EECE 230X Introduction to Computation and Programming
Open Enrollment Section
Entrance Exam

July 29, 2023

- The duration of this exam is 1 hour and 30 minutes, starting at 2:00 PM.
- The exam consists of 4 problems.
- **Each problem's solution should be submitted in a separate Python file** with the following names: Prob1.py, Prob2.py, Prob3.py, and Prob4.py
- **Each of the 4 problems has a separate submission link**. To submit your work on a problem, follow these steps:
  1. Click on the provided link (highlighted in light blue).
  2. Once inside the submission box, select the file for the respective question.
  3. You will be prompted to enter your First and Last Name.
  4. Enter the email you used to sign up for the course in both boxes, i.e., **use the email you used to sign up for the course as both your First Name and your Last Name**. This email address will serve as a unique identifier for your submission.
  5. Select and **Upload** the corresponding **file**.
  6. Click on the "Upload" button.
- **It is your responsibility to make sure that your work is properly submitted within the allotted exam time**
- The problems are of varying difficulty. Below is a rough ordering estimate of the problems in order of increasing difficulty.
  - Level 1 : Problem 1
  - Level 2 : Problems 2 and 3
  - Level 3 : Problem 4
- Plan your time wisely. Do not spend too much time on any one problem. Read through all of them first and attack them in the order that allows you to make the most progress.
- It's alright if you don't solve all the problems. Aim to solve as much as you can within the given time.
- Good luck!

Problem 1. Tabboule

Samir's family is hosting a family dinner, as they do every year. And as every year, Ali is handed the task of making "Tabboule". "Tabboule" is a famous Lebanese dish that mainly consists of 3 ingredients:

- Tomatoes
- Parsley
- Bulgur

To make a bowl large enough for the hungry guests, Samir must buy 3kg of tomatoes, 4 bunches of parsley, and 500g of bulgur. There are two Supermarkets in his village: one within walking distance, the other located 10 minutes away by car. Samir prioritizes the nearer supermarket but will only buy from the farther one if at least two of the ingredients cost at least 30 percent less.

Write a python program which asks the user to enter the prices of the 3 ingredients in the near supermarket and in the far supermarket, as shown below:

```
Enter price of 1 kg tomatoes in near supermarket: 5.05

Enter price of 1 bunch of parsley  in near supermarket: 3.04

Enter price of 1 kg bulgur in near supermarket: 8.45

Enter price of 1 kg tomatoes in far supermarket: 2.3

Enter price of 1 bunch of parsley  in far supermarket: 5.78

Enter price of 1 kg  bulgur in far supermarket: 6.7
```

Your program should print "Far" if Samir should buy from the far supermarket and "Near" if he should buy from the near supermarket.

Submit your solution in a file called `Prob1.py` using this link. Please enter the email you used to sign up for the course as both your `First Name` and `Last Name`.

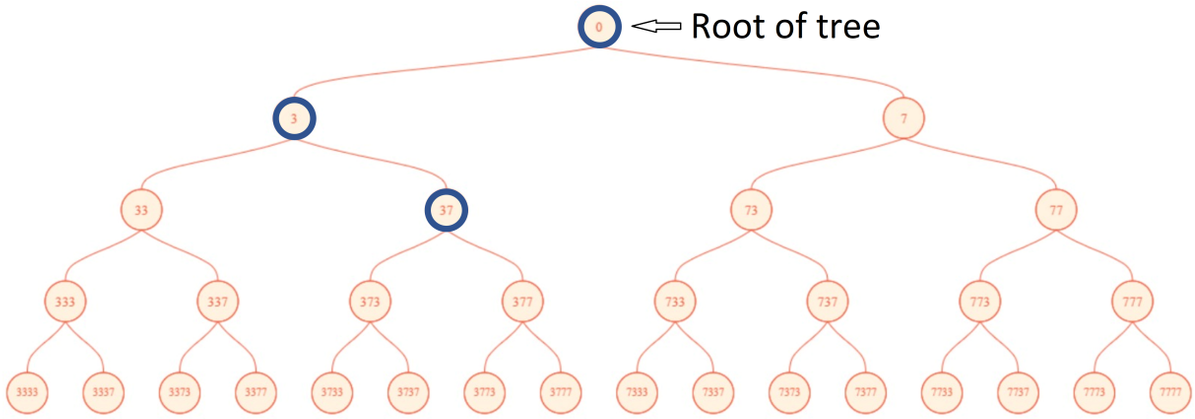
Problem 2. Sequence

Write a Python program, which given an positive integer integer n, prints a sequence as shown in the below examples for $n = 1, 2, \ldots, 5$. Guess the pattern for larger values of n.

```
Enter n:1
Output sequence: 1

Enter n: 2
Output sequence: 2 1

Enter n: 3
Output sequence: 3 2 3

Enter n: 4
Output sequence: 4 3 4 3

Enter n: 5
Output sequence: 5 4 5 4 5
```

Submit your solution in a file called `Prob2.py` using this link. Please enter the email you used to sign up for the course as both your `First Name` and `Last Name`.

Problem 3. Tree



This drawing shows the first 4 layers of an *infinite* tree. Can you identify the pattern of the numbers in deeper layers?

Write a Python program, which given an integer n, prints the sum of the nodes on the path from the root of the tree to the given number n if n appears in the tree. If n does not appear in the tree, your program should print 0.

For instance, if $n = 37$, the output is 40: the sum of the nodes highlighted in blue in the picture. If $n = 38$, the output is 0 because 38 does not appear in the tree.

Examples:

```
Input: 37
Output: 40

Input: 38
Output: 0

Input: 3377333773
Output: 3752593076

Input: 37373303773
Output: 0

Input: 21124894
Output: 0
```

You will get partial credit if your code works properly only when n appears in the tree.

Submit your solution in a file called `Prob3.py` using this link. Please enter the email you used to sign up for the course as both your `First Name` and `Last Name`.

Problem 4. Candy day

Samira, a school teacher, wants to make a good impression on her Grade 3 class students. She brought candy. However, she is faced with a problem: she wants to know how many candies remain if she divides the candy equally and maximally among the students.

The number of students and candies may be huge, so Samira asks you for help. Write an efficient algorithm that will answer Samira's question.

Input: The input consists of two positive integers, `candies` (the number of candies) and `students` (the number of students).

Output: Output a single integer representing the remaining candies after dividing them equally and maximally among the students.

You are asked to solve this problem **without using** the modulo operator % or the division operators / and // except for dividing by 2. Moreover, using the math module and any other module is not allowed; you are asked to solve it using loops.

Sample Input/Output:

```
Enter number of candies: 13

Enter number of students:  5

Number of remaining candies: 3

-----

Enter number of candies: 1293214314313

Enter number of students:  21312413

Number of remaining candies:19718299

-----

Enter number of candies: 917409749178208

Enter number of students: 234

Remaining candies: 130
```

Submit your solution in a file called `Prob4.py` using this link. Please enter the email you used to sign up for the course as both your `First Name` and `Last Name`.