HSC Software Engineering Sample Examination

Question 1 (1 mark)

Which of the following should take place during the requirements definition step when developing a software solution?

- ☐ Identifying algorithms to be used
- ☐ Documenting security vulnerabilities
- ☐ Identifying potential security threats in the software
- ☐ Documenting the needs and constraints of the software

Question 2 (1 mark)

Which of the following best describes SMTP?

- ☐ A protocol for email transmission
- ☐ A set of rules to securely transfer files across a network
- ☐ A set of rules for securing communication between computers
- ☐ A protocol used for synchronising communication across networks

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Question 3 (1 mark)

A company conducts all of its consultations with its clients via its website.
Which of the following is the best way for the company to maintain the security of its clients' data?

- ☐ Implement data encryption
- ☐ Ensure that the software is user-friendly
- ☐ Focus on software that incorporates metadata
- ☐ Use software that allows for easy data integration with other platforms

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Question 4 (1 mark)

Which of the following are benefits of collaborating with others when developing software solutions? (More than one may be selected.)

- ☐ Privacy is improved
- ☐ Security of data is increased
- ☐ Intellectual property is protected
- ☐ Different points of view can be considered
- ☐ Tasks can be delegated to those with expertise

Question 5 (1 mark)

New systems can be implemented in a number of different ways.
Match the implementation methods to their characteristics by dragging them to their corresponding boxes.

Methods: `Direct`, `Parallel`, `Phased`, `Pilot`

Description	Method
The new system runs immediately with no delay.	??????
The new system gradually replaces the old system.	??????
The new system and the old system run at the same time.	??????
The new system is trialled with a small group of users and then implemented entirely when ready.	??????

Question 6 (1 mark)

A company is creating a new online application.
Which of the following is the least important consideration when choosing an open-source front-end web framework for the new application?

- ☐ Popularity of the framework on social media
- ☐ Quality of existing framework documentation
- ☐ Knowledge of the framework within the company's development team
- ☐ Compatibility of the framework with the company's existing technology

Question 7 (1 mark)

Consider the following Python code:

```
for index in range(n):
    print(index)
```

Select the correct option to complete the equivalent pseudocode:

```
FOR index = _______
    Display index
NEXT index
```

Options:

- ☐ 0 TO n
- ☐ 1 TO n
- ☐ 0 TO n−1
- ☐ 1 TO n−1

Question 8 (2 marks)

The strategies listed below can be used to test the security of a web application that contains a database.
Classify each strategy as EITHER static application security testing (SAST) OR dynamic application security testing (DAST).

Strategy	SAST	DAST
Simulate attacks on the web application		
Check the way SQL queries are constructed		
Test the database's web interface for vulnerabilities		
Test the web application used to interact with the database when running		
Analyse the code for connecting to the database to identify vulnerabilities		

Question 9 (2 marks)

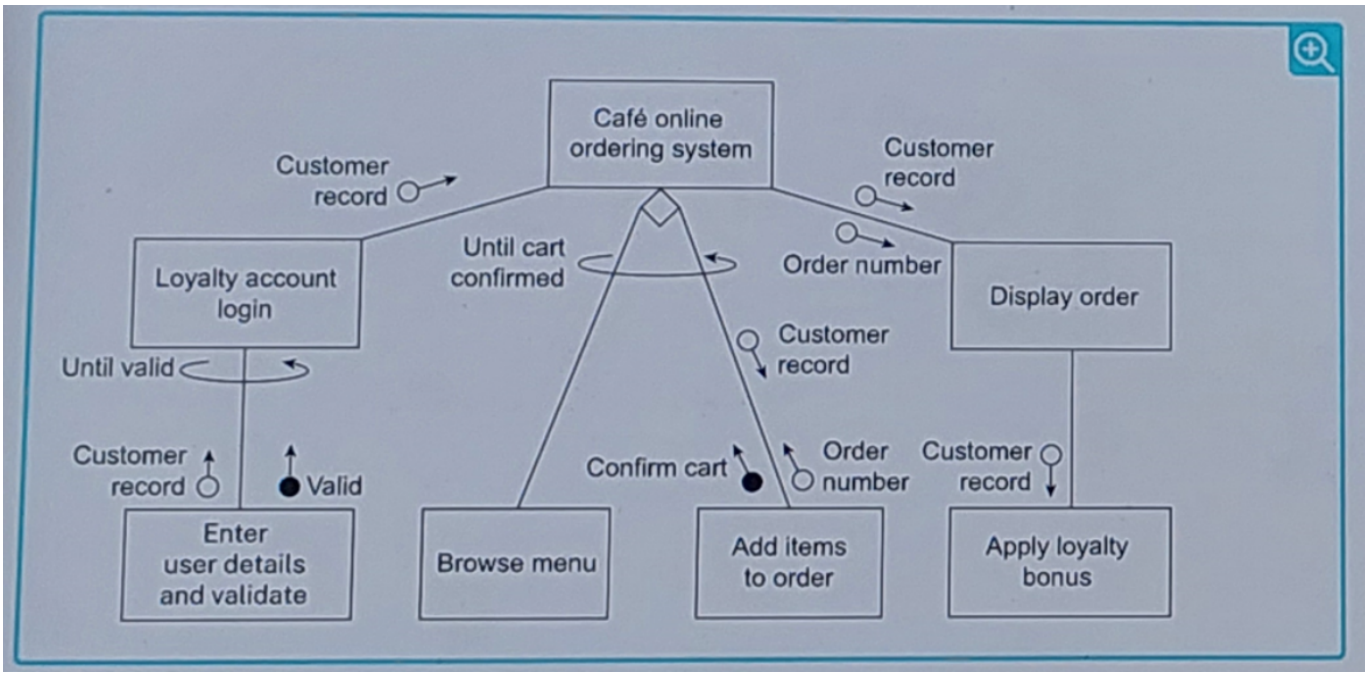
Place the following steps of a number guessing game algorithm in the correct order by dragging the steps into position.

```
BEGIN GuessingGame
Set guess = -1
[...steps...]
END GuessingGame
```

Steps to arrange:

- Display "Guess a number between 0 and 100:"
- Display "Well Done"
- Set number = random integer between 0 and 100
- WHILE guess <> number
- Get guess
- ENDWHILE

Question 10 (2 marks)



This structure chart describes an online ordering system for a café. Which of the following statements are TRUE about this structure chart? (More than one may be selected.)

- ☐ Confirm cart is Boolean
- ☐ Order number is a control variable
- ☐ A valid loyalty account is not required for online ordering
- ☐ The order cannot be displayed until the cart is confirmed
- ☐ A choice is repeatedly offered between *Browse menu* and *Add items to order*

Question 11 (3 marks)

Consider the following algorithm:

```
BEGIN responsiveScreen
    Get ScreenSize
    IF ScreenSize >= 1024 THEN
        Viewport = 'Desktop'
    ELSEIF ScreenSize >= 768 THEN
        Viewport = 'Tablet'
    ELSE
        Viewport = 'Phone'
    ENDIF
    Display "Display set to ", Viewport
END responsiveScreen
```

Provide a set of test data that will thoroughly test the algorithm.
Include the expected outputs and reasons for inclusion.

Test data (ScreenSize)	Expected output (Viewport)	Reason for inclusion
1		

Test data (ScreenSize)	Expected output (Viewport)	Reason for inclusion
2		
3		

Question 12 (6 marks)

(a) Explain how a web developer could test a website for cross-platform compatibility.
(3 marks – Max 75 words)

[Your answer here]

(b) Explain how the load time of a web page can be improved using a progressive web app (PWA).
(3 marks – Max 75 words)

[Your answer here]

Question 13 (3 marks)

Describe the function of protocols in the transfer of data. In your answer, refer to a specific web protocol.
(Max 75 words)

[Your answer here]

Question 14 (3 marks)

PseudoPizza creates and sells custom-designed pizzas.

The price of a small pizza is $10. The following costs are added, depending on the size of the pizza base and the number of toppings chosen:

- Medium size: $2
- Large size: $4
- Each topping: $1.50

An algorithm is needed to calculate the cost of pizzas ordered for a customer.
The algorithm should calculate and display:

- The cost of each pizza
- The total cost of the order

Write the algorithm using pseudocode. Include at least one subroutine in your answer.
You may assume that all inputs are valid.

[Write pseudocode here]

Question 15 (3 marks)

Describe how machine learning algorithms can be used in data analysis.
(Max 75 words)

[Your answer here]

Question 16 (3 marks)

A developer added a cascading style sheet (CSS) to their company's website.
The developer had expected the HTML code to display the word "Software" in bold and italics but it looks like regular text.

index.html

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <title>Welcome to Software</title>
    <link rel="stylesheet" href="main.css">
  </head>
  <body>
    <h1>Software</h1>
    <p><span id="qe_item">Software</span> includes code.</p>
  </body>
</html>
```

main.css

```
body {
  font-family: Arial;
}

h1 {
  font-weight: bold;
  text-align: center;
}

.qe_item {
  font-style: italic;
  font-weight: bold;
}
```

(a) Referring to the code, what is the cause of the problem? (1 mark)

- ☐ Font family is missing
- ☐ Attribute of `<span>` has not been defined
- ☐ `main.css` has not been correctly referenced
- ☐ The id `qe_item` has not been correctly referenced

(b) Outline TWO benefits of adding CSS to the company's website. (2 marks)

[Your answer here]

Question 17 (3 marks)

A shop uses an online database for recording its stock. The database contains a Products table and a Suppliers table.
The prices are in dollars and the masses are in grams.

The shop wants to identify all the products with a mass of at least 50 grams that are produced by Yumtreats.
Write an SQL query to display the product names and supplier names, in descending order by product name.

Products

ProductID	Name	Price	Mass	Producer	Quantity	SupplierID
PID001	TruffleSway	1.00	30	Yumtreats	100	SID001
PID002	PeanutPop	1.00	35	Yumtreats	500	SID002
PID003	Carameluxe	2.20	50	Yumtreats	100	SID003
PID004	BerryBlend	1.25	50	Yumtreats	8	SID001
PID005	Chocolate Cascade	1.25	52	Yumtreats	50	SID002
PID006	Hazelnut Symphony	2.50	50	Sugaryum	0	SID003
PID007	Caramel Delight	2.50	40	Treatopia	20	SID002
PID008	ChocoGlow	2.50	55	Treatopia	95	SID002

Suppliers

SupplierID	Name
SID001	The Lolly Pop
SID002	Sugar Rush Hour
SID003	Sweet Retreat

Write your SQL query here: [Your answer here]

Question 18 (6 marks)

An online site requires its users to create accounts. These accounts are created using a 'Create Profile' web form, which includes fields such as username, password, first name, last name, mobile number, and date of birth.

Each username must satisfy the following rules:

1. It must be at least 8 characters long.
2. It must start with an uppercase letter.
3. The second last character must be a lowercase letter.
4. The last character must be numeric.

A valid example: `NESA24a3`

(a) Explain how defensive data input handling practices can be implemented for this website.
(3 marks – Max 75 words)

[Your answer here]

(b) Write a function in Python that will check whether a username satisfies the rules.
(3 marks)

[Your answer here]

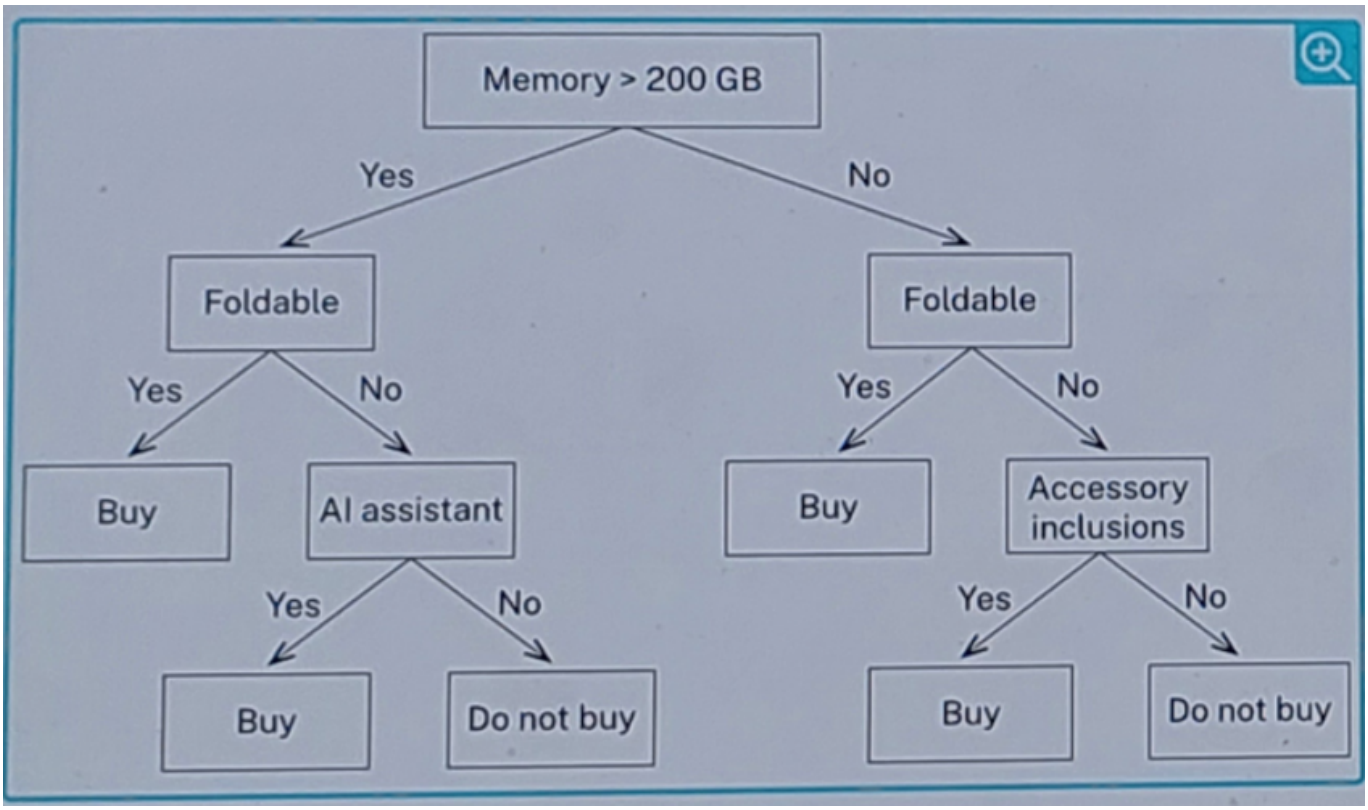
Question 19 (4 marks)

An app is being developed for use in a school. It will allow teachers to upload and assign work, and track student homework. Students can download work and upload their completed responses for marking.

Explain how authentication and authorisation could be applied to this app.
(Max 75 words)

[Your answer here]

Question 20 (4 marks)



Consider the following decision tree of a trained machine learning model that determines whether to purchase a mobile phone.

(a) **Using the decision tree, determine the outcome of each of the following situations:** (1 mark)

Scenario	**Buy? Y/N**
Memory = 256 GB, AI Assistant = Yes, Accessory Inclusions = No	
Memory = 128 GB, AI Assistant = No, Accessory Inclusions = Yes	
Foldable = Yes, AI Assistant = No, Accessory Inclusions = No	

(b) **The decision tree can be simplified without compromising its logic. Redraw the decision tree to reduce the number of branches.** (3 marks)

[Draw here]

Question 21 (6 marks)

At a school, each student studies five subjects. The school timetable has five periods each day, and each period is allocated to a different subject. The subject shifts to a different period each day so that each subject will appear in all five periods during the week.

Example timetable:

Period	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
1	English	Sport	Science	Drama	Software
2	Software	English	Sport	Science	Drama

Period	Monday	Tuesday	Wednesday	Thursday	Friday
3	Drama	Software	English	Sport	Science
4	Science	Drama	Software	English	Sport
5	Sport	Science	Drama	Software	English

In this example, the student studies English, Software, Drama, Science and Sport. From Monday to Friday, English is held in Period 1, Period 2, Period 3, Period 4 and Period 5. Software is held in Period 2, Period 3, Period 4, Period 5 and then Period 1. A similar pattern can be observed for the other subjects.

You are required to write a Python program to print out the timetable in the following format:

Monday
Period 1: English
Period 2: Software
Period 3: Drama
Period 4: Science
Period 5: Sport

and so on ...

Start your program with:
`subjects = ["English", "Software", "Drama", "Science", "Sport"]`

Different students may study different subjects.

The program will be used by different students to print out their timetable by changing the subjects listed in the first line of code.

(a) If the timetable is stored as a 2D array, what is the correct Python snippet for accessing the subject that is on Monday Period 3? (1 mark)

Options:

- Timetable[2]
- Timetable[1,4]
- Timetable[0][2]
- Timetable[1].Subject

(b) Write the Python program using subroutines. (5 marks)

```
subjects = ["English", "Software", "Drama", "Science", "Sport"]

# Your code here
```

Question 22 (5 marks)

An online relational database is used to keep track of students at a coding club. The contents of the database are shown.

StudentID	FirstName	Surname	Attended	Level
Student1	John	Doe	5	Beginner
Student2	Jane	Smith	4	Intermediate
Student3	David	Kim	3	Beginner
Student4	Sarah	Lee	2	Expert
Student5	Emma	Wilson	1	Beginner
Student6	Michael	Johnson	2	Intermediate
Student7	Olivia	Davis	2	Beginner
Student8	Ethan	Martinez	3	Intermediate
Student9	Sophia	Choi	4	Expert
Student10	Noah	Moore	5	Beginner
Student11	Isabella	Garcia	1	Intermediate
Student12	Liam	Vo	2	Expert

(a) **Complete the SQL query to generate the number of students at each level.** (2 marks)

```
SELECT Level, ???
FROM Students
??? BY Level;
```

(b) **Race conditions have been identified as a potential issue for this database.**
Provide an example of when a race condition may occur in this scenario and outline how secure code could be implemented to prevent it. (3 marks – Max 75 words)

[Your answer here]

Question 23 (6 marks)

(a) How can the effects of human bias be minimised when training machine learning algorithms?
(3 marks – Max 75 words)

[Your answer here]

(b) Compare *linear regression* and *K-nearest neighbour*.
(3 marks – Max 75 words)

[Your answer here]

Question 24 (4 marks)

A train company wants a class diagram that models the relationship between long-distance train trips and passengers.

The long-distance train has:

- A unique trip identifier (e.g. AL456)
- A model code for the train engine (e.g. E67) and a model code (e.g. P9754) for each passenger car
- Two different areas ("Standard" and "Executive")
    - Executive: 20 seats
    - Standard: 400 seats

Each passenger:

- Has contact details (email + phone number)
- Purchases a ticket ("Standard" or "Executive") and is given a seat number (e.g. 25D)
- May be a frequent traveller

Create a class diagram for the train company.
(Use the drawing tool)

Question 25 (8 marks)

A telecommunications company had a recent security breach which prompted a review to improve the security of its systems.
It has contracted QuidantCon to propose security enhancements.

QuidantCon's Proposal includes:

1. Business Process Automation (BPA) Security

- *Predictive analysis*: Identify vulnerabilities in business processes and automate risk mitigation
- *Automated compliance monitoring*: Ensure continuous compliance with security regulations through ML

2. DevOps Integration

- *Automated Security Testing*: Use ML-powered tools for automated code scanning and vulnerability testing
- *Anomaly Detection*: Monitor logs and traffic using ML

3. Robotic Process Automation (RPA) Enhancement

- *Intelligent task automation*: Optimise workflows using ML
- *Threat prediction*: Predict and prevent security threats with ML

Discuss QuidantCon's proposal for security enhancements to the company's systems.
(Max 300 words)

[Your answer here]