |
| States the purpose of the Open Systems Interconnection (OSI) model | 1 |
| **Total** | **/2** |

**Answer could include, but is not limited to:**
- The OSI model is a standardised framework for network communication, consisting of seven layers that establish a common language between different systems and devices in a network. Its purpose is to facilitate interoperability, efficiency and reliability by providing a layer-by-layer approach to network communication that enables troubleshooting and isolating specific issues to particular layers.

2. Describe one advantage and one disadvantage of the Open Systems Interconnection (OSI) model compared to the Department of Defence (DoD) transmission control protocol/internet protocol (TCP/IP) model.

| Description | Marks |
|---|---|
| For each advantage: | |
| Describes one advantage of the OSI model compared to the TCP/IP model | 2 |
| Describes one advantage of the OSI model | 1 |
| **Subtotal** | **/4** |
| For each disadvantage: | |
| Describes one disadvantage of the OSI model compared to the TCP/IP model | 2 |
| Describes one disadvantage of the OSI model | 1 |
| **Subtotal** | **/4** |
| **Total** | **/8** |

**Answer could include, but is not limited to:**
Advantages:
- Standardised model that is used on a greater number of networks as a guidance tool
- OSI model is generic on default and supports a larger number of devices from various manufacturers
- OSI model can be more flexible than the TCP/IP model
- OSI model can be more efficient to troubleshoot when there is a problem
Disadvantages:
- OSI model is theoretical and doesn't have the practical implementation of the TCP/IP model
- OSI model is more complex with repetition at times between tasks

3. identify the name of each missing layer of the Open Systems Interconnection (OSI) Model and describe one (1) role for each of the layers.

| Description | Marks |
|---|---|
| One mark per correct layer naming | 1–4 |
| Subtotal | /4 |
| For each description: | |
| Describes the role of the layer | 2 |
| States a fact about the role of the layer | 1 |
| Subtotal | /8 |
| Total | /12 |

**Answer could include, but is not limited to:**

| | |
|---|---|
| **5. Session** | • Inter-host communication<br>• Establishes, maintains and establishes connections between applications<br>• Synchronises data exchange at the application level<br>• Provides session recovery in the event of a network failure or interruption |
| **4. Transport** | • Breaks data into smaller packets<br>• Provides end-to-end connections<br>• Flow control<br>• Reliable delivery checking |
| **3. Network** | • Logical addressing<br>• Path determination and IP addresses<br>• Supports multicasting |
| **2. Data link** | • Physical addressing<br>• Combines packets into bytes and bytes into frames<br>• Performs error detection<br>• Access control |

4. Discuss how ping and traceroute can be used to evaluate network performance.

| Description | Marks |
|---|---|
| Discusses how ping and traceroute can be used to evaluate and increase network performance | 5 |
| Explains how ping and traceroute can be used to evaluate and increase network performance | 4 |
| Describes how ping and traceroute can be used to evaluate and increase network performance | 3 |
| Describes ping and traceroute | 2 |
| States a fact about ping and/or traceroute | 1 |
| Total | /5 |

**Answer could include, but is not limited to:**
• A ping test can be used to identify the connectivity between devices on a network. This includes the time it takes to connect to a device or server. Ping can be used to determine if any devices are slowing down the performance of a network or not connecting with the correct IP address when requested. By

| Description | Marks |
|---|---|
| using ping, you can test the connectivity between two network devices and measure the latency or response time. Frequent ping tests can help identify network bottlenecks, packet loss, and latency issues that can impact network performance. In addition, ping can be used to verify whether a network device is reachable or not.<br>• Traceroute is used to check the path of the data in a network by identifying the server hops to each location. This allows for the identification of the best path for data to travel and if a bottleneck appears on the path. Network performance is affected if data is not travelling via the most efficient path. By tracing the route that packets take, you can identify the routers and the network segments that take longer to forward packets and identify potential network bottlenecks. Furthermore, traceroute can help identify whether a slow response time experienced by a specific application is due to network-related issues or due to server-related issues. | |

5.  (a) Analyse the potential security issues in the network diagram.

| Description | Marks |
|---|---|
| Analyses the issues in the network diagram with reference to security | 4 |
| Explains the issues in the network diagram with reference to security | 3 |
| Describes the issues in the network diagram with reference to security | 2 |
| Provides limited information about the issues of the network diagram | 1 |
| **Total** | **/4** |

**Answer could include, but is not limited to:**
• The analysis of the network indicates that security was not a factor, as there is no firewall used in the network. Routers were not used within the network which is also a security factor. The network is also inadequately managed by switches and the company printer has been placed in a public place rather than being private. The network as it stands is not adequate for the business needs.

(b) Describe two the issues in the network diagram with reference to performance.

| Description | Marks |
|---|---|
| For each description: | |
| Describes the issues in the existing network diagram with reference to performance | 2 |
| Provides limited information about the issues of the network diagram | 1 |
| Total | /4 |

**Answer could include, but is not limited to:**
• Network performance is reduced by the over reliance of switches instead of routers
• Network isn't segmented resulting in broadcast traffic
• Network cabling is unclear and could be a factor in data transmission speeds.

(c) Outline one reason for how the network design makes the data vulnerable.

| Description | Marks |
|---|---|
| Outlines one reason for how the network design makes the data vulnerable | 1 |
| **Total** | **/1** |

**Answer could include, but is not limited to:**
- The current network design allows any access point access to all parts of the network. There is no segmentation using routers and/or firewalls to improve security.

(d) Describe two security methods the network owners could implement to improve security.

| Description | Marks |
|---|---|
| For each security method: | |
| Describes a security method that can be implemented to improve security | 2 |
| Identifies a security method that can be implemented to improve security | 1 |
| **Total** | **/4** |

**Answer could include, but is not limited to:**
- encryption of server
- using firewall to block/filter access from public facing devices
- each employee should have their own unique credentials
- replace selected switches with router to block/filter and block public facing devices.

6.  Explain the role of ethical hacking in improving network security.

| Description | Marks |
|---|---|
| Explains the role of ethical hacking in improving network security | 3 |
| Describes the role of ethical hacking in improving network security | 2 |
| States a fact about ethical hacking | 1 |
| **Total** | **/3** |

**Answer could include, but is not limited to:**
- Ethical hackers perform risk assessments which tests systems to identify possible vulnerabilities and exploits in a network. This allows the business to secure vulnerabilities before bad actors can exploit these network security issues. Ethical hacking can be conducted both virtually and physically.

7. With reference to IP addresses, explain IP spoofing.

| Description | Marks |
|---|---|
| Explains IP spoofing with reference to IP addresses | 3 |
| Describes IP spoofing with reference to IP addresses | 2 |
| Identifies IP spoofing with reference to IP addresses | 1 |
| **Total** | **/3** |

**Answer could include, but is not limited to:**
- IP spoofing is the creation of IP packets of data with a false source IP address in an attempt to hide the original source IP address of the packet. This can result in the impersonation of another computer or device that is accepted or trusted on the network, usually for malicious intent.

8. With reference to the information in the article, identify three security threats and explain a mitigation strategy to be incorporated to improve the organisation's cybersecurity.

| Description | Marks |
|---|---|
| Identifies a security threat | 1–3 |
| **Subtotal** | **/3** |
| For each threat: | |
| Explains a mitigation strategy with reference to the article | 3 |
| Describes a mitigation strategy with reference to the article | 2 |
| Identifies a mitigation strategy | 1 |
| **Subtotal** | **/9** |
| **Total** | **/12** |

**Answer could include, but is not limited to:**

Security threats:
- social engineering (phishing)
- physical security threats
- denial of service
- compromised credentials
- back door attacks
- lost or stolen devices.

Mitigation strategies:
- analysis of log files
- firewall filtering
- intrusion prevention systems
- user training
- physical security.

9.  Identify an early method of encryption and discuss your chosen encryption method against current best practices.

| Description | Marks |
|---|---|
| Identifies an early encryption method | 1 |
| **Subtotal** | **/1** |
| Discusses an early encryption method against current best practices | 5 |
| Explains an early encryption method against current best practices | 4 |
| Describes an early encryption method against current best practices | 3 |
| Describes an early encryption method | 2 |
| States a fact about an early encryption practice and/or current best practices | 1 |
| **Total** | **/6** |

**Answer could include, but is not limited to:**

Early methods and weaknesses:
*   Substitution cipher – swaps out characters. Assuming 26 alphabet characters; it is easily broken using character frequency.
*   Vigenère cipher – uses a repeated key combining plain text with the key. Easily broken if the length of the key is known and character frequency method similar to the substitution cipher is used.
*   Mechanical encryption – such as the WW2 Enigma machine. Each mechanical method had its own weakness. The Enigma's weakness was it never encrypted a letter as itself.
*   Data Encryption Standard (DES) – the first digital encryption standard used a key size of 56 bits, which is small compared to today's standards and is quickly cracked with fast processing speeds available today.

DES and AES use symmetric keys, which means the key used to encrypt is the same key to decrypt. This is a problem if you need to securely communicate with someone who does not have the private key. RSA (Rivest–Shamir–Adleman) encryption solves the problem with asymmetric encryption – your data is encoded with a public key that is then decrypted using a private key. It is very slow compared to AES, so it's often used to securely communicate the private AES key. RSA uses 2048–4096 key sizes and works using a key produced by an algorithm using two prime numbers.

Current best practice:
*   Secure your private key – a stolen key means your data is no longer secure. Ensure only those who need the key are able to access it.
*   Backup your key – a lost key means lost data as it will be permanently encrypted.
*   Use longer length keys to ensure brute force cracking is harder.
*   Use audit logs to check if keys have been accessed by unauthorised users.
*   Best practice is that users should encrypt any messages they send containing critical or sensitive files. This extends to the encryption of storage devices in case they fall into the wrong hands.

| | Total | /64 |
|---|---|---|

# Sample assessment task

## Computer Science – ATAR Year 12

Task 6 – Unit 4

**Assessment type:**   Project

**Conditions**          Time for the task:   Four weeks

**Task weighting:**   25%

A family member has decided to start a new online business and has asked you to develop a working software solution to manage customers and record sales information. Possible examples for your business include a food delivery service, a video streaming service or an online clothing retailer.

Once you have identified a suitable scenario, you will need to conduct appropriate research to provide a description of the system and develop a list of detailed requirements. From this list of requirements, you are to design a solution and then develop the software using a suitable development framework.

In creating your software solution, you should use a combination of Python and SQLite. If you wish to use a different framework, discuss this with your teacher. Only limited technical support will be provided if you choose to do this.

This task has been separated into two parts:

- Part 1 – Investigate and Design worth 40% of the overall mark
- Part 2 – Develop and Evaluate worth 60% of the overall mark

## Part 1 (40%)

### Investigate

- Analyse the steps required to produce your software solution and develop a schedule for when each of these steps needs to be completed. You should present your timeline in a suitable manner.
- Problem outline –
    - Write a brief outline of the software solution and its objectives
- Problem description – write a detailed description of the required solution. Your description should include:
    - a written description of the scenario which you will develop a solution
    - a list of detailed requirements that your solution needs to include to be useful, including both programming and database requirements. For example, your solution should be able to accept orders from a customer, or your solution needs to be able to give a list of all orders in the last month
    - a discussion of any ethical, legal and/or security issues that need to be considered
    - a description of any factors that may impact the quality of the data stored in your solution.

## Design

Once you have established a suitable scenario and problem, you should design a software solution that includes an appropriate database. In designing a solution, you should:

- Develop an appropriate entity-relationship diagram (with a **minimum** of 5 entities). Your diagram should include all primary and foreign keys, but does not need to include any other fields.
- Write the relational notation for the database you have designed.
- Create a data dictionary that will describe the data that you need to store. As part of your data dictionary, you should include a brief overview to describe what information is being stored in each table.
- Describe in plain English several queries that could be used in your database (NOTE: You do not need to write any SQL at this point).

## Part 2 (60%)

### Develop

You are to create a working software solution based on the design that you have produced. Your system should include a database back end and any necessary software features to make it useful.

Your software solution should include the following features:

- A script to create an initial (empty) database, including the enforcing of referential integrity.
- A script to insert sample data into the database that provides enough data to allow the system to be thoroughly tested
- Data validation to ensure the integrity of the database. This should be done using constraints within the SQL for each table and within the code to ensure there are no run time errors and any user data entry is valid.
- A number of different queries that will allow the user to extract useful information from the database. When developing your queries, you should develop different queries to fulfil the following criteria:
  - use of aggregate functions such as COUNT, SUM, AVG, MIN and MAX
  - use of clauses such as GROUP BY and ORDER BY
  - use of JOINS to retrieve data from a number of related tables
  - use of calculated and concatenated fields with aliases
  - ability to insert, update and delete records.

NOTE: You should ensure that you use a sufficient number of queries to use data from all the tables in your database. Your queries should also be complex enough to demonstrate your understanding of SQL.

- Any other software features you feel may improve your software solution. For example, you could:
  - provide a suitable method to present the results of queries to the user
  - export query results to a text file

- provide an interface for the user to insert, update and delete records.

## Evaluate

- Reflect on the success of your solution and how well it meets the system requirements. To perform your evaluation, you should:
  - consider how well your solution meets the requirements you outlined in Part 1
  - consider the ER diagram you developed in Part 1 and compare it to the structure of your finished database. Discuss any differences and explain why you have made these changes.
  - consider what extra features you implemented and what aspects of the solution could be improved.
  - document any known bugs and/or limitations in the solution and explain how they impact the performance of the solution.
- Perform a developer retrospective and reflect on the process you followed to develop your solution and how you could improve this process. Some aspects you should consider include:
  - what worked well?
  - what didn't work well?
  - what would you do differently next time to improve the development process?
- Document the sources you have used to get information about how to develop your solution, including all websites and textbooks.

Note: This task requires authentication to ensure students complete the work themselves. Some methods of authentication could include:

- Students taking screenshots of their code on a regular basis.
- Students using tools such as GitHub to demonstrate regular updates to their code.
- Students providing verbal explanations of their project and how it works.

## Part 1 (40%)

| Investigate | Marks |
|---|---|
| **Development Schedule** | |
| Breaks down the project planning into a series of meaningful steps and a realistic timeline for completing each step has been included | 2 |
| Breaks down the project into a limited series of steps with some attempt at showing a timeline | 1 |
| **Subtotal** | **/2** |
| **Problem Outline** | |
| Accurately outlines the purpose of the software solution | 1 |
| **Subtotal** | **/1** |
| **Problem Description** | |
| Provides a clear and detailed description of the scenario | 2 |
| Gives a limited description of the scenario | 1 |
| **Subtotal** | **/2** |
| **Requirements list** | |
| Provides a clear and detailed list of requirements that fully meet the needs of the problem description. Suitably classifies requirements | 3 |
| Provides a list of requirements that mostly meet the needs of the problem description. Partially classifies requirements | 2 |
| Provides an incomplete list of requirements that meet some of the needs of the problem description. Makes a limited attempt at classifying requirements | 1 |
| **Subtotal** | **/3** |
| **Ethical/Legal/Security Issues** | |
| Provides a clear and detailed discussion of appropriate ethical, legal and security issues that are relevant to the development of the software solution | 4 |
| Discusses legal, ethical and security issues regarding the development of the software solution | 3 |
| Limited discussion of several legal, ethical or security issues regarding the development of the software solution | 2 |
| Has identified a legal, ethical or security issue regarding the development of the software solution | 1 |
| **Subtotal** | **/4** |
| **Data Quality** | |
| Describes all relevant factors that will affect the quality of the data in the solution | 3 |
| Describes some relevant factors that will affect the quality of the data in the solution. | 2 |
| Identifies factors that may affect the quality of the data in the solution | 1 |
| **Subtotal** | **/3** |
| **Total** | **/15** |

| Design | Marks |
|---|---|
| DESIGN | |
| **ER Diagram** | |
| All necessary entities have been included, named appropriately and any many-to-many relationships have been resolved | 4 |
| Most entities have been included and named appropriately, or all included but not named appropriately | 3 |
| Some entities have been included | 2 |
| Limited entities have been included | 1 |
| **Subtotal** | **/4** |
| All relationships between tables have been included with correct cardinality indicated on each relationship | 4 |
| All relationships have been included although cardinality may be incorrect, or most relationships have been included with correct cardinality | 3 |
| Most relationships have been included although cardinality may not be correct | 2 |
| Some relationships have been included | 1 |
| **Subtotal** | **/4** |
| All primary and foreign keys have been included and have been placed in the correct entities | 3 |
| Most primary and foreign keys have been included in the correct entities | 2 |
| Some primary and foreign keys have been included in the correct entities | 1 |
| **Subtotal** | **/3** |
| **Relational Notation** | |
| All entities have been included with all primary and foreign keys indicated appropriately. All necessary non-key fields have been included and the correct notation conventions have been followed | 5 |
| All entities have been included, although some key fields have not been identified correctly or some non-key fields are missing | 4 |
| Most entities have been included with all necessary key and non-key fields indicated appropriately | 3 |
| Most entities have been included, although some key and non-key fields are missing | 2 |
| Some entities have been included | 1 |
| **Subtotal** | **/5** |
| **Data Dictionary** | |
| All entities have been included with a brief overview of each entity. All primary and foreign keys have been included for each entity with appropriate details included for each field | 6 |
| All entities and key fields but some details not included for each field | 5 |
| Most entities and key fields for all included entities with appropriate details | 4 |
| Most entities and key fields however some details not included for each field | 3 |

| Design | Marks |
|---|---|
| Some entities and key fields with appropriate details for fields | 2 |
| Some entities and key fields however some details not included for each field | 1 |
| **Subtotal** | **/6** |
| All necessary non-key fields have been included for each entity, with appropriate details included for each field | 4 |
| All included but missing details, or most included with all details | 3 |
| Most included but missing some details | 2 |
| Some included | 1 |
| **Subtotal** | **/4** |
| **Total** | **26** |
| **Total Part A** | **/41** |

## Part 2 (60%)

| Develop | Marks |
|---|---|
| DEVELOP | |
| **Create database** | |
| A database has been produced that accurately reflects the ERD and data dictionary. Any changes from the original design have been documented | 2 |
| A database has been produced with some errors | 1 |
| **Subtotal** | **/2** |
| Database effectively enforces entity, domain and referential integrity through use of constraints in the CREATE queries | 3 |
| Database partially enforces data integrity through the use of constraints | 2 |
| Database attempts to enforce some data integrity | 1 |
| **Subtotal** | **/3** |
| **Insert data** | |
| Appropriate data inserted into database to allow database to be tested thoroughly | 3 |
| Some data entered into database although insufficient to thoroughly test all aspects of the database | 2 |
| Limited data entered into database | 1 |
| **Subtotal** | **/3** |
| **Data validation** | |
| Database solution uses Python to thoroughly check the validity of data entered by the user. The database solution provides suitable error messages to the user to explain errors | 3 |
| Database solution uses Python to check the validity of most data entered by the user | 2 |

| Develop | Marks |
|---|---|
| Database solution uses Python to check the validity of some data entered by the user | 1 |
| **Subtotal** | **/3** |
| **SQL Queries** | |
| Note: It is possible for a query to earn marks across more than one of the categories below | |
| An appropriate number of working queries have been written that demonstrate a sufficient level of complexity and covers all tables in the database. All queries extract meaningful information from the database | 3 |
| An appropriate number of working queries have been written that cover most tables in the database | 2 |
| Some working queries have been written | 1 |
| **Subtotal** | **/3** |
| Queries demonstrate use of multiple aggregate functions to extract meaningful information | 3 |
| Multiple aggregate functions have been used to produce working queries | 2 |
| Attempts to use aggregate functions | 1 |
| **Subtotal** | **/3** |
| Queries demonstrate use of both GROUP BY and ORDER BY to extract meaningful information | 3 |
| GROUP BY and ORDER BY clauses have been used to create working queries | 2 |
| Attempts to use GROUP BY and ORDER BY clauses | 1 |
| **Subtotal** | **/3** |
| Queries use JOINS across multiple tables to extract meaningful information | 3 |
| Joins are used to create working queries | 2 |
| Attempts to use JOINS across a minimum of two tables | 1 |
| **Subtotal** | **/3** |
| Queries make use of calculated and concatenated fields to manipulate the results of the query. Queries use aliases to make the results of the query more meaningful | 3 |
| Uses calculated and concatenated fields to create working queries | 2 |
| Attempts to make use of calculate or concatenated fields in a query | 1 |
| **Subtotal** | **/3** |
| Queries have been written that allow the user to insert, update and delete records from the database | 3 |
| Queries have been written that allow the user to do two of the insert, update or delete records from the database | 2 |
| Attempts to create an insert, update or delete query | 1 |
| **Subtotal** | **/3** |
| **Other Features** | |

| Develop | Marks |
|---|---|
| Suitable extra features have been implemented effectively as part of the solution that allow the user to better interact with the database | 5 |
| Suitable extra features have been implemented that allow the user to interact with the database | 4 |
| Some extra features have been implemented | 3 |
| Implemented an extra feature as part of the solution | 2 |
| Attempted to implement some extra features as part of the solution | 1 |
| **Subtotal** | **/5** |
| **Product Evaluation** | |
| Provides a detailed evaluation of how the solution meets the requirements identified in Part 1, including discussion of design changes that have been made | 3 |
| Describes how the solution meets the requirements identified in Part 1 or describes changes to the database design | 2 |
| Makes a superficial comment about how the solution meets the requirements identified in Part 1 | 1 |
| **Subtotal** | **/3** |
| Provides a detailed discussion of how the final product could be improved and documents any bugs and/or limitations | 3 |
| Describes how the final product could be improved and documents some bugs and/or limitations with the solution | 2 |
| Makes a superficial comment about how the final product could be improved or identifies bugs | 1 |
| **Subtotal** | **/3** |
| **Retrospective** | |
| Provides a detailed evaluation of the development process and suggests future impacts | 3 |
| Completes an evaluation of the development process that was used including some suggested future impacts | 2 |
| Makes superficial comments on development process used and suggested future impacts | 1 |
| **Subtotal** | **/3** |
| **Total Part 1** | **/41** |
| **Total Part 2** | **/43** |
| **Total** | **/84** |

## Acknowledgements