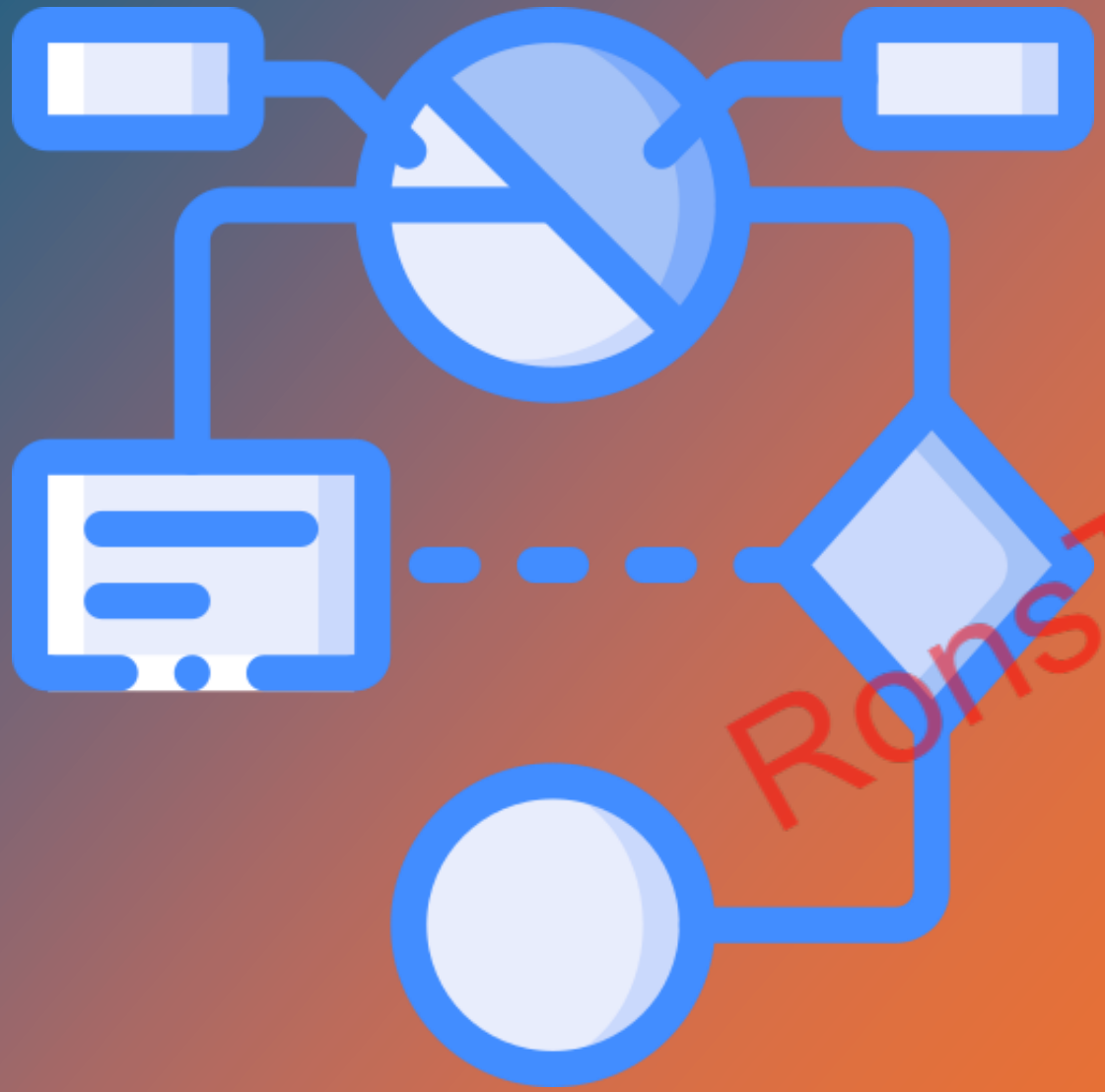
BTEC Level 3 Computing

Unit 1 - Principles of Computer Science

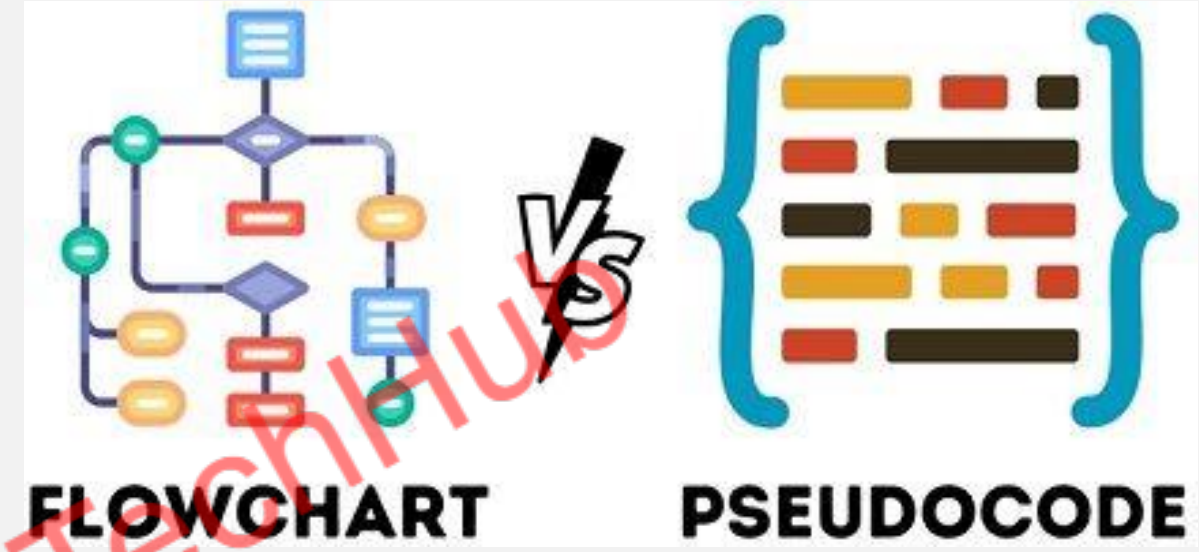
Algorithm Design



What is Algorithm Design?

- Describing a step-by-step strategy to solve a problem.

Algorithm Design Examples



- Pseudocode – textual.
- Flowcharts – pictorial.

Pseudocode

What is Pseudocode?

Pseudocode is like a rough draft or blueprint for a computer program.

No one size fits all, you can make it your own, mostly.

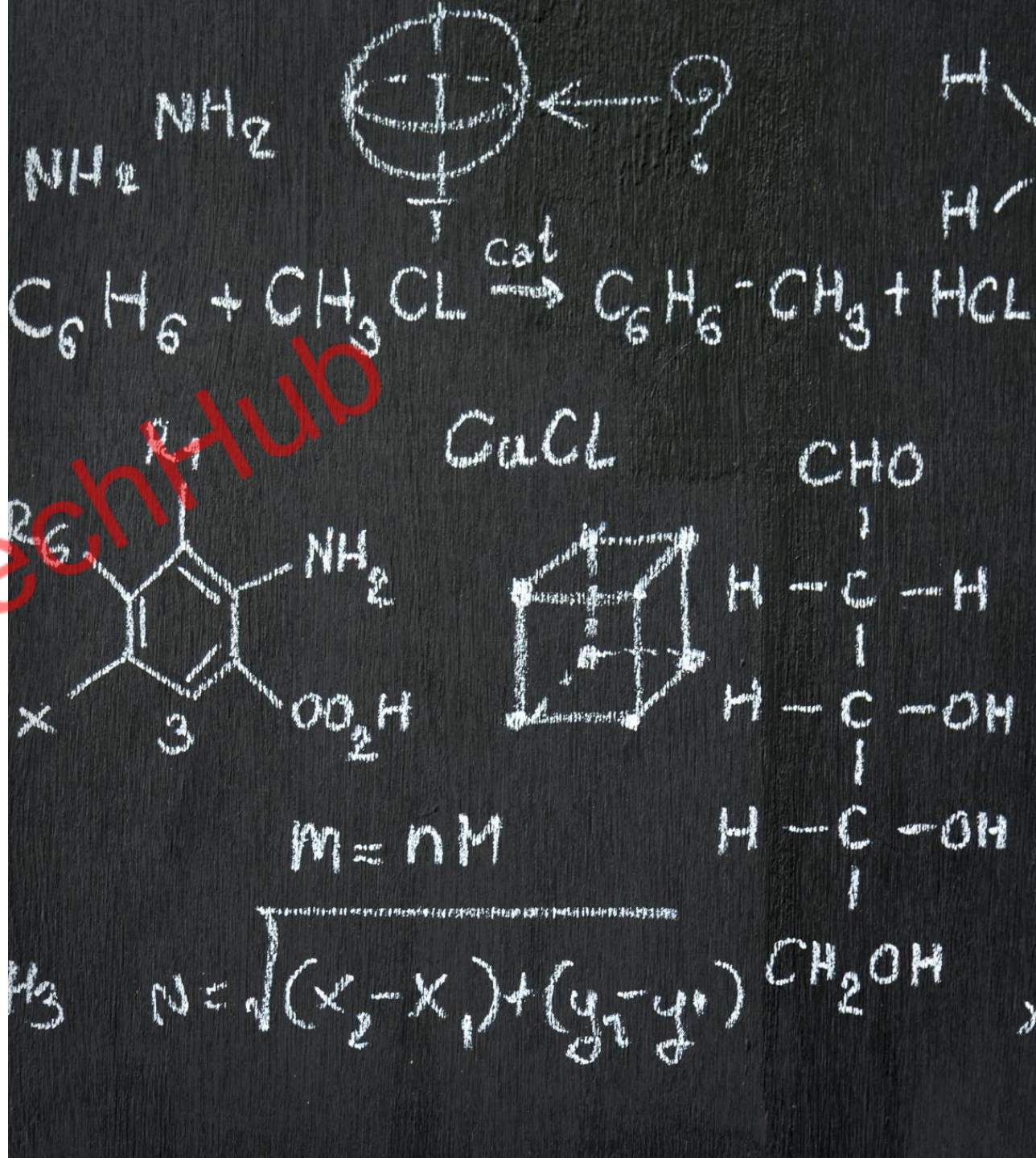
Pseudocode is Textual

- It is "text" that describes the logic of the system you want to develop.

- Flowchart uses shapes/images.

Simple Pseudocode Example

- Start
- Input length of rectangle
- Input width of rectangle
- Calculate area = length * width
- Display area
- End



Pseudocode To Code

Python 3

```python
length = float(input("Input length of rectangle: "))
width = float(input("Input width of rectangle: "))

area = length * width

print("Area:", area)
```

Keywords, BBC Bitesize

- You can use these keywords to solve most problems.
- https://www.bbc.co.uk/bitesize/guides/z3bq7ty/revision/2
- There are more key words on the specification.
- Once you understand the process the word will make sense.

Common pseudocode notation

There is no strict set of standard notations for pseudocode, but some of the most widely recognised are:

- **INPUT** – indicates a user will be inputting something
- **OUTPUT** – indicates that an output will appear on the screen
- **WHILE** – a loop (iteration that has a condition at the beginning)
- **FOR** – a counting loop (iteration)
- **REPEAT – UNTIL** – a loop (iteration) that has a condition at the end
- **IF – THEN – ELSE** – a decision (selection) in which a choice is made
- any instructions that occur inside a selection or iteration are usually indented

Keywords

Get.

Process.

Do.

These are some keywords that can be used as well.

Pseudocode Example From BBC

https://www.bbc.co.uk/bitesize/guides/zptd3k7/revision/7

Purpose

- A program is to be developed to create usernames for a class of twenty pupils
- The program will ask a teacher to enter the first name, surname and age of each pupil.
- The age entered must be between five and eighteen.
- The program should output a list of usernames for the teacher.

Pseudocode Example From BBC

Main steps (algorithim)

```
1 Initialise username

2 Start fixed loop for twenty pupils

3         Get first name and surname from user

4         Get valid age from user

5         Generate username

6 Display "Username", index, "is" username

7 End fixed loop
```

Pseudocode Example From BBC

Refinement

```
3.1 Get first name and store in first name array

3.2 Get surname and store in surname array

4.1 Get age and store in age array

4.2 While age is less than 5 or higher than 18 start conditional loop

4.3         Display error message "Invalid age, enter a number between 5 and
18 inclusive"

4.4         Get age and store in age array

4.5 End conditional loop

5.1 Concatenate first name, surname and age and store in username array

5.2 Start fixed loop from 0 to index -1

5.3      If username equals stored username

5.4           Add 1 to age

5.5           Concatenate first name, surname and age and store in username
array

5.6        End If

5.7 End fixed loop
```

My Interpretation

- START
- INPUT – Enter the first name
- PROCESS – Save first name to a variable/list
- INPUT – Enter last name
- PROCESS – Save last name to a variable/list
- INPUT – Enter age
- IF – age is less than 5 or age is more than 18
  - OUTPUT – The age must be between 4 and 19 (5 to 18)
- ELSE –
  - PROCESS – Save last name to a variable /list
- OUTPUT – The username is: xxxxx000
- END/REPEAT

Key Things To Note

1

Think about the log or flow of the program.

2

Write this down or think about this in plain english.

3

Convert the notes or thought into Pseudocode.

4

You must use some key words.

Keywords – Pages 31 and 32 Specification

- Link: https://qualifications.pearson.com/content/dam/pdf/BTEC-Nationals/computing/2016/specification-and-sample-assessments/btec-nat-l3-ext-dip-in-computing-spec.pdf

- sequence
- structure:
  - hierarchy
  - indentation
- operations:
  - BEGIN
  - END
  - INPUT
  - OUTPUT
  - PRINT
  - READ
  - WRITE
- decisions:
  - IF
  - THEN
  - ELSE
  - ELSEIF (ELIF)
  - WHEN
- repetition:
  - FOR
  - REPEAT UNTIL
  - WHILE
  - WHILE NOT.

Flowcharts

What is a Flowchart?

Visual diagram: It uses shapes and arrows to show the steps in a process.

Shows the flow: The arrows connect the shapes and show the order in which things happen.

Uses shapes for different things:

Ovals: Start and end of the process.

Rectangles: Actions or steps in the process.

Diamonds: Decisions that need to be made (yes/no questions).

Benefits of Flowchart

- Making complex processes easy to understand visually.
- Improving communication and collaboration.
- Finding bottlenecks and inefficiencies.
- Documenting processes clearly.
- Increasing efficiency and reducing errors.
- More or less the same for all forms of algorithm design.

Flowcharts Use Shapes

Oval: Represents the start or end of a process.

Rectangle: Represents a process, task, or action.

Diamond: Represents a decision point, where the flow can go in different directions depending on the answer.

Parallelogram: Represents input or output of data or information.

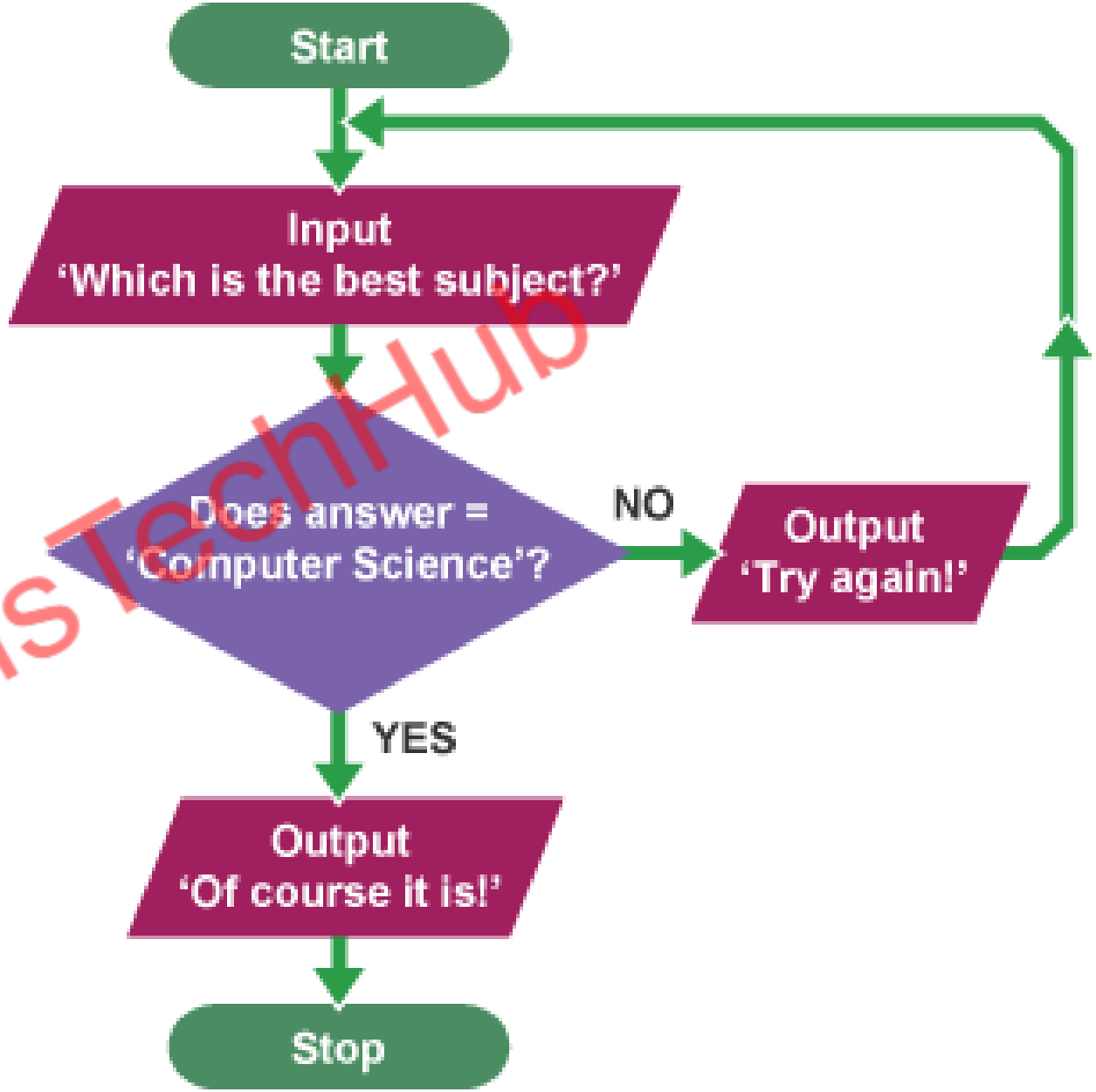
Arrows: Connect the shapes and show the direction of the flow.

Flowchart Shapes

BBC Bitesize

Symbol	Name	Function
	Start / End	An oval shape represents or end of a process
	Input / Output	A parallelogram represe output
	Decision	A diamond represents a
	Process	A rectangle represents a
	Arrow	An arrow is a connector relationships between th shapes and what they re

Flowchart Example



Flowchart To Code Example – Python 3

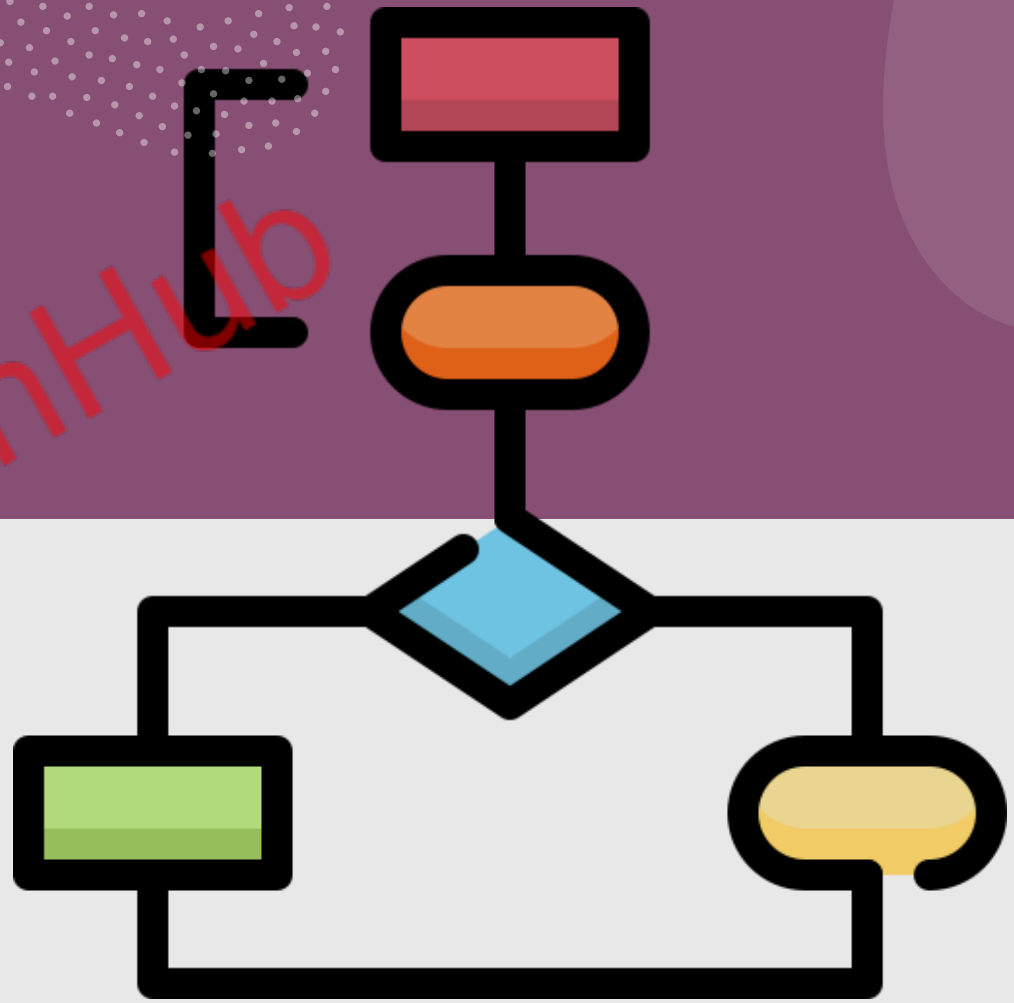
```
1  while True:
2      answer = input("What is the best subject?")
3      print(answer)
4      if answer == "Computer Science":
5          print("Of course it is... well done")
6          break
7
8      elif answer != "Computer Science":
9          print ("Error detected, please try again")
```

Pseudocode Task

Write pseudocode for a program that determines the largest of three numbers entered by the user.

Flowchart Task

- Design a flow chart to represent the process of making a cup of tea. Include the following steps: boiling water, adding tea leaves or a tea bag, steeping, and adding sugar or milk if desired.



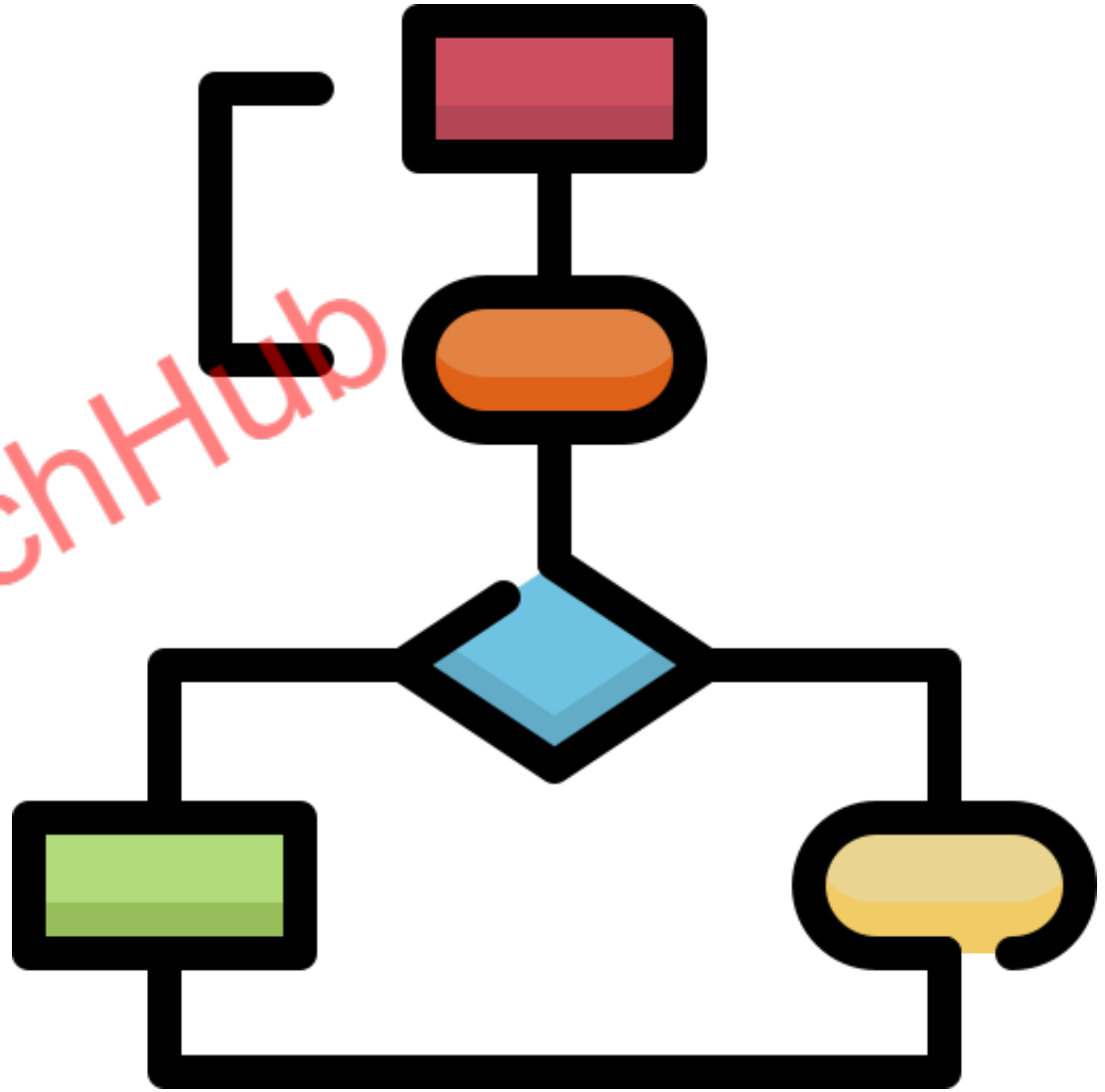
Possible Pseudocode Answer

- BEGIN
- INPUT num1
- INPUT num2
- INPUT num3

- IF num1 > num2 AND num1 > num3 THEN
- PRINT "The largest number is:", num1
- ELSE IF num2 > num1 AND num2 > num3 THEN
- PRINT "The largest number is:", num2
- ELSE
- PRINT "The largest number is:", num3
- ENDIF
- END

Possible Flowchart Answer

- Draw this out.



Next Time

Programming Paradigms.