

# Girraween paper sample answers

2025

Higher School Certificate

Year 12 Trial HSC Examination

Software Engineering

General Instructions

- Reading time - 10 minutes
- Working time - 2 hours 20 minutes

**Total Marks: 80**

**Section I**

Total marks (20)

- Attempt questions 1-17
- Allow about 25 minutes for this section

**Section II**

Total marks (60)

- Attempt questions 18-30
  - Allow about 1 hour and 55 minutes for this section
- 

**Section I**

**Total marks (20)**

**Attempt Questions 1-17**

**Allow about 25 minutes for this section**

1.

Which of the following concepts in object-oriented programming refers to the mechanism where you can derive a class from another class for a hierarchy of classes that share a set of attributes and methods.

- ☒ ☒ **Inheritance**
- ☐ **Abstraction**
- ☐ **Polymorphism**
- ☐ **Encapsulation**

1/1p

2.

The preferred diagram for modelling classes is

- ☒ ☒ **Universal Modelling Language**
- ☐ **Context diagram**
- ☐ **Class Data flow diagram**
- ☐ **Class models**

1/1p

3.

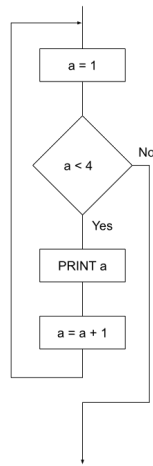
Which type of testing is extensively used when developing mechatronic solutions.

- ☒ ☒ **Unit testing**
- ☐ **Grey box testing**
- ☐ **Black box testing**
- ☐ **Oscilloscope testing**

1/1p

4.

What is the most significant issue with this flowchart?

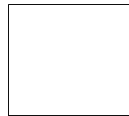


- ☒ ☒ There is an endless loop
- ☐ The condition should be  $a \leq 1$
- ☐ The variable  $a$  is the incorrect data type
- ☐ ☒ A non-standard control structure is used

0/1p

5.

What does the following symbol represent when used in a data flow diagram?



- ☐ A data store
- ☐ A subroutine
- ☒ ☒ An external entity
- ☐ A manual process

1/1p

6.

Which statement explains why the below programming pattern is common in mechatronic system design.

**setup () # runs once**  
code...

**loop () # infinite loop**  
code...

- ☐ As the loop allows for repetitive system design.
- ☒ ☒ So the hardware can be configured before the software implementation.
- ☐ Because it is a requirement of the IDE.
- ☐ As the loop needs to happen after setup.

1/1p

7.

Consider the following algorithm

The array arrAge contains 50 elements and is indexed from 0.

```

1 BEGIN
2   sumOfAges = 0
3   FOR index = 0 TO 50 STEP 1
4     sumOfAges = sumOfAges + arrAge(i)
5   NEXT index
6   averageAge = sumOfAges/numItems
7 END
  
```

a) What control structure is used in the algorithm?

- ☐ Multiway loop
- ☐ Post-test loop
- ☒ ☒ Counted loop
- ☐ Pre-test loop

1/1p

b) When coded and executed an error occurs. Which of the following best describes this error?

- ☐ Logic error
- ☐ Syntax error
- ☐ Parsing error
- ☒ Runtime error

1/1p

8.

Identify the appropriate headings for a "software requirements" document

- ☐ Software document
- ☐ Test data
- ☒ Functional requirements
- ☐ Non functional requirements

1/2p

9.

In linear regression, what is the primary goal of the model?

- ☒ To predict the value of a dependent variable based on one or more independent variables
- ☐ To classify data into distinct categories
- ☐ To cluster similar data points together
- ☐ To minimize the number of features in the dataset

1/1p

10.

What type of relationship does polynomial regression model?

- ☒ Non-linear relationships between variables
- ☐ Only linear relationships
- ☐ Random relationships without any pattern
- ☐ Only relationships involving three variables

1/1p

11.

Which of the following is a key advantage of using neural networks?

- ☒ They can learn complex patterns from large amounts of data
- ☐ They require less data than traditional models
- ☐ They are always faster than other algorithms
- ☐ They do not require any tuning of parameters

1/1p

12.

In a decision tree, what do leaf nodes primarily represent?

- ☐ They are used for splitting the data.
- ☐ They connect different levels of the tree.
- ☐ They represent the decision points in the tree.
- ☒ They are the final output or classification.

1/1p

13.

Which of the following is an example of supervised learning?

- ☒ Classification of emails as spam or not spam
- ☐ Clustering customer segments
- ☐ Market basket analysis
- ☐ Anomaly detection in network traffic

1/1p

14.

In mechatronics, which technique would you use to group similar sensor readings without prior labels?

- ☐ Supervised learning
- ☒ Unsupervised learning
- ☐ Reinforcement learning
- ☐ Deep learning

1/1p

15.

Email clients send mail using which protocol?

- ☒ SMTP
- ☐ POP3
- ☐ IMAP
- ☐ FTP

1/1p

16.

The following context diagram describes a food ordering app.



Based on the above diagram, which statements are correct?

- ☐ Food outlets, Customers and Financial Institutions are sub-modules or sub-programs
- ☒ This is a level 0 data flow diagram
- ☐ Food Ordering App is an external entity that interacts with the system
- ☒ Food outlets, Customers and Financial Institutions are external entities
- ☐ The Food Ordering App sends the Order Details to the Food Outlet before the Transaction Status is received

2/2p

17.

A user logs into their bank's website, which allows money transfers via a button. A hacker sends the user a malicious email containing a link. When the user clicks the link, a money transfer request is executed without their knowledge.

What type of attack is this?

- ☒ Cross-Site Request Forgery (CSRF)
- ☐ Cross-Site Scripting (XSS)
- ☐ Denial of Service (DoS)
- ☐ SQL Injection

1/1p

## Section II

Total marks (60)

Attempt ALL Questions (Q18 - Q30)

Allow about 1 hour and 55 minutes for this section

18.

Match the debugging tool with the definition

<input checked="" type="checkbox"/> Breakpoint	An intentional stopping or pausing place in a program.
<input checked="" type="checkbox"/> Single line step	Executing code one instruction or line at a time.
<input checked="" type="checkbox"/> Compiler	Translate the entire code at once, displaying all syntax errors in a list.
<input checked="" type="checkbox"/> Debugging output statements	Inserting in the source code statements that print the content of variables or notifying events have occurred.
	Installed tools to support debugging

4/4p

19.

Distinguish between authentication and authorisation

Answer:

Authentication is a process which verifies the identity of a user. For example, a log in page will authenticate a user by determining whether the provided credentials match an existing user.

Authorisation is a process which determines the permission levels of a user based on their role or other attributes. For example, when accessing a critical feature of a program such as a database, the system should authorise or deny access to a user based on their role or attributes.

80 words

2/2p

20.

The Python code below defines a function that allows a user to purchase an item.

```
import threading
lock = threading.Lock()
def purchase_item(user_id, item_id):
    with lock:
        if inventory[item_id] > 0:
            inventory[item_id] -= 1
            confirm_purchase(user_id, item_id)
```

Explain what a race condition is and how it could affect the purchase\_item function if no lock was implemented.

**Answer:**

A race condition is a security vulnerability in which information is processed concurrently on multiple threads, which causes an unpredictable output and unpredictable output order. The lock in the purchase\_item function prevents multiple purchases from being submitted to the system at once, ensuring that the system is updated in a predictable manner. If no lock was implemented, then multiple customers would be able to purchase items at the same time, which may be common in events such as sales or product launches. This would cause unpredictable behaviour and may result in orders not being processed correctly or duplicate orders being processed.

102 words

3/3p

21.

A school's online portal allows students to upload assessment files. Recently, a student discovered that by modifying the URL, they could access and download other students' submitted files. It was also found that students could re-upload their work multiple times, overwriting previous submissions without detection even after the due date.

Describe how confidentiality, accountability and integrity has been compromised in this scenario.

**Answer:**

Confidentiality has been compromised as the student, who is unauthorised, was able to easily access sensitive data (assessment files) through an invalid forwarding and redirecting vulnerability.

Accountability has been compromised as the student, who executed these actions, was not authenticated or authorised by the server, and no logs were recorded of submissions even after the due date. This means the school will be unable to identify who has uploaded which file.

Integrity has been compromised in this scenario by the student, as the files he is uploading are no longer genuine and correct. He is uploading assessments that are not owned and created by him, meaning there is no integrity in what he has submitted under his own name.

119 words

4/4p

22.

Discuss the benefits of collaboration in software engineering.

In your response:

- Highlight at least three key advantages that effective collaboration can bring to a software development project.
- Provide an example of a collaboration tool and explain how it facilitates collaboration among developers.

**Answer:**

There are three key advantages which effective collaboration in teams or as individuals can bring to a software development project: efficiency, higher quality software solutions, and effective debugging. Collaboration in software development projects is often done with programs such as Git/GitHub, which allow for multiple developers and teams to collaborate in one project and maintain version control.

Working in teams or with multiple developers is more efficient as different tasks can be handled by different teams or individuals concurrently. For example, a team may have a front-end development team, a back-end development team, and a tester team. Each team will be responsible for creating one aspect of a project, as opposed to a single dev creating all aspects, which reduces the time taken to complete a software development project. These can all be put together in a GitHub repository, which allows all members to keep track of both individual teams' progress and progress across the entire project, along with providing a central location to compile a project and discuss bugs or new features.

Higher quality software solutions can be produced through collaboration, as each allocated team will likely specialise in the task their team is assigned to. Continuing from the previous example, the front-end development team will contain developers who are experienced in and specialise in front-end development. This will mean that the front-end aspect of the project will be completed both quickly and to a high standard, compared to if one developer completed the full project. An individual dev may only specialise in one or two aspects, which may reduce quality of other aspects. Improvements and upgrades may also be more feasible- other members of the team can propose improvements and these can be pushed through version control on GitHub.

Debugging will be more effective in a collaborative setting as there will be multiple people who will view and run the code, which allows more bugs and vulnerabilities to be caught early, and reduces time taken to debug. From the initial example, a front-end development team may be able to easily catch each others' bugs or vulnerabilities in their code before it becomes officially part of a project. This reduces the time spent on debugging and prevents easily exploitable vulnerabilities from being released. Additionally, if there is a separate tester team, they will specialise in finding bugs and vulnerabilities within a system- this also means that there is a higher chance of a secure project, as opposed to an individual dev either taking excessive amounts of time to debug, or missing critical bugs or vulnerabilities.

427 words

6/6p

23.

You have been tasked with designing and developing a Progressive Web App (PWA) aimed at enhancing the accessibility and inclusivity of educational resources for infants school students.

Outline how you would address the following key design principles when creating the user interface (UI) and user experience (UX) of your PWA.

- Font selection and typography
- Colour schemes and contrast
- The use of audio and video elements
- Navigation design

**Answer:**

When designing this program, I would ensure that fonts are large and in a simple font which does not contain extra details which may make letters hard to distinguish, or use fonts specifically targeted at disabilities such as dyslexia. I would also reduce any special effects to fonts to ensure visual clarity to prevent confusion. Additionally, text should be reasonably large and spaced out enough to be easy on the eyes. This is to ensure that students will be able to read and comprehend resources provided on the PWA.

For colour schemes and contrast, colours should be a mix of both white/paler colours for backgrounds and bolder colours or black for elements such as text or navigation bars. This ensures that the program itself is visually engaging for students, but does not sacrifice readability. The contrast between the colours should be strong enough to ensure that students can distinguish between different elements- for example, using dark text on a light background. This also makes sure that text is readable and accessible to all students.

With audio elements, these should be used in moderation. Audio, such as music, is not required for all aspects of a website, but could be presented as an option for students. This prevents students from being distracted from tasks at hand on the PWA. Audio may be used to read text out loud for students who struggle with reading or are visually impaired, which allows all students to access the same resources.

With visual elements, these should also be used in moderation. Excessive use of visual cues such as images or flashing colours may either distract children from the task, trigger conditions such as epilepsy, or overload senses for children who struggle with sensory overload. By using visuals only where necessary, such as illustrating a concept or as a mascot, this keeps the task engaging while preventing distraction and other health related issues.

Navigation throughout the app should be kept as simple and minimal as possible. As some children may find excessive categories overwhelming or difficult to find what they require, any internal navigation links should be kept to a minimum, and presented in large enough text and spacing to ensure readability for all users. Additionally, audio transcription can be provided to ensure that visually impaired children will also be able to navigate the PWA.

390 words

6/6p

24.

Compare and contrast between supervised and unsupervised learning. Give a real world example for each

**Answer:**

Supervised learning is a method of training a machine learning model by providing existing datasets and their outputs to a model to 'learn' from. An example of supervised learning is providing images of dogs and cats, and labelling each image as either a dog or a cat. This is an example of classification, where the machine learning model will learn to classify each category based on attributes. The model is trained on this dataset, where it learns the attributes of dogs and cats to correctly identify them.

Unsupervised learning is a method of providing datasets without outputs, and instead allowing the model to create patterns on its own. For example, data of images of dogs and cats may be provided, but without any labels. The machine learning model will categorise each image by similarities in attributes, and will learn to classify each with increasing accuracy over time.

147 words

4/4p

25.

For the algorithm

```
1  START myFunction (array[])
2  SET num = array[0]
3  FOR index = 0 TO 4 STEP 1
4    IF array[index] > num
5      num = array[index]
6    ENDIF
7  NEXT index
8  PRINT num
9  END myFunction
```

a) Outline the purpose of the algorithm

**Answer:**

This algorithm cycles through each list item of the given array of numbers, starting from the first number, to check for the largest number in the list. The purpose of this algorithm is to find and print the largest number in an array or list.

32 words

2/2p

b) There is an error in the algorithm. Perform a Desk check of the algorithm assuming the passed in array is [1, 6, 19, 3] and identify the line and type of error.

**Answer:**

In line 3, the for loop states that the loop should be iterated from index = 0 to 4. As Python is zero-indexed, the first number will be 0. There are 4 values in the array given in the example, so the indices will be 0, 1, 2, and 3. This causes an out of range error, as the loop will be unable to test the 4th index, and preventing the program from printing the final number.

76 words

3/3p

c) Identify and outline three improvements you can make to this algorithm

**Answer:**

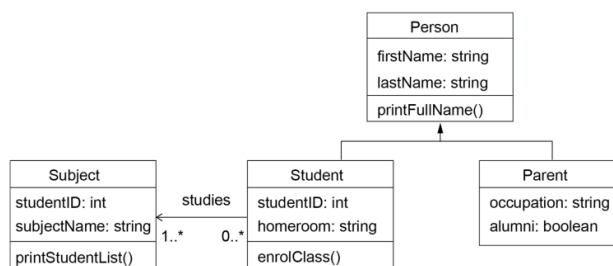
1. Can first sort the list in ascending order using the sort() function, allowing the algorithm to grab the last term which must be the largest number, no matter how big the list is. This also makes the algorithm faster as it no longer has to iterate through every list item and save the largest number each time, making it highly scalable.
2. Can check the length of the list instead of hard coding a for loop from 0 to 4 so that lists of many lengths can be put through the function
3. There can be a check put in place to validate the inputted list, making sure that there are no other characters and only integers or floats to ensure that no error occurs when trying to use the operator, as you cannot use it with strings.

49 words

3/3p

26.

Consider the following class diagram which models a student management system:





Based on the provided class diagram for Student Management System discuss the relationships and key principles of Object-Oriented Programming (OOP) that are demonstrated. Your answer should specifically address:

1. **Inheritance:** Identify an example of inheritance and explain its purpose.
2. **Encapsulation:** Describe how encapsulation is applied within the classes, referencing attributes and methods.
3. **Composition or Aggregation:** Explain the relationship between the classes. Justify your answer.

**Answer:**

The Student and Parent class both inherit from the Person class, in an example of multiple inheritance. This allows for the Student and Parent class to inherit common methods and attributes from the Person class, to reduce redundant methods and making code more reusable and easy to read.

2. Encapsulation in OOP refers to the hiding of the background processes of an algorithm through a method. In this UML diagram, the enrolClass() function of Student is encapsulated, hiding all the backend algorithms that allow for a student to enrol into a class. Furthermore, the printStudentList() method of the Subject class is encapsulated in a function as similarly, the back end program is hidden.

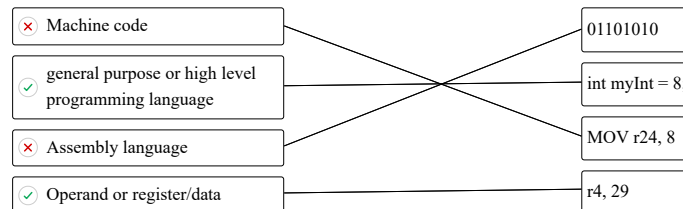
3. Subject is an aggregation of Student, where multiplicity shows that a subject can have 0 or more students studying it while a student must have at least 1 subject. Aggregation of the class shows that the Subject class can exist on its own without the student.

209 words

5/5p

27.

Match the code snippet with it's type.



1/2p

28.

- a) Identify the error in the following SQL query and provide the correct version: `SELECT * FROM users WHERE age = '20';`

**Answer:**

The error is the program uses only a single equals sign, not a double equal sign. When looking for a number in SQL, you should not use quotations around number values, whereas here they have put quotations around the '20' signifying that it is a string instead of a number. To fix this, the SQL query should be: `SELECT * FROM users WHERE age=20.`

26 words

1/1p

- b) Fix the syntax error in the following SQL statement: `INSERT INTO students VALUES (1, 'John', 'Doe');`

**Answer:**

`INSERT INTO students VALUES (1, 'John', 'Doe');`

7 words

1/1p

- c) What is wrong with this SQL query? `UPDATE products SET price = '19.99' WHERE id = 5;`

**Answer:**

there should be no quotations around 19.99

0.5/1p

- d) Identify the mistake in this SQL statement: SELECT name, age FROM employees WHERE age > '30';

**Answer:**

Similarly to part A, there should be no quotations around the numbers when trying to use operators. Checking age > '30' is invalid as '30' is recognised as a string rather than an integer value. Thus, to fix this, the correct statement should be SELECT name, age FROM employees WHERE age > 30

1/1p

**29.**

The K-Nearest Neighbours (KNN) algorithm is used to classify a new data point by comparing it to existing classified/labelled data points. It calculates the Euclidean distance between the new data point (shown as a question mark on the chart below) and every other point in the training data. It then counts the labels of the k closest points. The most common label among these neighbours is the predicted label assigned to the new point.



Write a pseudocode algorithm for a function called knn. It is passed:

- newPoint: the x and y coordinates of the point to classify as A, B, C or D
- tData: an array of x and y coordinates for all labelled points
- tLabels: an array of strings with the label A, B, C or D for each known point
- k: an integer

You may use the following pre-defined functions in your algorithm:

- distance(p1, p2): returns the Euclidean distance between two (x, y) points
- sort(pairlist): sorts an array of [distance, label] pairs in ascending order by distance
- mode(array): returns the label that occurs most frequently in an array

Your algorithm should return the predicted label for the new data point.

**Answer:**

```
tData = [x, y]
tLabel = [x, y, Label]
START knn(newPoint[], k)
  index = 0
  distance_array = []
  k_common_labels = []
  FOR index IN tData:
    p2 = tData[index]
    distance = distance(newPoint, p2)
    distance_array APPEND (distance, tLabel[row[index], column[2]])
  ENDFOR
  sort(distance_array)
  FOR x in distance_array IN range = k:
    label = distance_array[row[x], col[1]]
    k_common_labels APPEND label
  ENDFOR
  prediction = mode(k_common_labels)
  RETURN prediction
END knn
knn_prediction = knn(newPoint[], k)
PRINT knn_prediction
```

80 words

4/4p

30.

Your friends have asked you for a simple program to convert their results to a band where:

- Band 6 = 90 - 100 marks.
- Band 5 = 80 - 89 marks.
- Band 4 = 70 - 79 marks.
- Band 3 = 60 - 69 marks.
- Band 2 = 50 - 59 marks.
- Band 1 = 0 - 49 marks.

Write a Python CLI program where students input their grade for atleast 4 different subjects and the program outputs:

- a Band for each subject along with subject name
- calculate the average or overall marks and Band
- print the average/overall marks and band.

Your program must demonstrate efficient logic, validations where applicable, intrinsic documentation, loop/repetition for multiple students.

Attach your program to this question.

**Answer:**

```
SCORES = {
    "Math": 96,
    "Science": 93,
    "English": "80", # Demonstrating Input Validation
    "Software": 95,
    "Art": "N", # Demonstrating error handling
    "Tech": 1000 # Demonstrating validation
}

def check_band(score):
    try:
        integ = int(score) # Converting strings to integers
        if integ < 50 and integ >= 0:
            return 1
        elif integ < 60:
            return 2
        elif integ < 70:
            return 3
        elif integ < 80:
            return 4
        elif integ < 90:
            return 5
        elif integ < 100:
            return 6
        else:
            return "Not a valid score"
    except ValueError:
        return "Not an integer"

valid_scores = []
for subject, score in scores.items():
    band = check_band(score)
    print(subject + ": " + str(band))
    try:
        integ = int(score)
        if integ <= 100:
            valid_scores.append(integ)
    except ValueError:
        continue

total = sum(valid_scores)
avg = total / len(valid_scores)
avg_band = check_band(avg)

print("Average: " + str(avg))
print("Average Band: " + str(avg_band))
```

7.5/8p