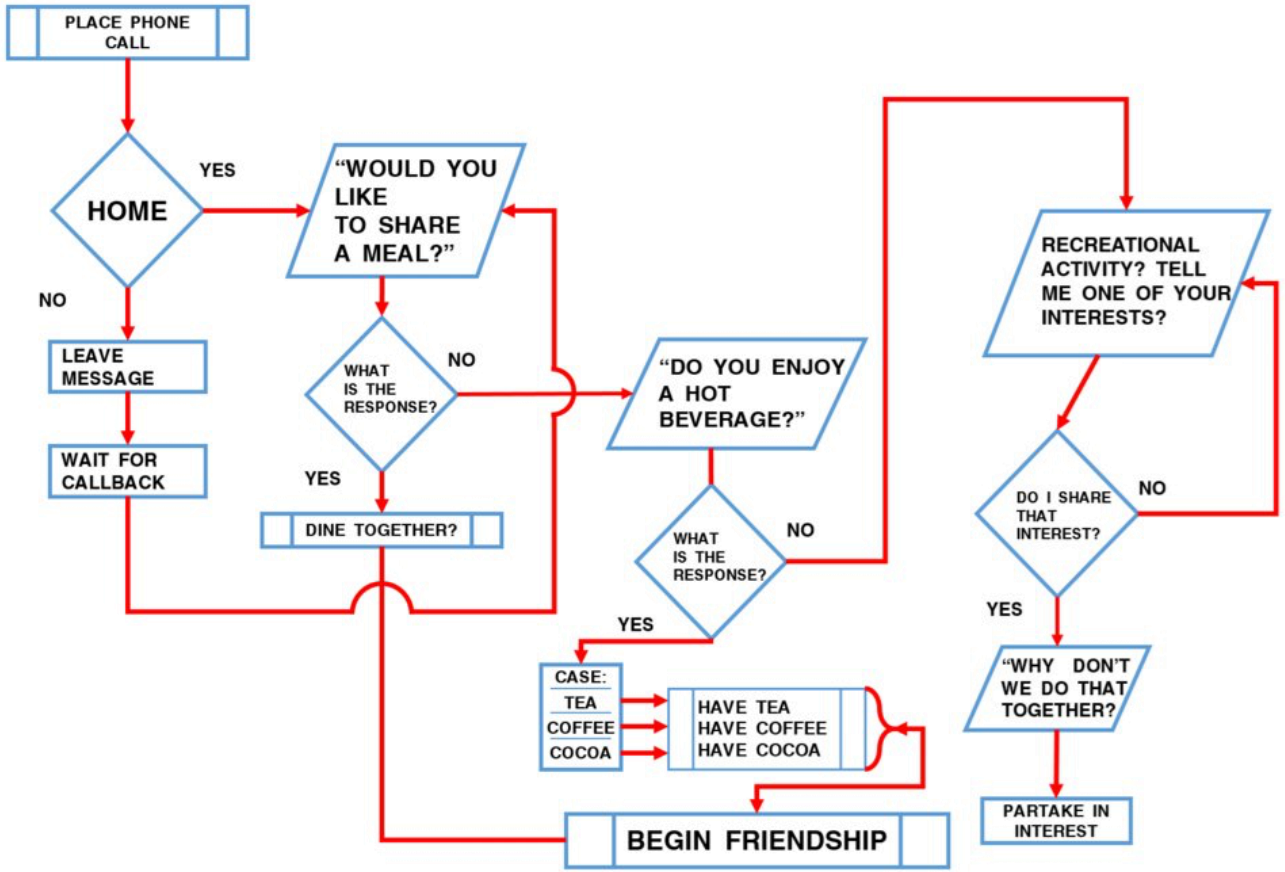
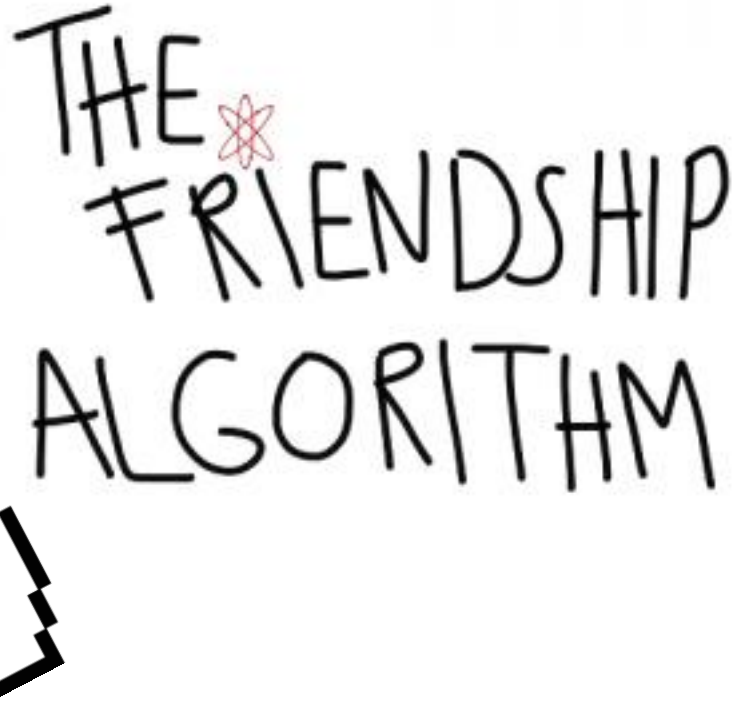
COMPUTER SCIENCE





Topic – **Problem Solving**

Algorithms

An algorithm is a precise step-by-step set of instructions for solving a problem or carrying out a task

They are often used to improve efficiency by removing the need for human input

A computer following an algorithm can decide what decision to make far more quickly than a human

Algorithms

There are four methods of writing algorithms

On the next four slides we will look at the same algorithm written in each method

Types of Algorithms

There are four methods of writing algorithms

All algorithms can be represented in each of these methods

The four types are..

Types of Algorithms

1	**Written Description**

Step by step instructions written in plain English

Types of Algorithms

2	**Flowchart**

A graphical method of showing the flow of information using a series of symbols and arrows

Types of Algorithms

3	**Pseudocode**

Uses structured English and keywords with a heavy focus on the order of the instructions (the logic)

Half way between plain English and a programming language

Book

Types of Algorithms

4	**Program Code**

Code that is produced using a programming language such as Python

Algorithms

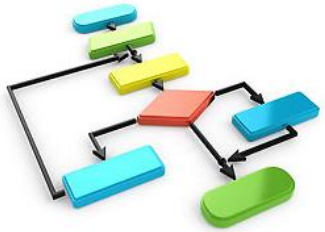
Watch this video to find out more about algorithms

Link: https://www.youtube.com/watch?v=McM9YCeyt_Q

Flowcharts

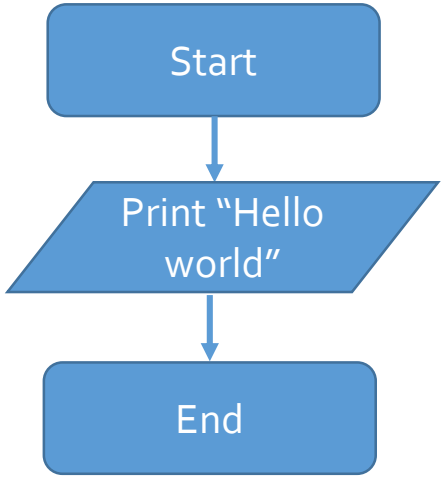
Algorithms can be displayed as flowcharts

Terminal		
Decision/Selection		
Process		
Input / Output		
Subroutine		
Line		



Flowcharts

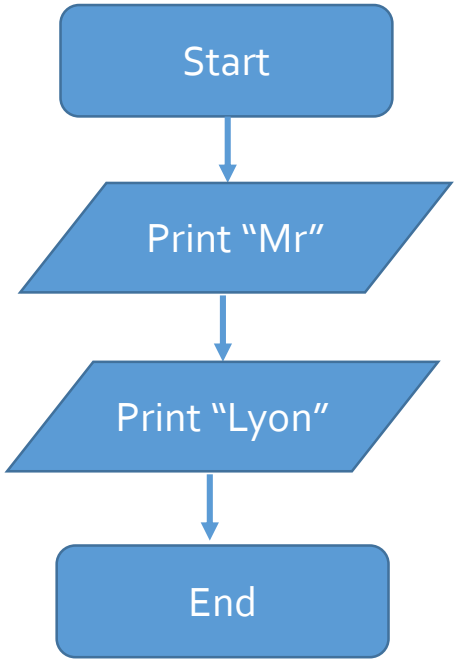
Example Flowcharts (Easy)



Terminal

Output

Terminal



Terminal

Output

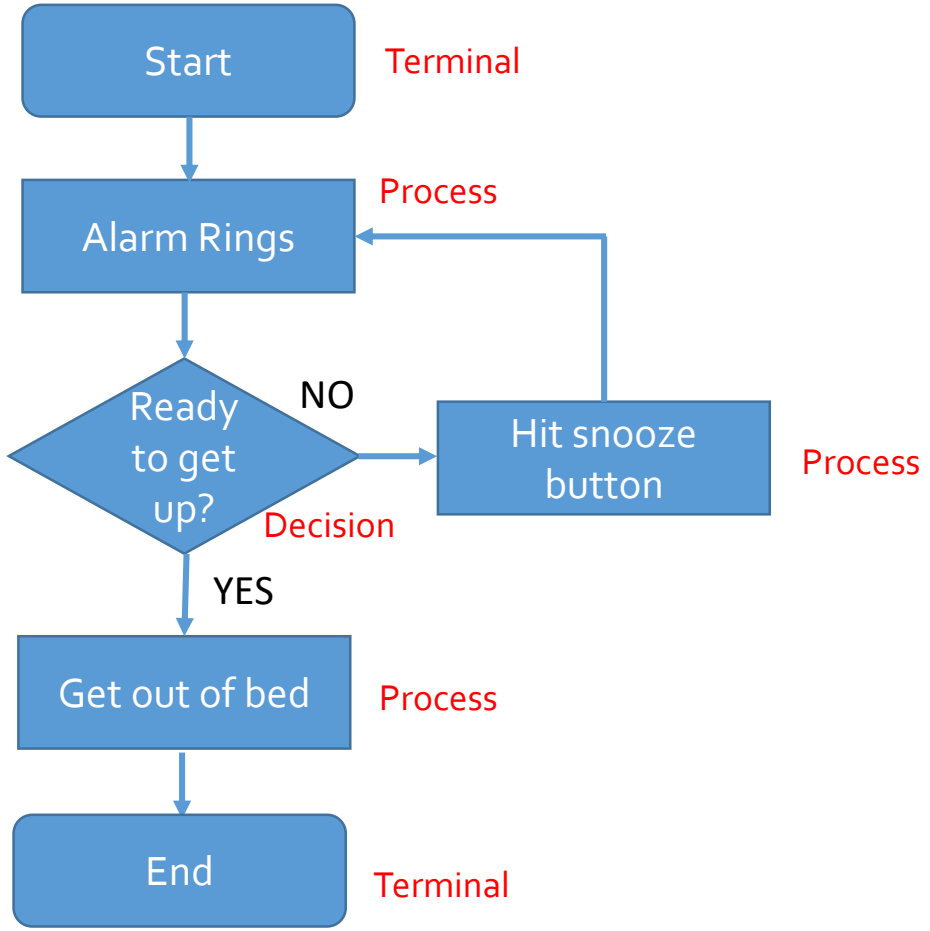
Output

Terminal

Change this to your name!

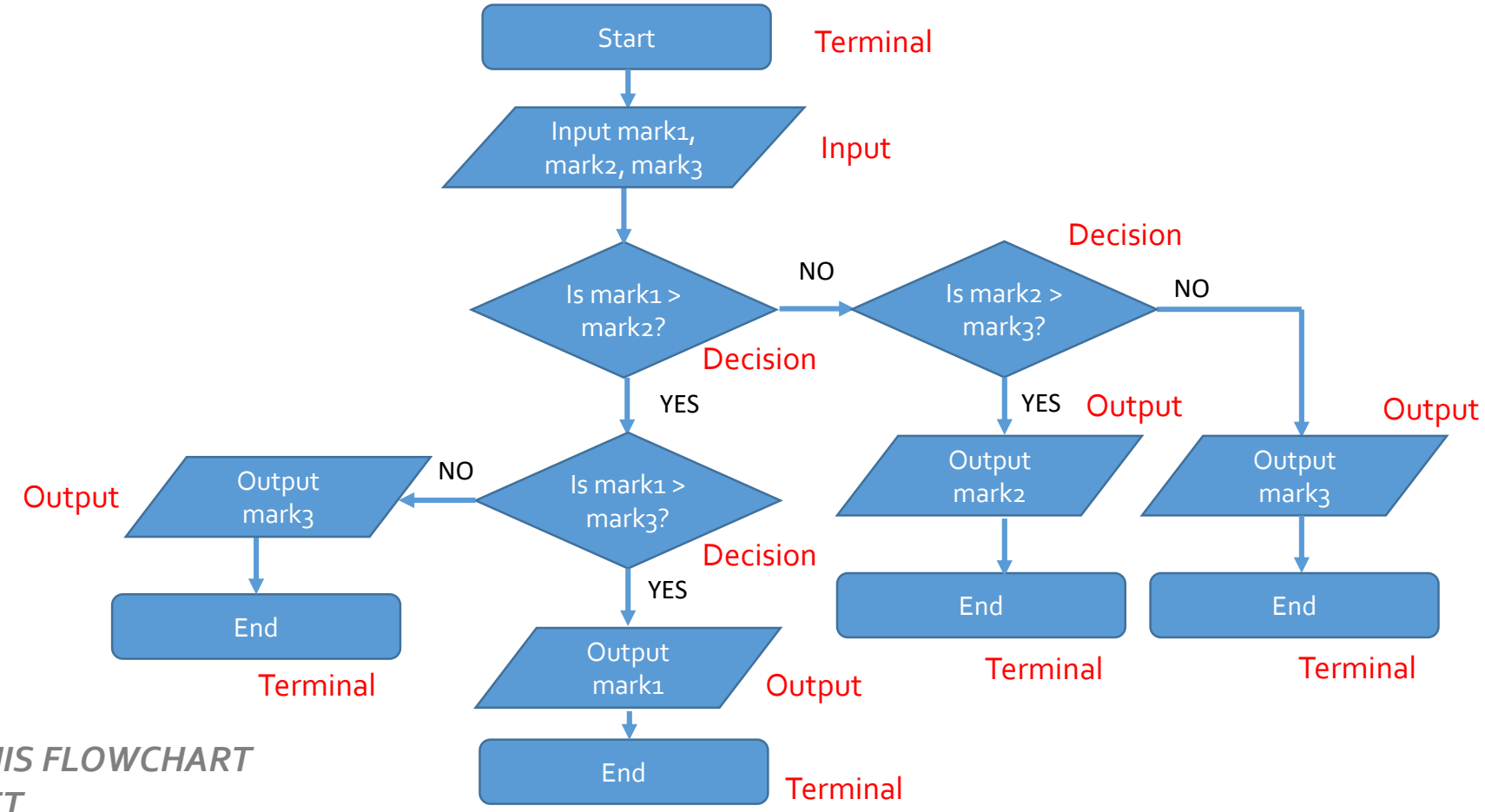
Flowcharts

Example Flowchart (Medium)



Flowcharts

Example Flowchart (Difficult 1)



DO NOT DRAW THIS FLOWCHART
IT IS ON THE SHEET

Main Task

Complete the flowchart worksheet(10mins)

Work sheet 2

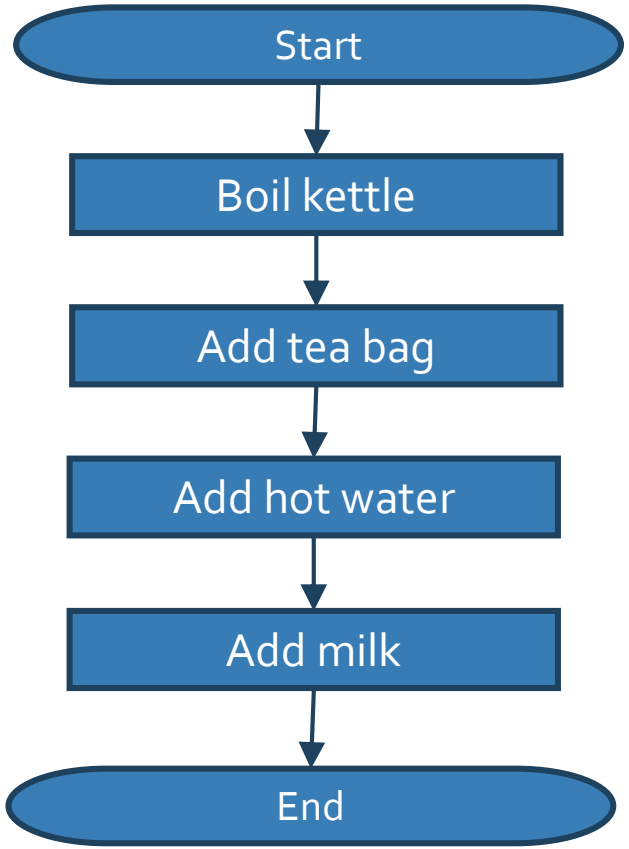
- Answer work sheet 2 on flowchart(5mins)

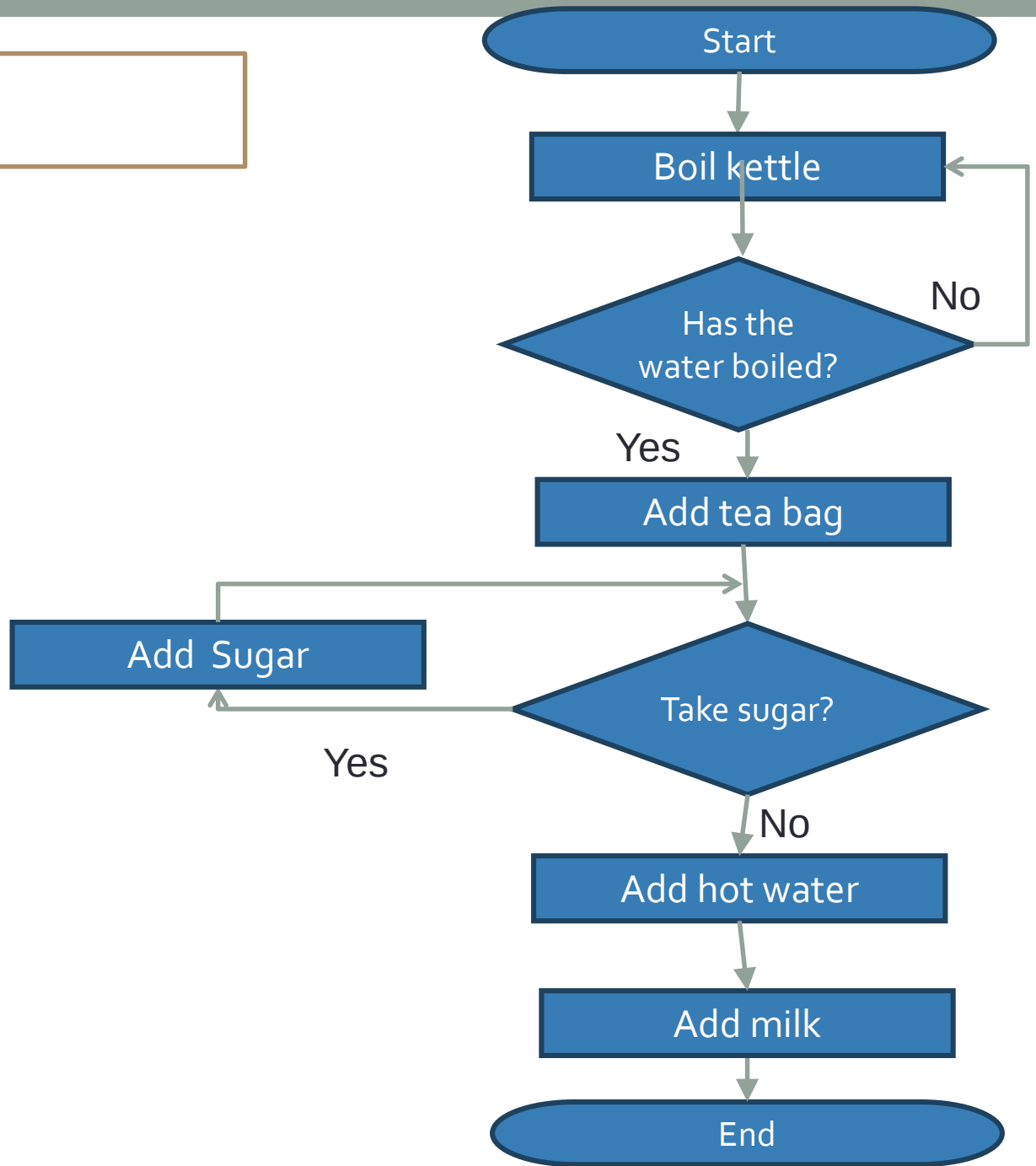
Create a flow chart which shows the process of making a cup of tea

ALL – Use at least 4 processes and two terminals
MOST – Use at least 5 processes and one decisions

SOME – Use more than 3 decisions in your flow chart

Making a Cup of Tea





Why do we need to use flowcharts?

- Plan a New Project
- Design something for someone else to see
- visualize and troubleshoot
- Mapping computer algorithms

Extension

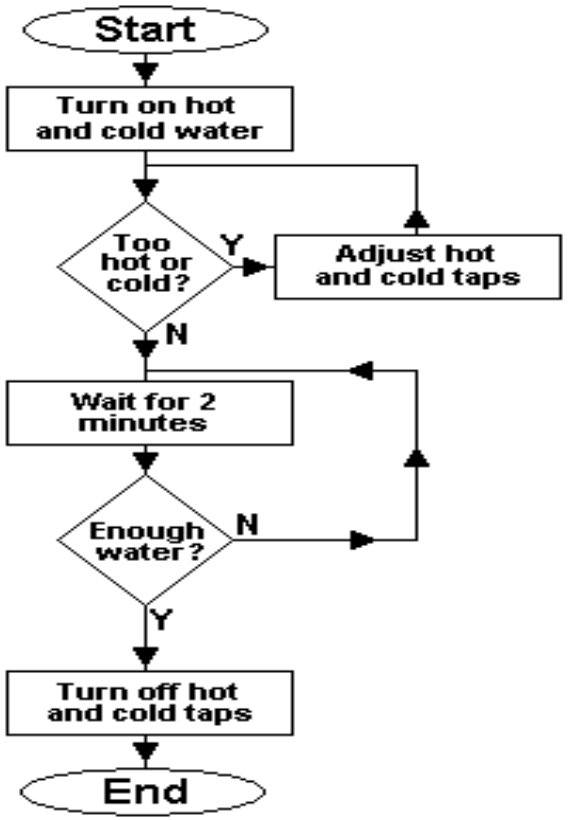
Create a flow chart which shows the process of getting up and going to school

ALL – Use at least 4 processes and one decision

MOST – Use at least 4 processes and one decisions

SOME – Use more then one decisions and 5 processes

Symbol	Name	Function
	Start/end	An oval represents a start or end point.
	Arrows	A line is a connector that shows relationships between the representative shapes.
	Input/Output	A parallelogram represents input or ouptut.
	Process	A rectangle represents a process.
	Decision	A diamond indicates a decision.



Plenary Task

Answer the following questions

1. Draw and explain the symbols used in flow charts
2. Give two examples of where flow charts might be used
3. Give a reason why flow charts are used

EXTENSION: Explain how the data in a flow chart could become stuck in an infinite loop

Home work- due Tuesday 27th

Create a flow chart for one of the following. Remember to include as many steps as possible

Flowcharts

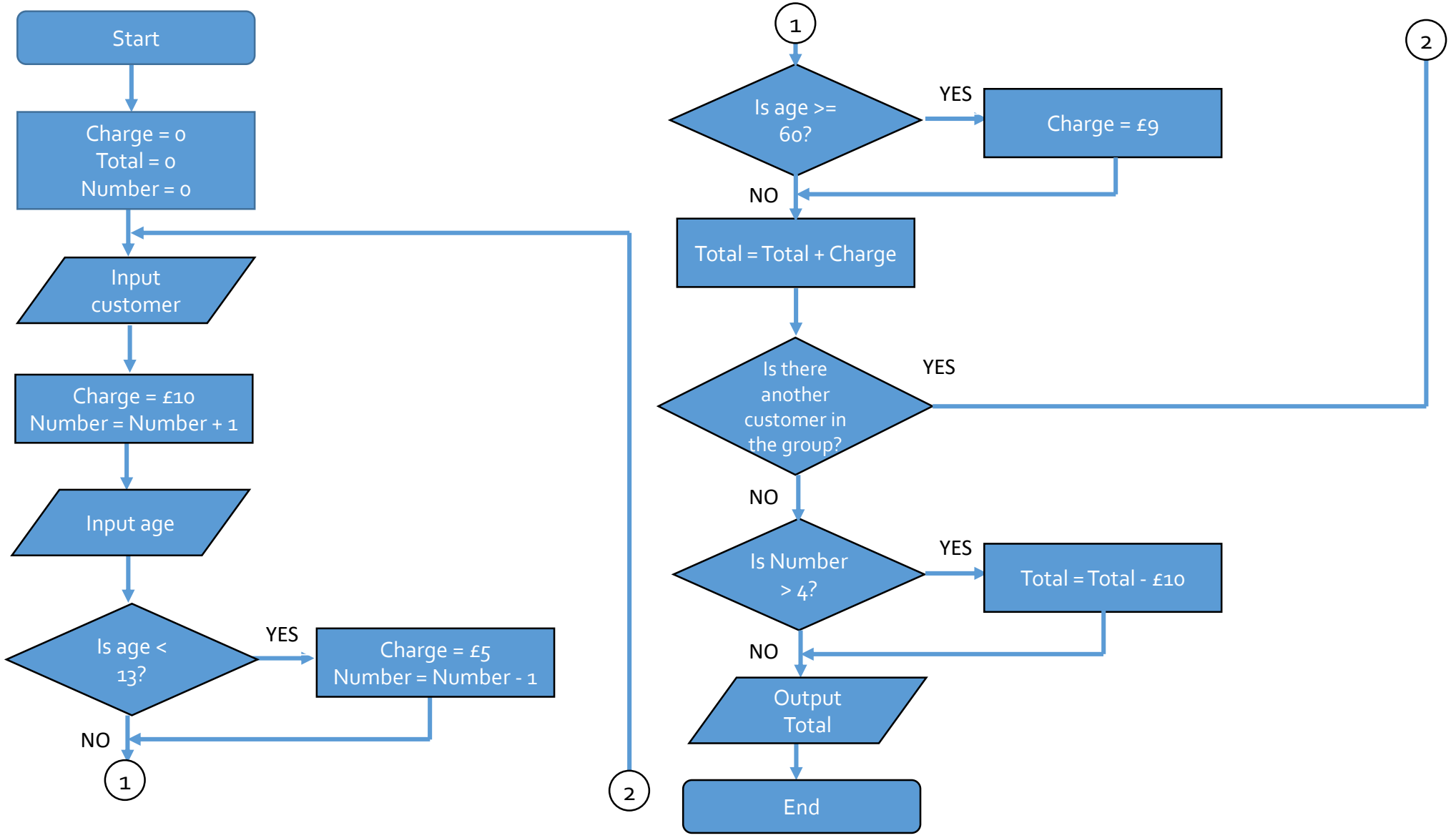
Example Flowchart (Difficult 2)

On the next slide is a flowchart used by a theme park to calculate how much a group of people should pay for entry

Part 1

Flowcharts

Example Flowchart (Difficult 2)



Part 2

Activity 1

Example Flowchart (Difficult 2)

1	List the variables that are used in the algorithm
2	Label where each of the three constructs (sequence, selection and iteration) are used
3	Describe how the algorithm calculates the total amount that should be paid
4	The Smith family are visiting the park. The family consists of two children, one aged 8 and one aged 10, their two parents and their grandfather, who is aged 65. Use the algorithm to calculate how much the family should pay

Part 3

Activity 2- Draw a flowchart for Guessing a Number Between 1 and 20

Pseudocode

Algorithms can be displayed using Pseudocode

A way of expressing an algorithm in structured English that resembles computer language

Does not use strict syntax, it just needs to be clear and consistent


Book

Pseudocode

Use of Pseudocode

Uses commands, keywords and structures similar to those found in computer languages

Cannot be understood by computers, but is used to develop the logic of a program without needing to worry about the syntax

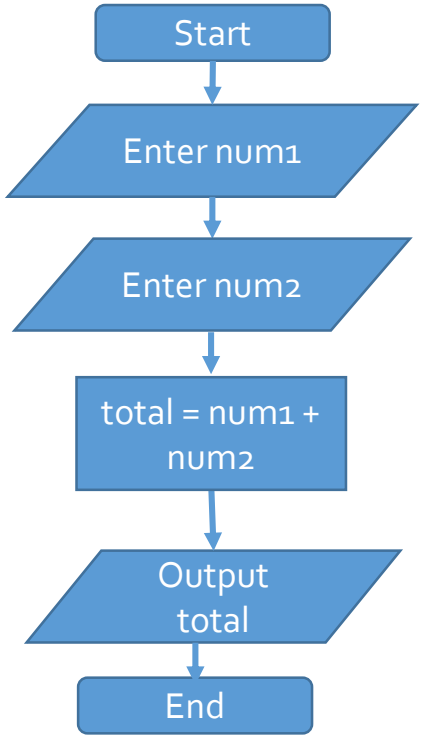
A human can follow the logic of an algorithm even if there are spelling mistakes, missing brackets or quotation marks etc.

A solution in pseudocode can then be converted into a high-level language such as Python

Sheet

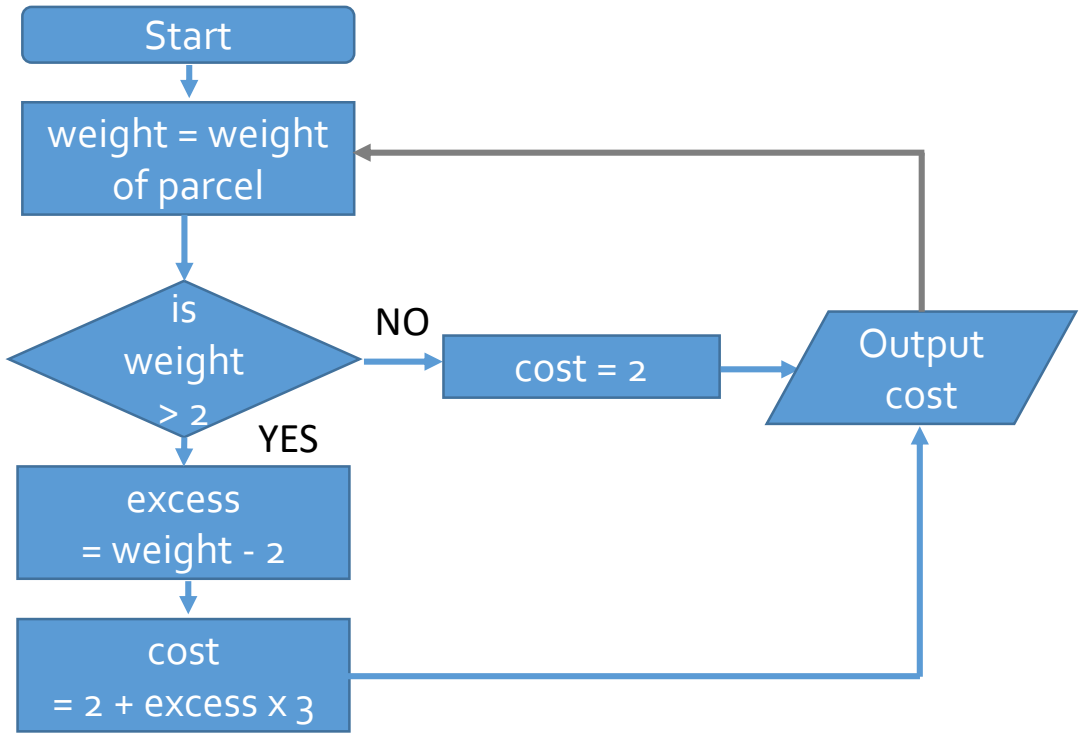
Worked Example-write the Pseudocode for the flowchart

An Algorithm in Pseudocode: Example 1

Written Description	Flowchart	Pseudocode
Enter first number Enter second number Add together to get the total Output the total		SEND 'Enter first number' TO DISPLAY RECEIVE num1 FROM (INTEGER) KEYBOARD SEND 'Enter second number' TO DISPLAY RECEIVE num2 FROM (INTEGER) KEYBOARD SET total TO num1 + num2 SEND total TO DISPLAY END

Worked Example

Flowchart



Pseudocode

```
SET parcel TO 'y'
WHILE parcel = 'y' DO
        RECEIVE weight FROM (FLOAT) KEYBOARD
        IF weight <= 2 THEN
                SET cost TO 2
        ELSE
                SET excess TO weight – 2
                SET cost TO 2 + (excess * 3)
        END IF
        SEND cost TO DISPLAY
        SEND 'press y for another parcel' TO DISPLAY
        RECEIVE parcel FROM (STRING) KEYBOARD
END WHILE
```

Algorithms

Purpose of an Algorithm

Pseudocode	Explanations

SET parcel to 'y'
WHILE parcel = 'y' DO
RECEIVE weight FROM (FLOAT) KEYBOARD
IF weight <= 2 THEN
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SET cost TO 2 + (excess * 3)
END IF
SEND cost TO DISPLAY
SEND 'press y for another parcel' TO DISPLAY
RECEIVE parcel FROM (STRING) KEYBOARD
END WHILE
	While loop ensures the program keeps running
	
	User enters the weight of the parcel
	
	If/else statement to work out the cost of the parcel depending on if the weight is above or below 2
	
	Outputs the final cost depending on the weight
	User is asked if they wish to run the program again
	
	Programs ends if 'y' is not entered

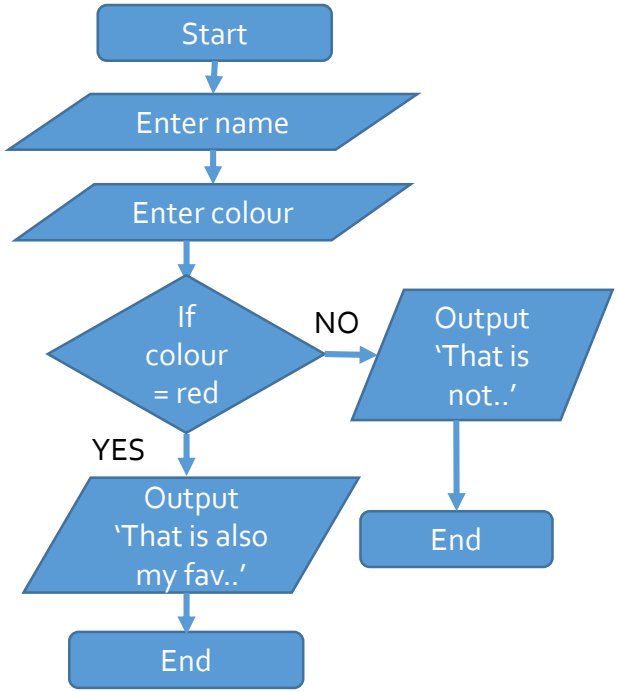
Activity 3-Pseudocode

An Algorithm in Pseudocode: Example 2

Written Description

Enter your name
Enter your favourite colour
If the colour chosen is red display 'That is my favourite colour'
Else if the colour chosen is anything else display 'That is not a nice colour'

Flowchart



Pseudocode

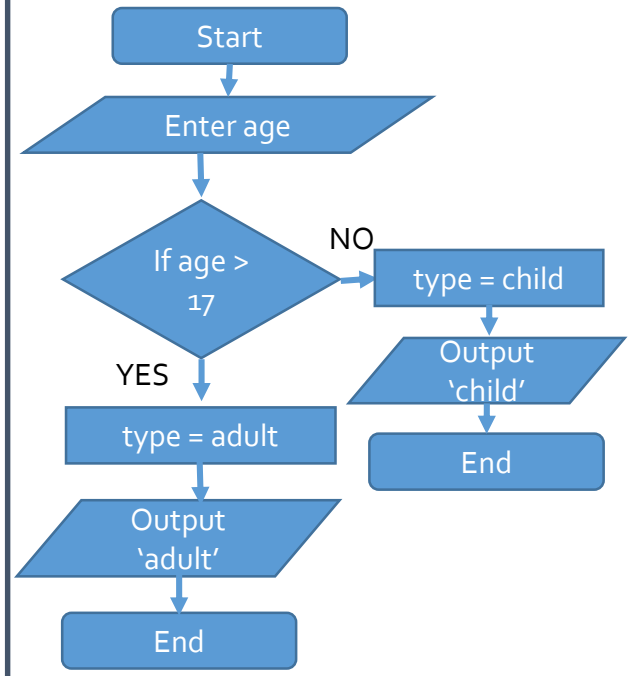
Activity 4-Pseudocode

An Algorithm in Pseudocode: Example 3

Written Description

Enter your age
If the age is larger than 17 set the type to adult
Else if the age is less than or equal to 17 set the type to child
Display the type

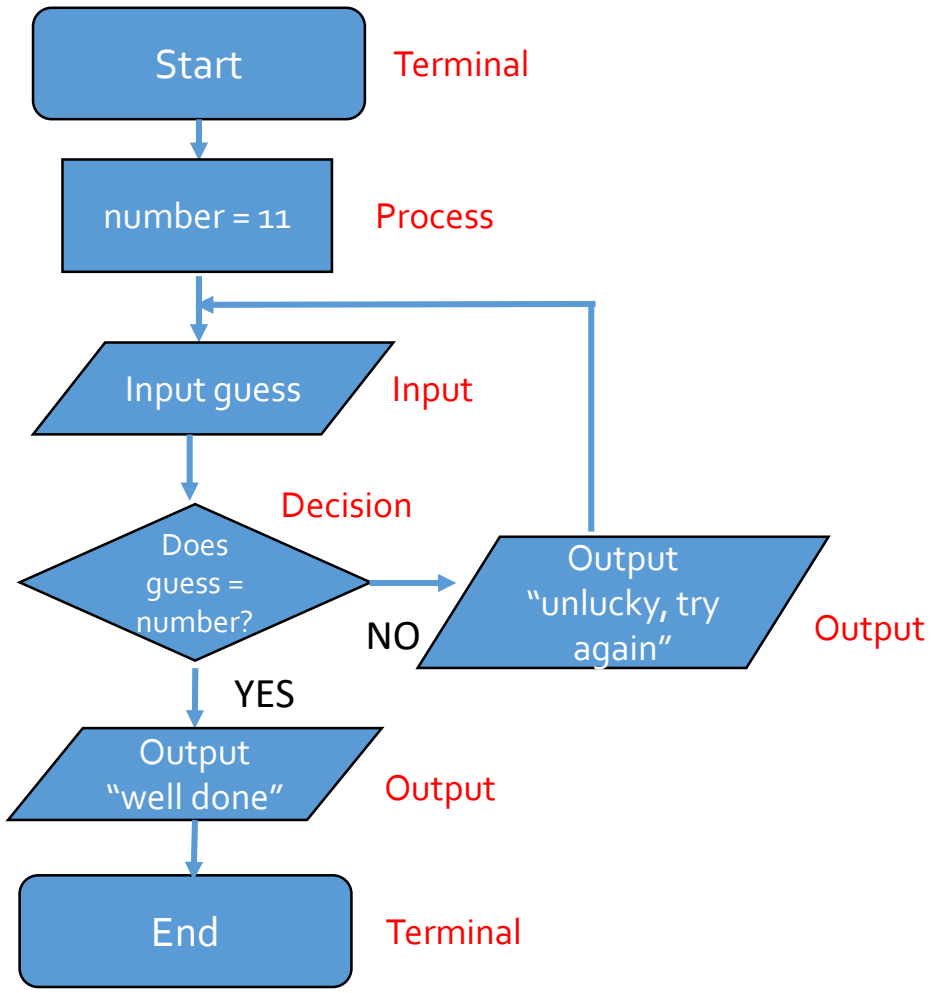
Flowchart



Pseudocode

.....
....

Exercise 5- write Pseudocode for the flowchart

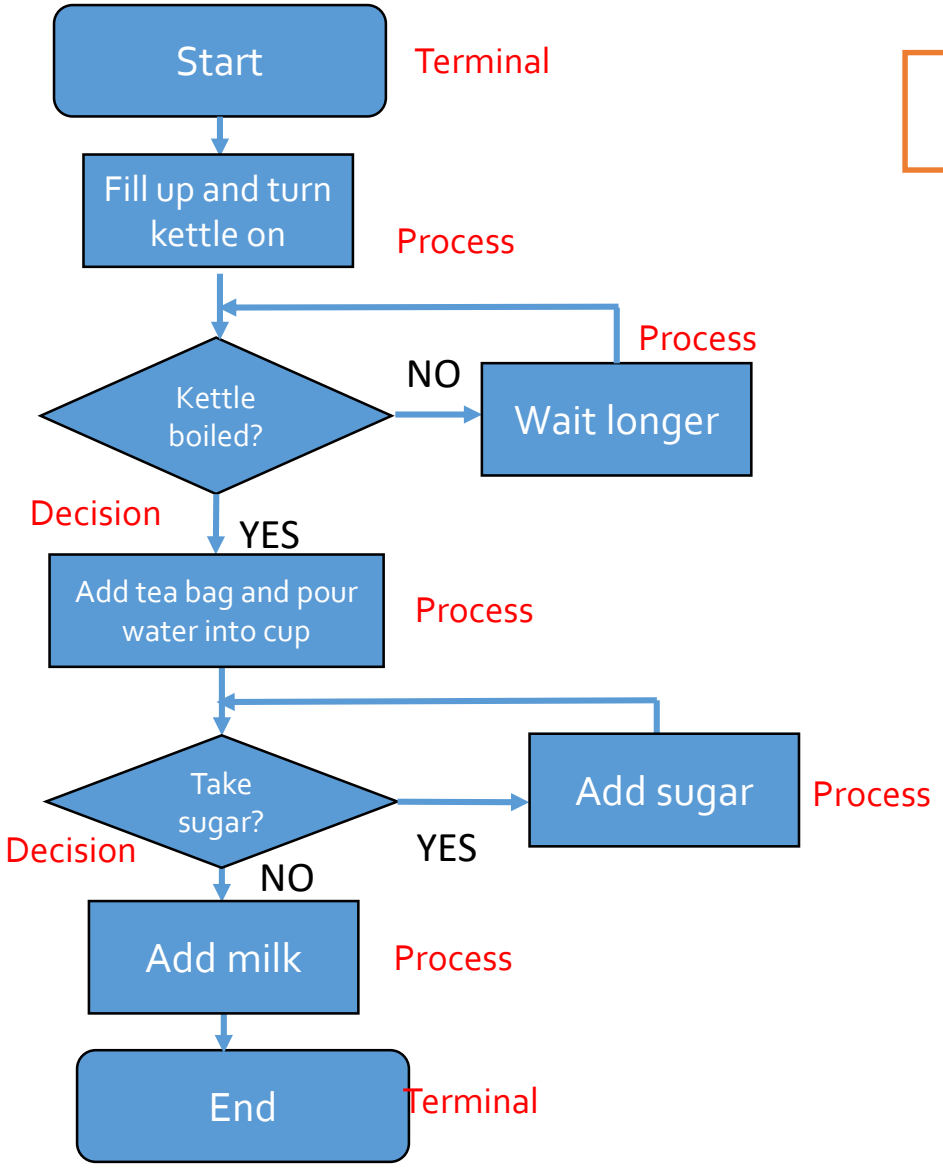


Pseudocode

.....

....

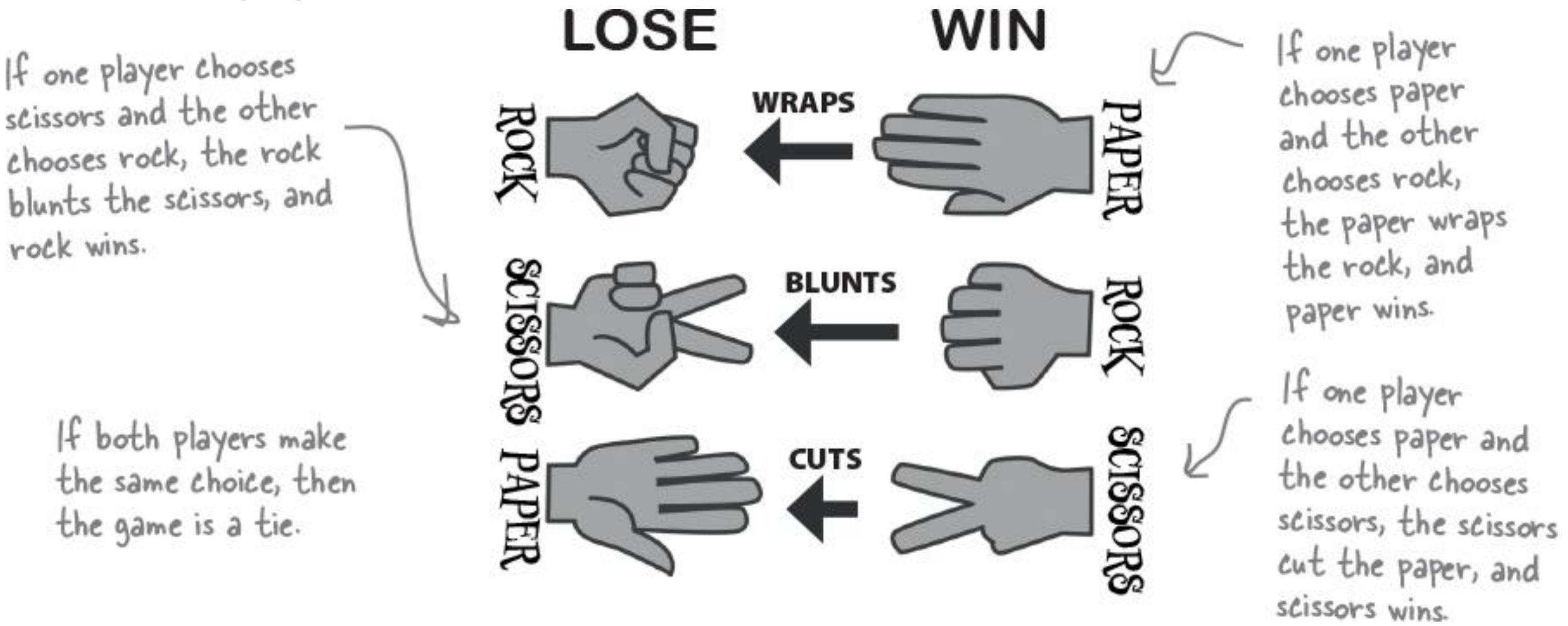
Activity6

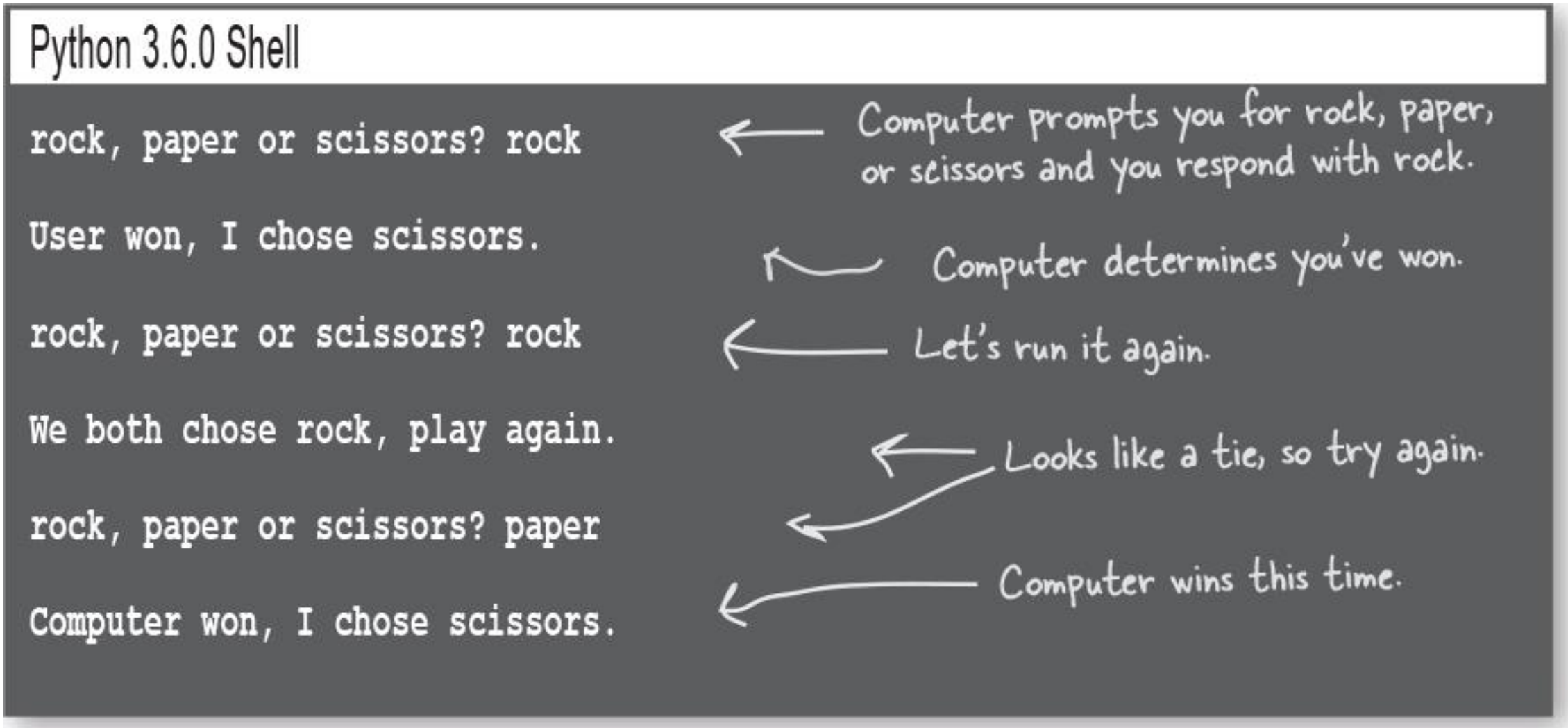


Write down an algorithm for making a cup of tea

Sheet

Extension task Create a flowchart and a Pseudo code for the game Rock, paper




Python 3.6.0 Shell
rock, paper or scissors? rock
User won, I chose scissors.
rock, paper or scissors? rock
We both chose rock, play again.
rock, paper or scissors? paper
Computer won, I chose scissors.
Computer prompts you for rock, paper, or scissors and you respond with rock.
Computer determines you've won.
Let's run it again.
Looks like a tie, so try again.
Computer wins this time.

Algorithms

Purpose of an Algorithm

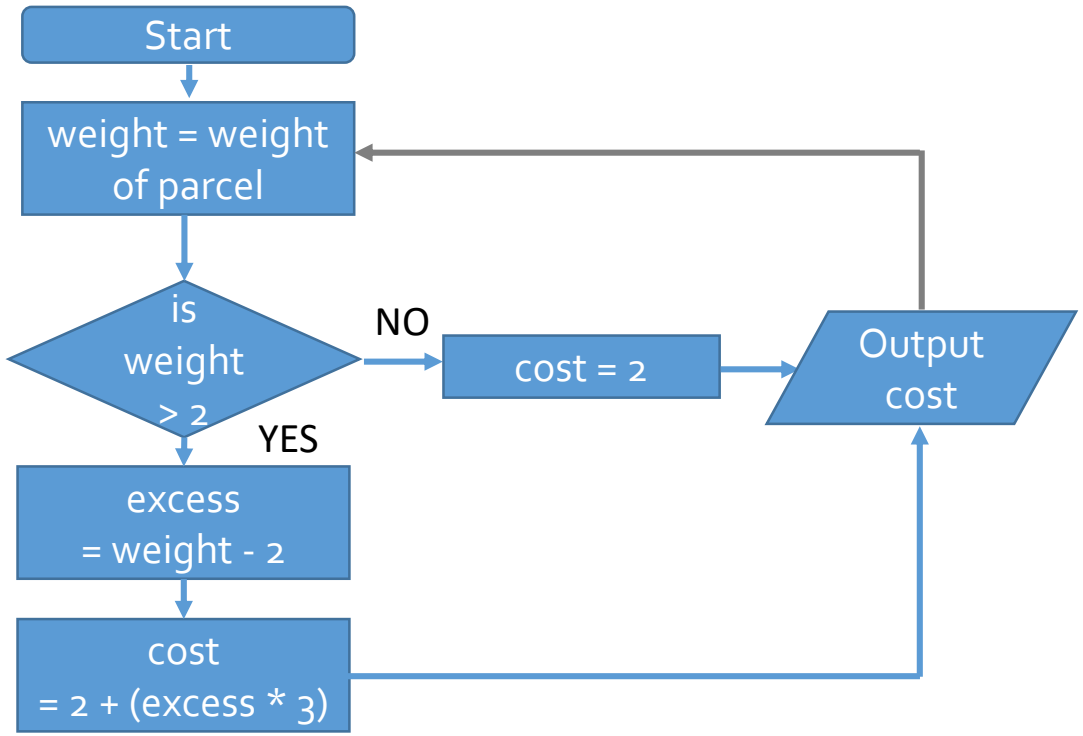
You need to be able to work out what the purpose of an algorithm is

Starter

Name: :

Purpose of an Algorithm

Flowchart



ACTIVITY

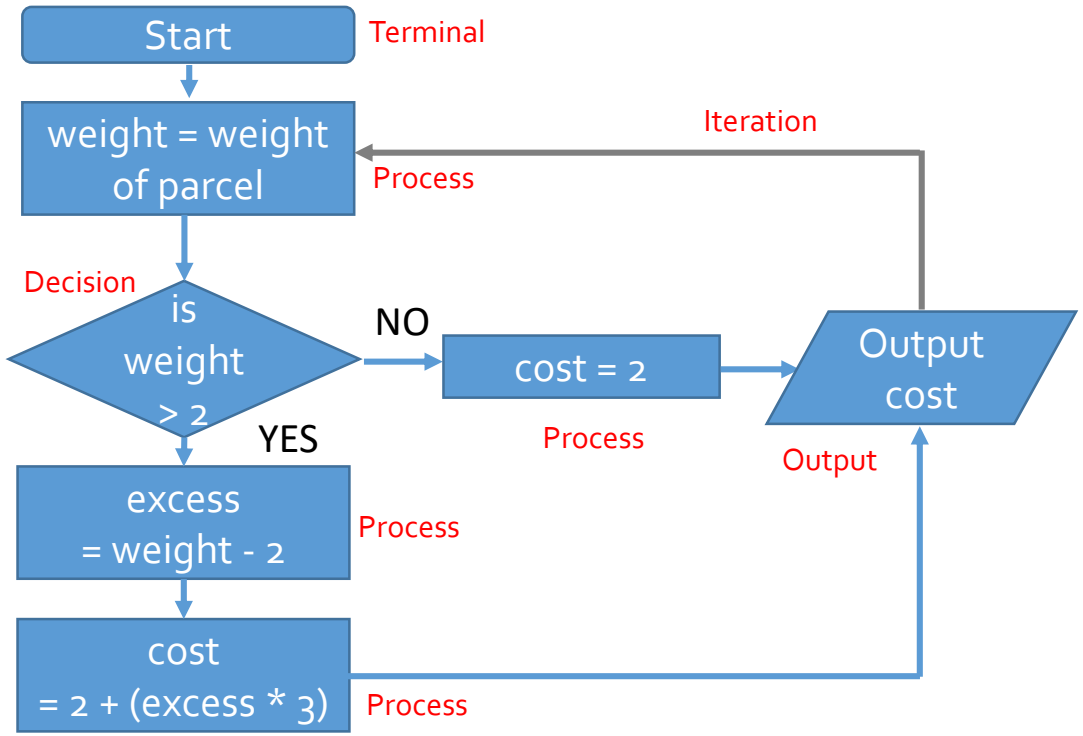
Copy the following flowchart. On your diagram label the following:

- processes
- decisions
- terminals
- iteration
- input/outputs

Algorithms

Purpose of an Algorithm

Flowchart



ACTIVITY

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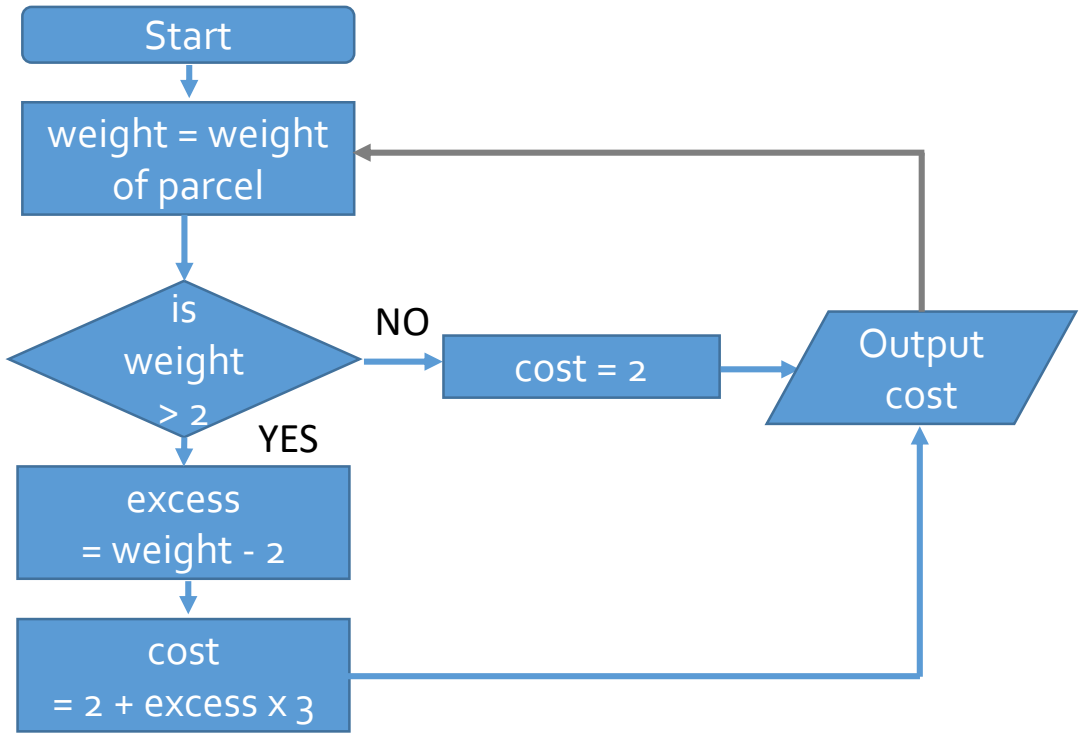
- input/outputs

Algorithms

Purpose of an Algorithm

Flowchart



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Algorithms

Purpose of an Algorithm

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Algorithms

Purpose of an Algorithm

Pseudocode

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        SEND 'press y for another parcel' TO DISPLAY
        RECEIVE parcel FROM (STRING) KEYBOARD
END WHILE
```

Questions	Answers
weight = 2	cost = 2
weight = 3	cost = 5
weight = 1.5	cost = 2
weight = 5	cost = 11
weight = 10	cost = 26