CS234 Computer Science II
Lab 1
100 points

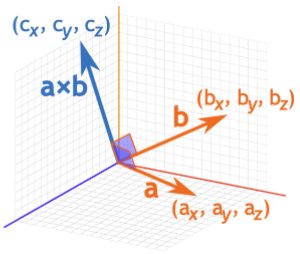
Read the instructions carefully.

1 (**20** points) **Write** the **pseudocode** for an algorithm that computes the **cross product** of two 3D vectors. The algorithm needs to output the final vector.

You can compute the cross product in the following way.

When **a** and **b** start at the origin point (0,0,0), the Cross Product will end at:

- $c_x = a_y b_z - a_z b_y$
- $c_y = a_z b_x - a_x b_z$
- $c_z = a_x b_y - a_y b_x$



Example: The cross product of **a** = (2,3,4) and **b** = (5,6,7)

- $c_x = a_y b_z - a_z b_y = 3 \times 7 - 4 \times 6 = -3$
- $c_y = a_z b_x - a_x b_z = 4 \times 5 - 2 \times 7 = 6$
- $c_z = a_x b_y - a_y b_x = 2 \times 6 - 3 \times 5 = -3$

Answer: **a** × **b** = (−3,6,−3)

Vectors can be represented as Arrays. You can manually initialize these vectors (i.e., no need of user input)

Remember that in CS, arrays start from the index 0.
See the submission details for more information)

Example of Output using the same vector values as in the previous example.

IGCSE pseudocode

```
// Exercise 1
```

CONSOLE

```
[-3,6,-3]
```

2 (**20** points) **Write** the **pseudocode** for an algorithm to ***replace every second*** character in a list with its upper-case representation. At the end your algorithm prints out the final list.

Assume that a list filled with lower-case letters is already provided.

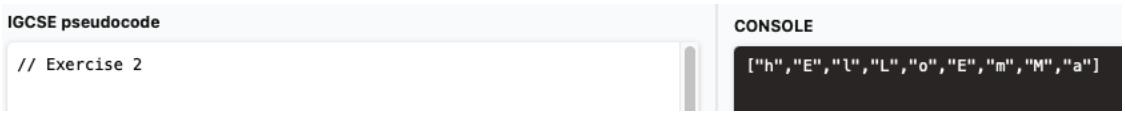
Use the following values for your solution. Having chars = [‘h’, ‘e’, ‘l’, ‘l’, ‘o’, ‘e’, ‘m’, ‘m’, ‘a’].

After running the algorithm, the array will be, chars = [‘h’, ‘E’, ‘l’, ‘L’, ‘o’, ‘E’, ‘m’, ‘M’, ‘a’].

You can manually initialize this list (i.e., no need of user input)

(See the submission details for more information)

Example of the output:

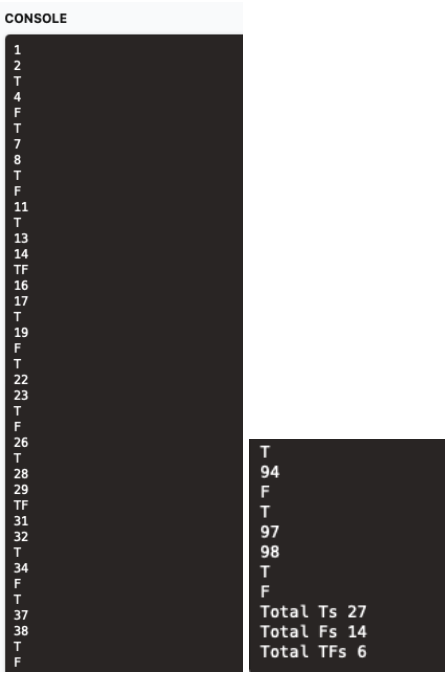


3. (**30** points, 15 each)
You need to solve the following problem. For every number from one to one hundred, output “T” if the number is divisible by three, output “F” if the number is divisible by five and output “TF” if the number is divisible by both three and five.
If the number is divisible by both (i.e., 3 and 5) *do not double count it* for three and five.
For example, the number 15 should be displayed just as “TF”, not “T”, “F”, and “TF”.
If none of these conditions match, then just output the number.
Finally, your program must show how many numbers are divisible by 3 and 5, how many divisible by 3, and how many divisible by 5.

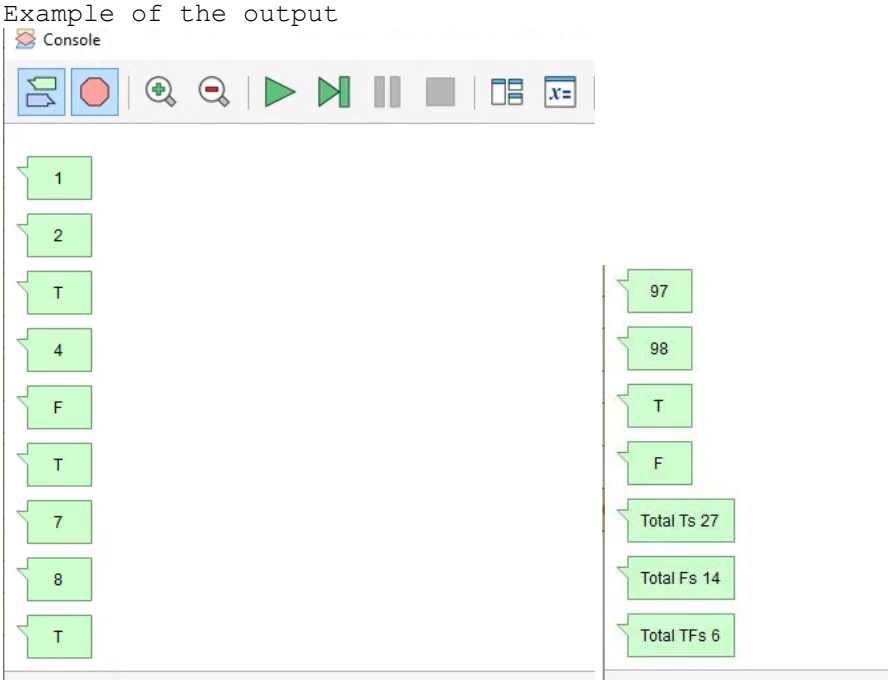
a) Create a **pseudocode** for an algorithm to solve this problem.

(See the submission details for more information)

An example of the output is the following



b) Create the **Flowchart** for your algorithm. (See the submission details for more information)
Example of the output



4 (**30** points, 15 each)

You need to solve the following problem. Create an algorithm to compute the Body Mass Index (BMI). To calculate BMI, you must first determine a person's height and weight.
The formula is the following:

$$\text{BMI} = 703 \times \frac{\text{Weight (in pounds)}}{\text{Height}^2 \text{ (in inches)}}$$

Your algorithm needs to **get the information from the user input.** Consider the weight and height as Integer numbers.

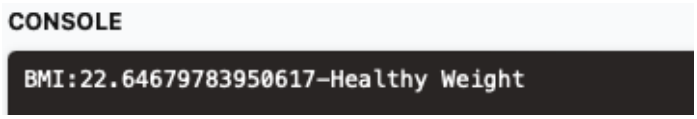
Moreover, your algorithm needs to determine the weight status of the user based on the following table:

BMI	Weight Status
Below 18.5	Underweight
18.5 – 24.9	Healthy Weight
25.0 – 29.9	Overweight
30.0 and Above	Obesity

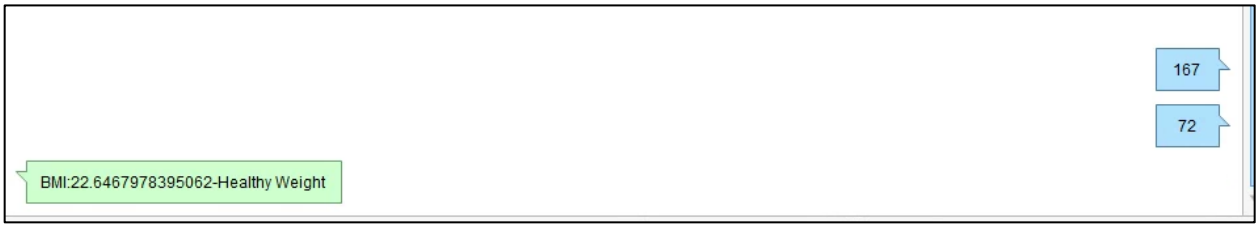
The final output is the BMI and the Weight status.
An example of the output is the following when the weight is 167 pounds and height is 72 inches is given below:

a) Create the **pseudocode** for your algorithm
(See the submission details for more information)

An example for the output is the following



b) Create the **Flowchart** for your algorithm. (See the submission details for more information)
Example of the output



Submission details:

For your *pseudocodes* you need to use the *IGCSE Pseudocode Compiler.*
IGCSE Pseudocode Compiler: https://cs.coursemo.com/igpc/
The documentation for the Pseudocode Compiler is here
https://cs.coursemo.com/cs0478-book/igpc/overview.html

For your *Flowcharts you need to use Flowgorithm.*
Flowgorithm for Windows. http://www.flowgorithm.org/download/
Flowgorithm for Mac. https://github.com/gogorama/Flowgorithm-macOS
(How to Install Flowgorithm on macOS)https://youtu.be/8szC72_eTbo
Flowgorithm for Linux: https://github.com/emanuele/flowgorithm_linux
The documentation for Flowgorithm is here
http://www.flowgorithm.org/documentation/index.html

1. Create **a txt file for each** of your pseudocodes. Write in your txt file the code you made in the IGCSE Pseudocode Compiler. Enumerate the txt file according to the exercise.
2. Take screenshots for each of your pseudocodes with their execution. Make sure to show the whole window (pseudocode and result)
3. Save your Flowgorithm files. Enumerate them according to the exercise.
4. Take screenshots for each of your flowcharts and their execution.
5. Create a single PDF file containing your screenshots.

Upload to canvas **a Zip file** containing:
1. Your txt files for the pseudocodes
2. Your flowgorithm files for the flowcharts
3. Your **PDF** with your screenshots. (Do not send MS Word files or just JPG files.)

Name your ZIP file as follows: **Lab1_Lastname_Firstname.zip**

The **ZIP** must be uploaded to Canvas. I do not accept answers via email or as comments on Canvas.

Make sure to check the **due date** for this activity on Canvas. **There are no late submissions.**
Try to submit it before the due date so you can have time to check for improvements.
Make sure you are **submitting the correct files**. I will grade the files uploaded to Canvas.

Read all the instructions carefully.

Do not assume requirements, contact me if you have questions!