

# HSC Software Engineering

## Sample Examination

### Marking Guidelines

#### Question 1

Criteria	Marks
• Identifies the correct answer	1

**Answer:**

Documenting the needs and constraints of the software

#### Question 2

Criteria	Marks
• Identifies the correct answer	1

**Answer:**

A protocol for email transmission

#### Question 3

Criteria	Marks
• Identifies the correct answer	1

**Answer:**

Implement data encryption

**Question 4**

Criteria	Marks
• Correctly identifies the benefits	1

**Answer:**

Different points of view can be considered.  
Tasks can be delegated to those with expertise.

**Question 5**

Criteria	Marks
• Correctly matches the implementation methods	1

**Answer:**

<input type="checkbox"/> Direct	The new system runs immediately with no delay.
<input type="checkbox"/> Phased	The new system gradually replaces the old system.
<input type="checkbox"/> Parallel	The new system and the old system run at the same time.
<input type="checkbox"/> Pilot	The new system is trialled with a small group of users and then implemented entirely when ready.

**Question 6**

Criteria	Marks
• Identifies the correct answer	1

**Answer:**

Popularity of the framework on social media

**Question 7**

Criteria	Marks
• Identifies the correct answer	1

**Answer:**

```
FOR index = 0 TO n-1
    Display index
NEXT index
```

## Question 8

Criteria	Marks
• Correctly classifies all the strategies	2
• Correctly classifies THREE strategies which must include ONE SAST and ONE DAST strategy	1

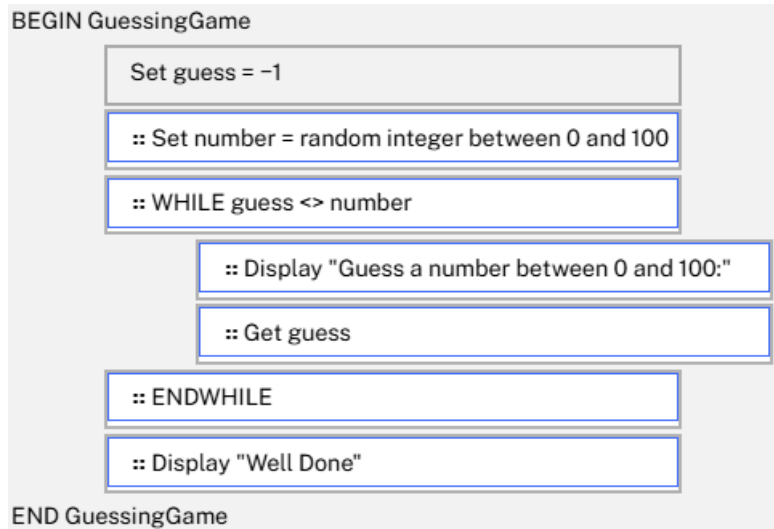
### Answer:

	Static Application Security Testing (SAST)	Dynamic Application Security Testing (DAST)
Simulate attacks on the web application	<input type="radio"/>	<input checked="" type="radio"/>
Check the way SQL queries are constructed	<input checked="" type="radio"/>	<input type="radio"/>
Test the database's web interface for vulnerabilities	<input type="radio"/>	<input checked="" type="radio"/>
Test the web application used to interact with the database when it is running	<input type="radio"/>	<input checked="" type="radio"/>
Analyse the code for connecting to the database to identify security vulnerabilities	<input checked="" type="radio"/>	<input type="radio"/>

## Question 9

Criteria	Marks
• Correctly orders the steps	2
• Correctly orders the WHILE and ENDWHILE steps	1

**Answer:**



## Question 10

Criteria	Marks
• Correctly identifies all the items that are true about the structure chart	2
• Identifies true or false correctly for THREE out of five checkboxes	1

**Answer:**

- ☒ **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

Criteria	Marks
<ul style="list-style-type: none"> <li>Provides a set of test data that will thoroughly test the algorithm</li> <li>Includes expected outputs and reasons for inclusion</li> </ul>	3
<ul style="list-style-type: none"> <li>Provides a set of test data that tests most of the boundaries and paths</li> <li>Includes the relevant expected outputs and reasons for inclusion</li> </ul>	2
<ul style="list-style-type: none"> <li>Provides some relevant information</li> </ul>	1

### Sample answer:

Test data (ScreenSize)	Expected output (Viewport)	Reason for inclusion
1024	Desktop	Boundary check
768	Tablet	Boundary check
100	Phone	Below lowest screen size check
850	Tablet	Between Tablet and Desktop
2000	Desktop	Above highest screen size check

## Question 12 (a)

Criteria	Marks
<ul style="list-style-type: none"> <li>Explains how a developer could test a website for cross-platform compatibility</li> </ul>	3
<ul style="list-style-type: none"> <li>Outlines how to test a website for cross-platform compatibility</li> </ul> OR <ul style="list-style-type: none"> <li>Identifies strategies to test a website for cross-platform compatibility</li> </ul>	2
<ul style="list-style-type: none"> <li>Provides some relevant information</li> </ul>	1

### Sample answer:

A web developer can use browser developer tools. These tools, built into most modern browsers, allow developers to simulate how their website looks and behaves on different devices and screen sizes. By using these tools, developers can identify and fix any issues related to cross-platform compatibility, ensuring that the website works well across a variety of devices and browsers.

### Answers could include:

- The use of online tools built specifically for testing cross-platform compatibility
- Conducting manual testing on different devices and browsers can help identify any remaining issues
- The developer could validate the website's code using the W3C Markup Validation Service to ensure it meets the web standards.

**Question 12 (b)**

Criteria	Marks
<ul style="list-style-type: none"> <li>Explains how the load time of a web page can be improved using a progressive web app (PWA)</li> </ul>	3
<ul style="list-style-type: none"> <li>Outlines some features of a progressive web app (PWA) and/or issues affecting load time</li> </ul>	2
<ul style="list-style-type: none"> <li>Provides some relevant information</li> </ul>	1

**Sample answer:**

A progressive web app (PWA) can optimise assets by compressing files and pre-caching important resources, allowing files such as image-gallery.js and video-gallery.js to be loaded into memory or cache while the rest of the page loads. PWAs also use service workers to cache resources, ensuring faster load times on repeat visits and offline functionality. They also use lazy loading, where only the necessary content is loaded initially, improving load speed, while other non-essential resources are loaded as needed.

**Question 13**

Criteria	Marks
<ul style="list-style-type: none"> <li>Describes the function of protocols in the transfer of data, with reference to a specific web protocol</li> </ul>	3
<ul style="list-style-type: none"> <li>Describes the function of protocols in the transfer of data</li> </ul> OR <ul style="list-style-type: none"> <li>Provides an example of a web protocol and its use</li> </ul>	2
<ul style="list-style-type: none"> <li>Provides some relevant information</li> </ul>	1

**Sample answer:**

Protocols are important in data transfer as they establish rules for communication between devices connected to a network, such as the internet. HTTP (Hypertext Transfer Protocol) enables browsers to request web content from servers, which respond with the requested data. The protocol defines the structure of requests and the response so that data transfer can occur.

**Answers could include:**

- TCP/IP
- DNS
- FTP, SFTP
- SSL, TLS
- SMTP, POP 3, IMAP
- Data packets.

## Question 14

Criteria	Marks
<ul style="list-style-type: none"> <li>Provides substantially correct pseudocode</li> <li>Includes at least ONE subroutine</li> </ul>	3
<ul style="list-style-type: none"> <li>Provides pseudocode that addresses some of the requirements</li> </ul>	2
<ul style="list-style-type: none"> <li>Shows some understanding of the problem</li> </ul>	1

### Sample answer:

```

BEGIN main
    Get num_pizzas
    total_cost = 0
    FOR i = 1 TO num_pizzas
        Get pizza_size

        Get num_toppings
        cost_per_pizza = calculate_pizza_cost(pizza_size,
num_toppings)
        DISPLAY cost_per_pizza
        total_cost = total_cost + cost_per_pizza
    NEXT i
    DISPLAY total_cost
END main

BEGIN calculate_pizza_cost(size, num_toppings)
    base_price = 10
    topping_price = 1.5
    IF size = "Medium" THEN
        base_price = base_price + 2
    ELSEIF size = "Large" THEN
        base_price = base_price + 4
    ENDIF
    pizza_cost = base_price + num_toppings * topping_price
    RETURN pizza_cost
END calculate_pizza_cost

```

**Question 15**

Criteria	Marks
• Describes how machine learning algorithms can be used in data analysis	3
• Outlines some features of machine learning algorithms relevant to data analysis	2
• Provides some relevant information	1

**Sample answer:**

Machine learning algorithms can be trained with a subset of the data to automatically identify patterns and trends within large datasets. The algorithms can handle complex relationships and nonlinearities present in the data allowing for efficient and comprehensive analysis. Machine learning can also be used for predictions and forecasting. These models can learn from new data over time, continuously improving their analysis and predictive accuracy and performance.

**Question 16 (a)**

Criteria	Marks
• Identifies the correct answer	1

**Answer:**

The id "se\_item" has not been correctly referenced.

**Question 16 (b)**

Criteria	Marks
• Outlines TWO benefits of adding CSS to the company's website	2
• Provides some relevant information	1

**Sample answer:**

It can provide the same look and feel across the company's websites for consistency and ease of use. Separate html and CSS code can allow developers to work independently on files.



## Question 17

Criteria	Marks
• Provides a correct SQL query	3
• Provides a SQL query that addresses some of the requirements	2
• Shows some understanding of SQL	1

### Sample answer:

```
SELECT Products.Name AS 'Product', Suppliers.Name AS 'Supplier'
FROM Products, Suppliers
WHERE Products.SupplierID = Suppliers.SupplierID
      AND Products.Producer = 'Yumtreats'
      AND Products.Mass >= 50
ORDER BY Products.Name DESC
```

## Question 18 (a)

Criteria	Marks
• Explains how defensive data input handling practices can be implemented for the website	3
• Outlines some features of data input handling practices	2
• Provides some relevant information	1

### Sample answer:

Data sanitisation using client-side scripting can clean the data and remove dangerous input. Input validation on the client-side can check that entered data meets all of the requirements before getting processed by the server. Errors generated by data not meeting rules can be shown to the user.

**Question 18 (b)**

Criteria	Marks
• Provides a correct function in Python to check whether a username satisfies the rules	3
• Provides a partially correct function in Python to check the username	2
• Shows some understanding of the problem and Python programming	1

**Sample answer:**

```
def validate_username(username):
    valid = True

    # length check
    if len(username) < 8:
        valid = False
    elif (not username[0].isupper()):
        valid = False
    elif (not username[-2].islower()):
        valid = False
    elif (not username[-1].isdigit()):
        valid = False

    return valid
```

**Question 19**

Criteria	Marks
• Explains how authentication and authorisation could be applied to the app	4
• Explains how authentication or authorisation could be applied to the app OR • Outlines how authentication and authorisation could be applied to the app	3
• Outlines some features of authentication and/or authorisation	2
• Provides some relevant information	1

**Sample answer:**

Authentication ensures that only staff and students with valid usernames and passwords, which should be encrypted in storage (eg using hashing), can access the app. Authorisation controls access to specific features of the app based on user roles or groups. Teachers may have permissions to upload, assign and track homework, while students can only download tasks and upload completed work. By organising users into specific roles or groups, the app restricts access to appropriate functionality, ensuring that each user can only perform actions relevant to their role or group.

### Question 20 (a)

Criteria	Marks
<ul style="list-style-type: none"> <li>Correctly determines the outcomes</li> </ul>	1

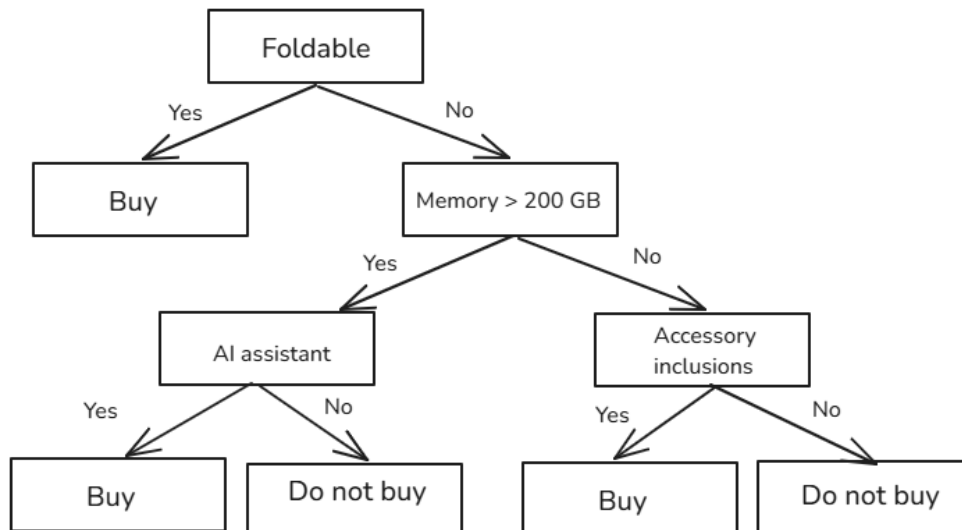
**Answer:**

	Buy	Do not buy
Memory = 256 GB, AI Assistant = Yes, Accessory inclusions = No	<input checked="" type="radio"/>	<input type="radio"/>
Memory = 128 GB, AI Assistant = No, Accessory inclusions = Yes	<input checked="" type="radio"/>	<input type="radio"/>
Foldable = Yes, AI Assistant = No, Accessory inclusions = No	<input checked="" type="radio"/>	<input type="radio"/>

### Question 20 (b)

Criteria	Marks
<ul style="list-style-type: none"> <li>Draws a correctly simplified decision tree</li> </ul>	3
<ul style="list-style-type: none"> <li>Draws a simplified decision tree with most of the logic</li> </ul>	2
<ul style="list-style-type: none"> <li>Shows some understanding of the requirement</li> </ul>	1

**Sample answer:**



**Question 21 (a)**

Criteria	Marks
<ul style="list-style-type: none"><li>Identifies the correct answer</li></ul>	1

**Answer:**

Timetable[0][2]

## Question 21 (b)

Criteria	Marks
<ul style="list-style-type: none"> <li>Provides a substantially correct Python program that addresses the following requirements: <ul style="list-style-type: none"> <li>Places each subject in the correct period</li> <li>Displays all 5 days of the timetable</li> <li>Provides a solution with appropriate subroutines</li> <li>Programmatically builds the timetable</li> </ul> </li> </ul>	5
<ul style="list-style-type: none"> <li>Provides a Python program that addresses most of the requirements</li> </ul>	4
<ul style="list-style-type: none"> <li>Provides Python code that addresses some of the requirements</li> </ul>	3
<ul style="list-style-type: none"> <li>Provides Python code that addresses a requirement</li> </ul>	2
<ul style="list-style-type: none"> <li>Shows some understanding of the problem</li> </ul>	1

### Sample answer:

```

subjects = ["English", "Software", "Drama", "Science", "Art"]
NUM_DAYS = 5
NUM_PERIODS = 5
DAYS_OF_WEEK = ["Monday", "Tuesday", "Wednesday", "Thursday", "Friday"]

def create_timetable(subjects):
    timetable = []
    for day in range(NUM_DAYS):
        periods = []
        for period in range(NUM_PERIODS):
            periods.append(subjects[(period - day) % NUM_PERIODS])
        timetable.append(periods)
    return timetable

def print_timetable(timetable):
    print()
    for day in range(NUM_DAYS):
        print(f"{DAYS_OF_WEEK[day]}")
        for period in range(NUM_PERIODS):
            print(f"\tPeriod {period+1}: {timetable[day][period]}")
        print()

timetable = create_timetable(subjects)
print_timetable(timetable)

```

## Question 22 (a)

Criteria	Marks
• Correctly completes the SQL query	2
• Correctly selects at least TWO correct options	1

**Answer:**

```
SELECT Level, COUNT(Level)
FROM Students
GROUP BY Level
```

## Question 22 (b)

Criteria	Marks
<ul style="list-style-type: none"> <li>Provides an example of when a race condition may occur in this scenario</li> <li>Outlines how secure code could be implemented to prevent it</li> </ul>	3
<ul style="list-style-type: none"> <li>Outlines some features of race conditions</li> </ul>	2
<ul style="list-style-type: none"> <li>Provides some relevant information</li> </ul>	1

**Sample answer:**

With multiple teachers potentially accessing the database at the same time, race conditions can allow malicious users to gain unauthorised access. Authentication could be used to restrict access to the database, and code can be written to use atomic transactions and database locks to time the reading and writing of data.

## Question 23 (a)

Criteria	Marks
<ul style="list-style-type: none"> <li>Shows thorough understanding of how the effects of human bias on the training of machine learning algorithms can be minimised</li> </ul>	3
<ul style="list-style-type: none"> <li>Outlines some effects of human bias on machine learning</li> </ul> OR <ul style="list-style-type: none"> <li>Outlines some features of the training of machine learning algorithms</li> </ul>	2
<ul style="list-style-type: none"> <li>Provides some relevant information</li> </ul>	1

**Sample answer:**

Training data is initially selected by humans, who may unintentionally introduce their own biases. To minimise this, ensure that training data is representative of the problem the ML model will address. Reviewing data by individuals from diverse backgrounds could identify and reduce potential biases, ensuring fairer and accurate model performance.

## Question 23 (b)

Criteria	Marks
• Compares linear regression and K-nearest neighbour	3
• Outlines features of linear regression and/or K-nearest neighbour	2
• Provides some relevant information	1

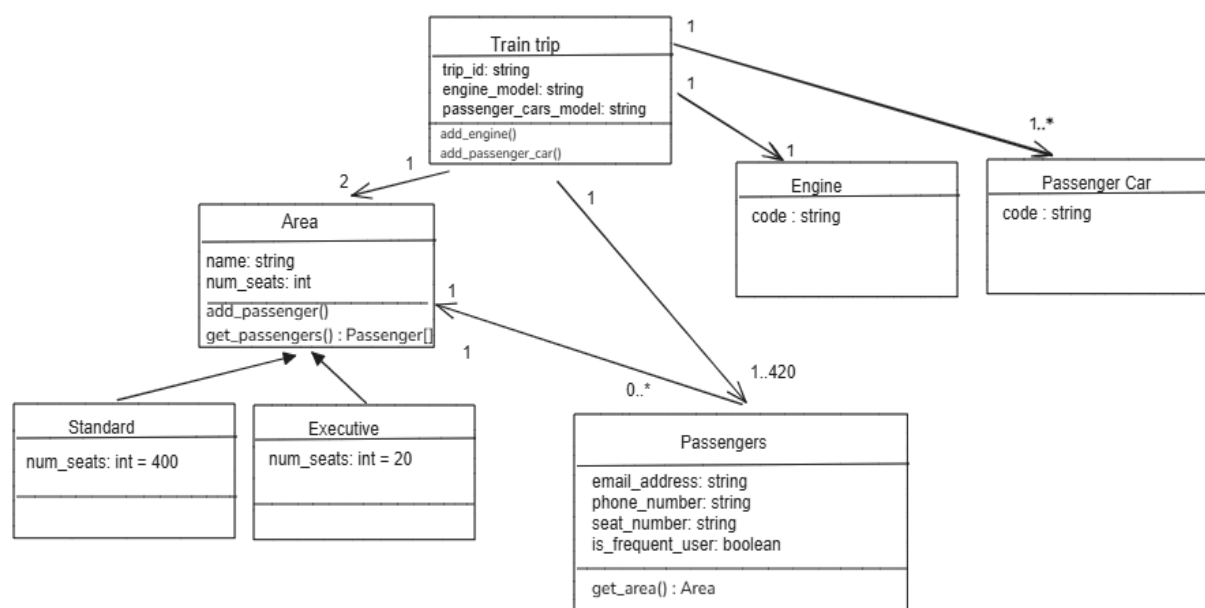
### Sample answer:

Linear regression and K-nearest neighbours (KNN) are both supervised learning algorithms that make predictions from labelled data. The key difference is how they handle data: linear regression assumes a linear relationship between input features and the target variable, while KNN makes predictions based on the closest 'K' training examples, allowing it to handle more complex, non-linear patterns. However, KNN can be more computationally expensive than linear regression and is usually slower.

## Question 24

Criteria	Marks
• Creates a substantially correct class diagram that includes suitable classes with attributes, and methods showing inheritance, relationships and multiplicity	4
• Creates a class diagram that represents most features of the system	3
• Creates a class diagram with some features of the system	2
• Provides a diagram that shows some understanding of the scenario	1

### Sample answer:



## Question 25

Criteria	Marks
<ul style="list-style-type: none"> <li>Discusses the proposal for security enhancements to the company's systems, with reference to machine learning (ML) in DevOps, robotic process automation (RPA) and business process automation (BPA) from the slideshow</li> </ul>	8
<ul style="list-style-type: none"> <li>Outlines advantages and disadvantages of the proposal, with reference to at least TWO of these areas: machine learning (ML) in DevOps, robotic process automation (RPA), business process automation (BPA)</li> </ul>	6–7
<ul style="list-style-type: none"> <li>Outlines some advantages and/or disadvantages of the proposal, with reference to machine learning (ML) in DevOps and/or robotic process automation (RPA) and/or business process automation (BPA)</li> </ul>	4–5
<ul style="list-style-type: none"> <li>Shows some understanding of the features of the proposal</li> </ul>	2–3
<ul style="list-style-type: none"> <li>Provides some relevant information</li> </ul>	1

### **Sample answer:**

QuidantCon's proposal for the company suggests leveraging machine learning (ML) and automation to bolster security measures. One key benefit is the automation of security testing and vulnerability scanning, facilitated by integrating ML-powered tools into the DevOps pipeline. This approach ensures continuous security testing and provides rapid feedback to developers, allowing for early detection of security issues and reducing the risk of vulnerabilities being exploited. The frequent and automated testing improves the overall security position and enhances compliance with industry standards. Additionally, ML algorithms can analyse vast amounts of data to detect patterns and anomalies, which is crucial for proactive threat identification. This capability enables the company to identify security risks proactively, learn from past incidents, and predict future attacks, thereby enhancing their overall security measures.

QuidantCon's proposal for the company also raises some concerns. One key issue is the need for high-quality data for ML algorithms to work effectively. If the data is inconsistent or incomplete, the ML models may not perform well, leading to false positives or missed threats. Another concern is the complexity of implementing ML solutions, which can be challenging and may require specialised skills and training. This complexity could result in integration challenges, higher costs, and delays. Additionally, ML systems can be biased, potentially affecting security decisions. Security and privacy are also critical, as handling sensitive data requires protection against unauthorised access and breaches. These concerns emphasise the need for a careful and balanced approach when considering ML and automation in security practices.

### **Answers could include:**

Automation of security testing and vulnerability scanning:

- Automation of security testing including the use software tools to automatically test the security of an application or system
- Conducting scans for vulnerabilities, misconfigurations, and potential threats
- Automation helps in detecting security issues early in the development lifecycle, reducing the risk of vulnerabilities being exploited
- Automation also enables more frequent testing, improving overall security posture and compliance with security standards
- Integration of automation into the DevOps pipeline, allowing for continuous security testing and rapid feedback to developers.



Use of machine learning powered tools to enhance security practices:

- Machine learning helps in identifying security risks by analysing vast amounts of data to detect patterns and anomalies that may indicate a potential threat
- Machine learning algorithms can learn from past security incidents and use this knowledge to predict and prevent future attacks
- Machine learning can automate the analysis of security logs and events, providing real time insights
- Machine learning can assist in automating incident response in RPA, enabling faster and more effective mitigation of security risks.

Safe and efficient operation of Robotic Process Automation (RPA) bots:

- Machine learning algorithms for real-time detection and response to security threats
- Machine learning algorithms can continuously monitor RPA bot behaviour to detect any anomalies or deviations from normal operation
- By analysing data on bot performance and interactions, machine learning can identify potential security threats or operational issues
- Machine learning can optimise the performance of RPA bots by identifying areas for improvement and suggesting enhancements.

Protection of Business Process Automation workflows from cyber threats

- Machine learning algorithms can analyse BPA workflows to identify potential vulnerabilities
- By continuously monitoring BPA processes, machine learning can detect and respond to cyber threats in real-time
- Machine learning can automate the implementation of security controls and policies
- Machine learning can enhance BPA workflows by predicting and preventing potential security breaches.

Additional benefits of machine learning in security:

- Improved efficiency and accuracy in detecting security threats
- Enhanced ability to respond to security incidents in real-time
- Ensuring security and compliance while automating business processes.

Disadvantages of ML in Security:

- Complexity and learning curve
- Dependency on data quality
- Potential for bias
- Security and privacy concerns
- Integration challenges
- Cost considerations.

# HSC Software Engineering Sample Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes	Targeted performance bands
1	1	Secure Software Architecture – requirements definition	SE-12-07	2–3
2	1	Programming for the Web – SMTP	SE-12-03	2–3
3	1	Secure Software Architecture – data protection	SE-12-05	2–3
4	1	Secure Software Architecture – benefits of collaboration	SE-12-01	3–4
5	1	Software Engineering Project – implementation methods	SE-12-07	3–4
6	1	Programming for the Web – front-end web development	SE-12-06	3–4
7	1	Software Engineering Project – pseudocode	SE-12-06	3–4
8	2	Secure Software Architecture – SAST and DAST	SE-12-07	4–5
9	2	Software Engineering Project – algorithm construction	SE-12-07	4–5
10	2	Software Engineering Project – structure chart	SE-12-06	5–6
11	3	Software Engineering Project – testing data	SE-12-08	2–4
12 (a)	3	Programming for the Web – use of developer tools	SE-12-06	2–4
12 (b)	3	Programming for the Web – progressive web app	SE-12-06	2–4
13	3	Programming for the Web – the function of web protocols	SE-12-03	2–5
14	3	Software Engineering Project – algorithm design	SE-12-08	3–5
15	3	Software Automation – applications of ML algorithms	SE-12-03	3–5
16 (a)	1	Programming for the Web – HTML and CSS	SE-12-02	3–4
16 (b)	2	Programming for the Web – CSS and its impact on the design of a web application	SE-12-02	3–5
17	3	Programming for the Web – SQL	SE-12-02	3–5
18 (a)	3	Secure Software Architecture – defensive data input handling practices	SE-12-04	3–5
18 (b)	3	Secure Software Architecture – programming with Python	SE-12-07	3–5
19	4	Secure Software Architecture – authentication and authorisation	SE-12-04, SE-12-06	3–6
20 (a)	1	Software Automation – decision tree	SE-12-09	4–5
20 (b)	3	Software Automation – decision tree	SE-12-09	3–5
21 (a)	1	Software Engineering Project – programming with Python	SE-12-02	3–4

Question	Marks	Content	Syllabus outcomes	Targeted performance bands
21 (b)	5	Software Engineering Project – programming with Python	SE-12-02, SE-12-07	2–6
22 (a)	2	Programming for the Web – SQL	SE-12-02, SE-12-08	3–5
22 (b)	3	Secure Software Architecture – vulnerabilities in user action controls	SE-12-04	4–6
23 (a)	3	Software Automation – human bias in the development of ML	SE-12-05	3–5
23 (b)	3	Software Automation – linear regression and K-nearest neighbour	SE-12-03	4–6
24	4	Software Engineering Project – demonstrate the use of modelling tools	SE-12-06, SE-12-09	3–6
25	8	Software Automation – the use of DevOps, robotic process automation (RPA) and business process automation (BPA), common applications of key ML algorithms	SE-12-03, SE-12-04, SE-12-05	2–6