TEMASEK JUNIOR COLLEGE

Temasek Junior College

2021 JC1 H2 Computing

Problem Solving & Algorithm Design 3 – Dry Running (Desk Checking) of Algorithms

1 Dry Runs and Trace Tables

A good way to check whether an algorithm works as intended is to **dry run (desk check)** the algorithm using a **trace table** with different **test data**.

Dry Run

- Involves manually working through an algorithm or program step by step.
- Checks the execution of an algorithm or program by recording all the variable values and conditional values at each step of the algorithm or program execution in a **trace table**.
- Usually carried out on parts of an algorithm or program rather than on the entire algorithm or program itself.
- ***Advantage***: Can be performed on a section of an algorithm or on a high-level language program to locate errors effectively, in particular runtime errors.

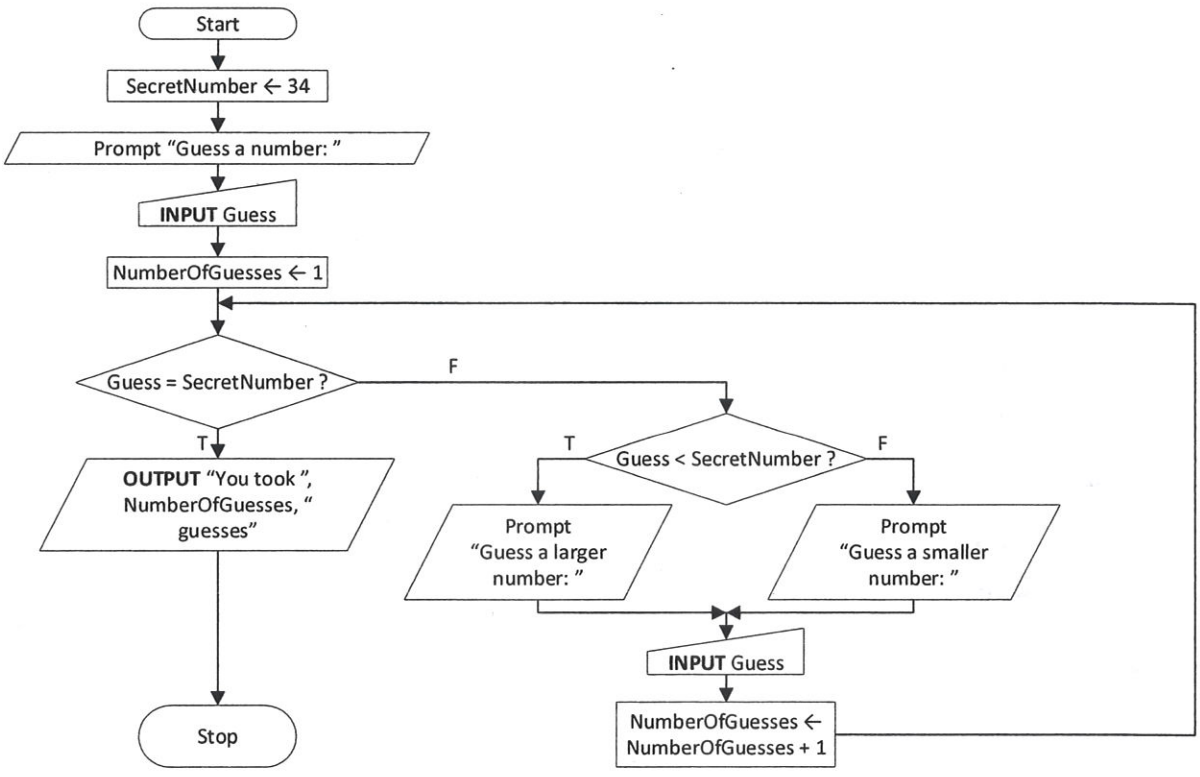
Trace-table

A table that contains

- A column to identify each instruction of the algorithm or program to be executed.
- A column for each variable and each conditional value to record the new variable value and new conditional value when each instruction of the algorithm is executed.

Example 1

The flowchart below gives the algorithm for a number-guessing game.



To test the algorithm, we construct a trace table with one column for each variable used in the algorithm and also for the condition: `Guess < SecretNumber`

Now carefully look at each step of the algorithm and record what happens. Note that we do not tend to write down values that don't change. Here, `SecretNumber` does not change after the initial assignment, so the column is left blank in subsequent rows.

We only make an entry in a cell when an assignment occurs. Values remain in variables until they are overwritten. Hence a **blank cell** means that the value from the previous entry remains.

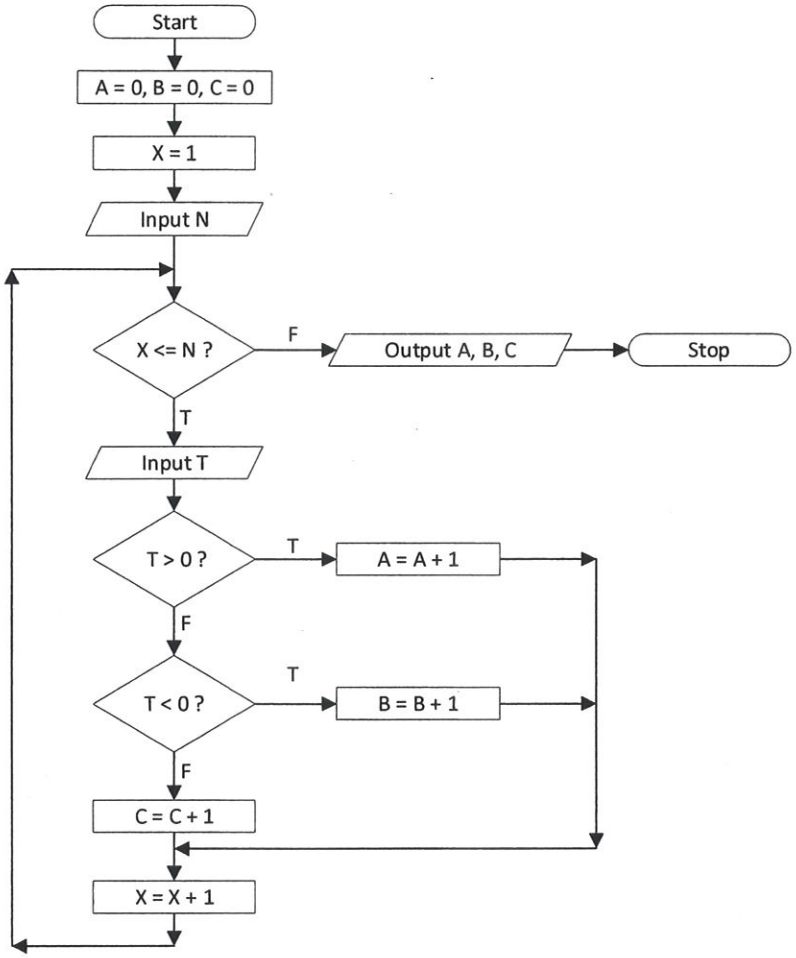
It is important to start filling in a new row in the trace table for each iteration (each time round the loop).

Trace table for Number-Guessing Game

SecretNumber	Guess	NumberOfGuesses	Guess < SecretNumber	Message
34	5	1		... larger ...
	55	2		... smaller ...
	30	3		... larger ...
	42	4		... smaller...
	36	5		... smaller ...
	33	6		... larger ...
	34	7		... 7 guesses

Example 2 Class Practice

1 Read the following flowchart carefully.



Draw the trace tables for the following sets of test data

(i) 5, 30, 20, –20, 10, –30

X	N	T	A	B	C	Output
			0	0	0	
1	5	30	1	0	0	0,0,0
2	5	20	2	0	0	
3	5	-20	2	1	0	
4	5	10	3	1	0	
5	5	-30	3	1	0	
6						3, 2, 0

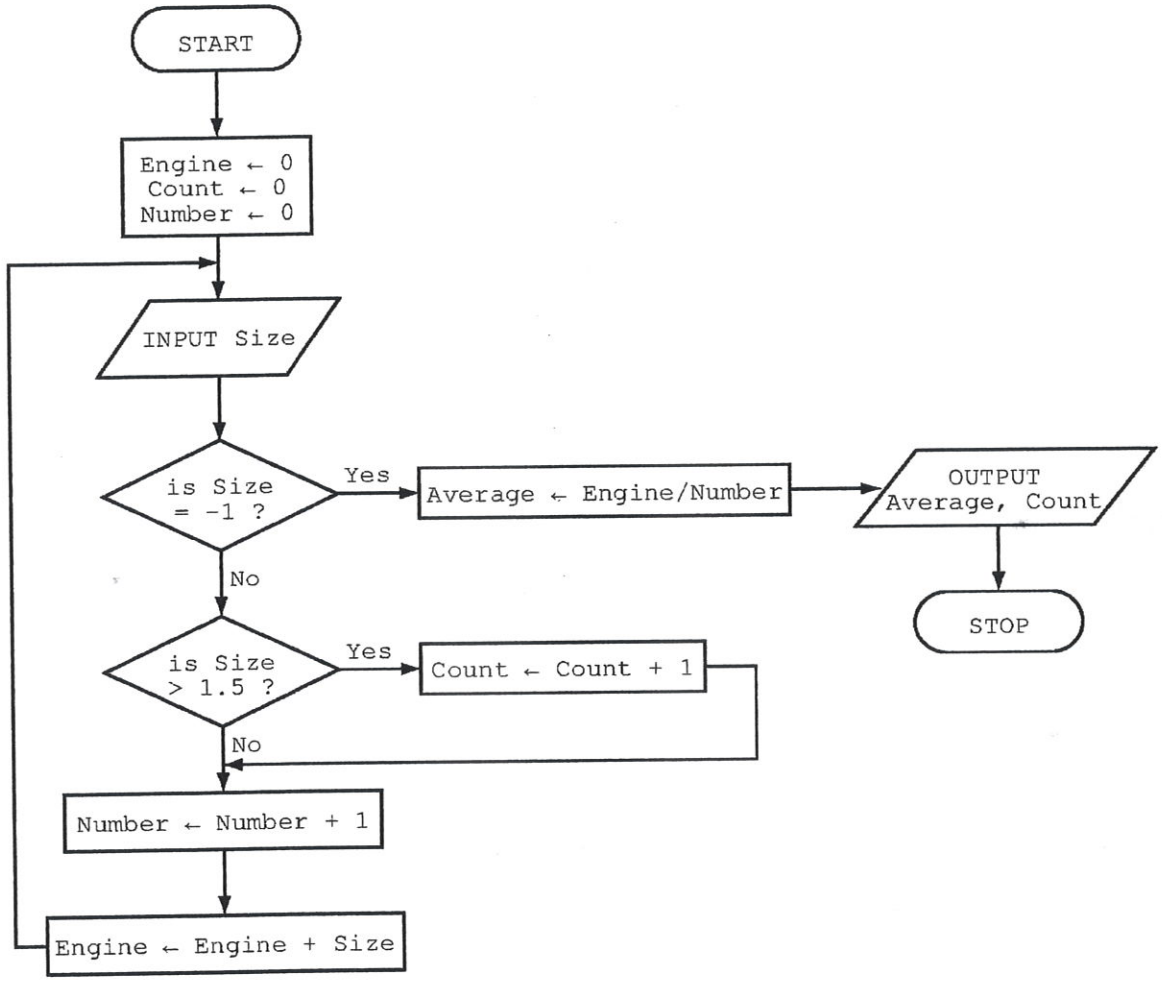
(ii) 8, 0, 0, –10, 5, 20, 0, 0, 0 challenge on myself to try the short and concise statement.

X	N	T	A	B	C	Output
			0	0	0	
1	8	0	0	0	1	
2	8	0	0	0	2	
3	8	-10	0	1	2	
4	8	5	1	1	2	
5	8	20	2	1	2	2,1,2
6	8	0	2	1	3	
7	8	0	2	1	4	
8	8	0	2	1	5	2,1,5

Tutorial 3

1* The flowchart inputs the size of a number of car engines; a value of –1 stops the input. This information is output: *average engine size and number of engines with size > 1.5*
Copy and complete the trace table for the input data.

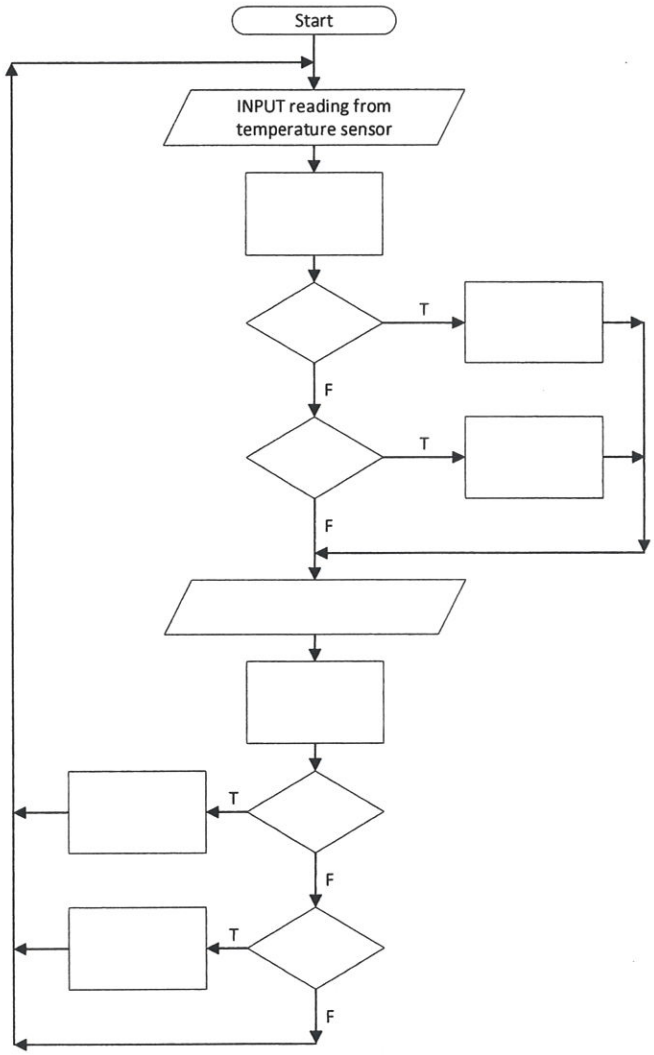
1.8, 2.0, 1.0, 1.3, 1.0, 2.5, 2.0, 1.3, 1.8, 1.3, –1



Engine	Count	Number	Size	Average	OUTPUT
0	0	0			

2* The following flowchart shows how a computer and sensors are used to control the environment in a greenhouse. Temperatures must be between 25°C and 35°C. Light must be between 50 and 80 light units.

(a) Copy and complete the flowchart, using the item number only, from the list of items given below.

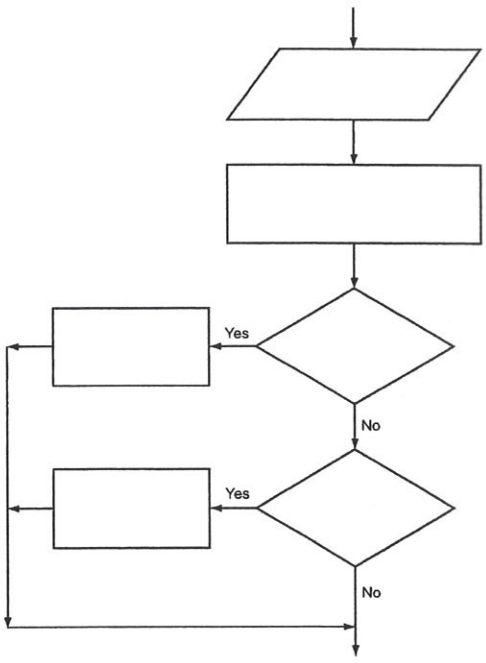


Item Number	Item Description
1	convert temperature sensor reading using ADC
2	convert light sensor reading using ADC
3	input reading from light sensor
4	is light sensor reading < 50 light units?
5	is light sensor reading > 80 light units?
6	is temperature reading < 25°C
7	is temperature reading > 35°C
8	send signal to activate switch to turn on lights
9	send signal to motor to close blinds
10	send signal to motor to open windows
11	send signal to activate switch to turn on heater

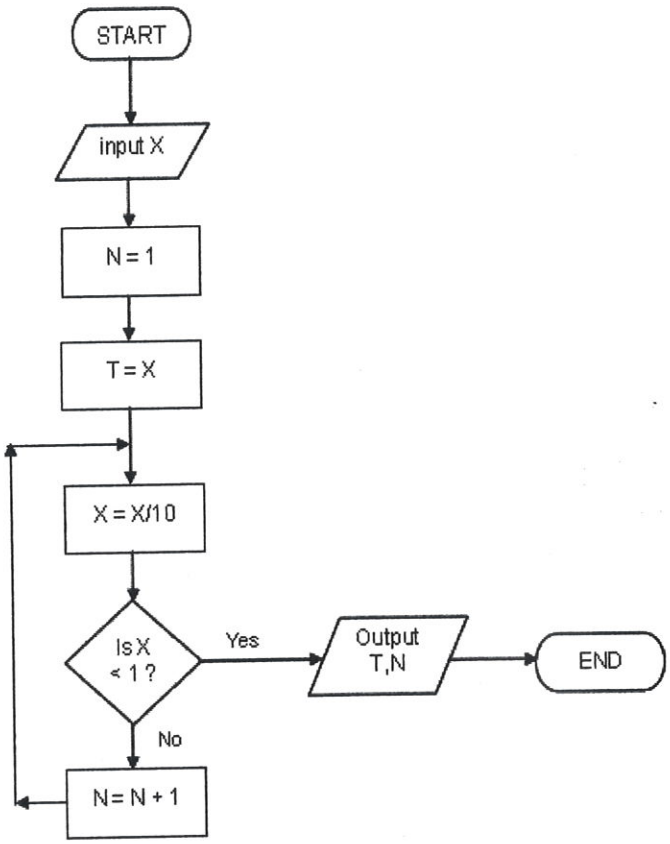
(b) The computer also checks on humidity levels (using humidity sensors) which must be between the values of 40 and 90.

If humidity is too low, water is sprayed into the air.
If humidity is too high, fresh air is allowed to enter.

Write the necessary commands in the following flowchart (copy and complete) section to show how the humidity levels are controlled:



3* This algorithm inputs 3 numbers, each number goes through successive division by 10 until its value is less than 1. An output is produced which contains the number input and a value generated by the flowchart processing. Copy and complete the trace table.



Data to be used: X = 85, 3190, -40

Trace Table			
X	N	T	Output T,N
85	1	85	