EECS 1012. LAB 6: More Computational Thinking

A. IMPORTANT REMINDERS

1) You should attend your own lab session (the one you are enrolled in). If you need to change your lab enrollment, you should go to the department. Instructors or TAs cannot change your enrollment. TAs are available to help you during your lab hours.
2) You are required to pass the pre-lab mini quiz posted on eClass not later than the first 10 minutes of your lab time. You have 3 attempts; and you need at least 75% to pass. However, each time you may get some different questions. Make sure you do not start the pre-lab quiz unless you have done the pre-lab tasks. Failing the pre-lab mini quiz is equal to failing the whole lab, yet you are still highly encouraged to complete the lab and submit your work to eClass.
3) You can also have your work verified and graded during the lab sessions. Feel free to signal a TA for help if you stuck on any of the steps below. Yet, note that TAs would need to help other students too.
4) Submit your lab work in eClass before the deadline. To pass this lab, your grade for it should be at least 70%.

B. IMPORTANT PRE-LAB TASKS YOU NEED TO PERFORM BEFORE THE LAB

1) Download this lab's files and review them completely.
2) Practice tracing algorithms with different sample inputs. There are several examples in "06 Computational Thinking 3".
3) In Slides 23 and 24 of the above notes, there is an example of sub-algorithm. Review it and implement it in JavaScript, once with, and once without using sub-algorithms.

C. GOALS/OUTCOMES FOR LAB

- To practice computational thinking by first drawing flowcharts for basic computation problems, verify if they are correct (by tracing them), and implement the solutions in JavaScript.

D. TASKS

1) Your first task in this lab is to verify 5 algorithms, in Exercises 1 to 5, by tracing them for some sample inputs. You also provide pre- and post- conditions for each algorithm. In Exercise 6, you draw a flowchart that includes two sub-algorithms. These tasks must be done in teams of two. (By the permission of the TA, only one team can be in team of three if the lab population is odd.) While you are done, you should show your trace tables, pre- and post- conditions for all flowcharts, as well as yor solution to Exercise 6 to your TAs before you go to the next part. The TA may ask you to make minor modifications to demonstrate your computational thinking skills in those contexts. Do NOT open VS-Code or browsers before finishing Task 1.
2) In Part 2, you implement all 6 exercises in JavaScript. You should create one html, one css, and one js file for all your work, and you demo it to the TA. See next pages for further instructions.

E. SUBMISSION

1) Manual verification by a TA (optional)

   You may have one of the TAs verify your lab before submission. The TA will look at your various files in their progression. The TA may also ask you to make minor modifications to the lab to demonstrate your knowledge of the materials. The TA can then record your grade in the system.

2) eClass submission

   You will see an assignment submission link on eClass. Create a folder named "Lab06" and copy all your lab materials inside (`img_{01,02,03,04,05,06}.jpg`, `Lab06<yourName>.html`, `Lab06<yourName>.css` and `Lab06<yourName>.js`). No zipping is required.

F. COMPUTATIONAL THINKING

Part 1

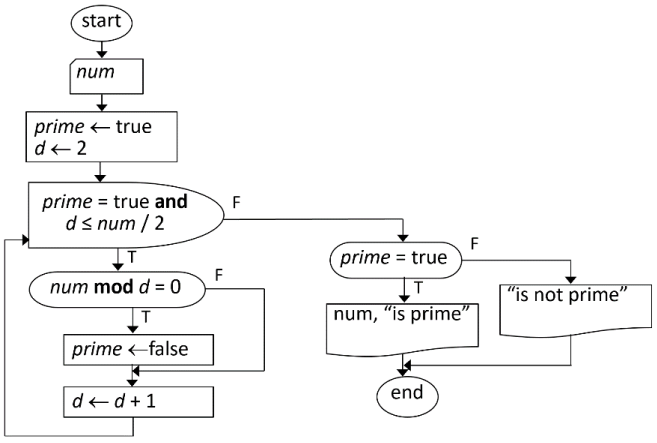
Preferably in teams of two. If you have already [mostly] completed it, you must discuss it with your peer before you show your final solution to your TA or submit it.

In Exercises 1 to 5, you verify the correctness of all algorithms by tracing them with some sample inputs. If an algorithm ends without using all inputs, re-run it for the remaining inputs. You also write pre- and post- conditions for each algorithm. In Exercise 6, you devise an algorithm that calls two sub-algorithms. In that Exercise you trace your new sub-algorithms for some sample inputs. Note that terms algorithm, sub-algorithm, function, method, programs are used interchangeably, yet they have subtle differences.

For each exercise, take one picture of all your trace tables and pre- post- conditions, including your name. By end of this lab, both you and your teammate should submit these pictures to eClass as **img_**{01,02,03,04,05,06}**.jpg** files, where **img_x** is the picture for exercise **x** below. Make sure the size of each image is less than 500KB, e.g. by reducing the resolution of your camera.

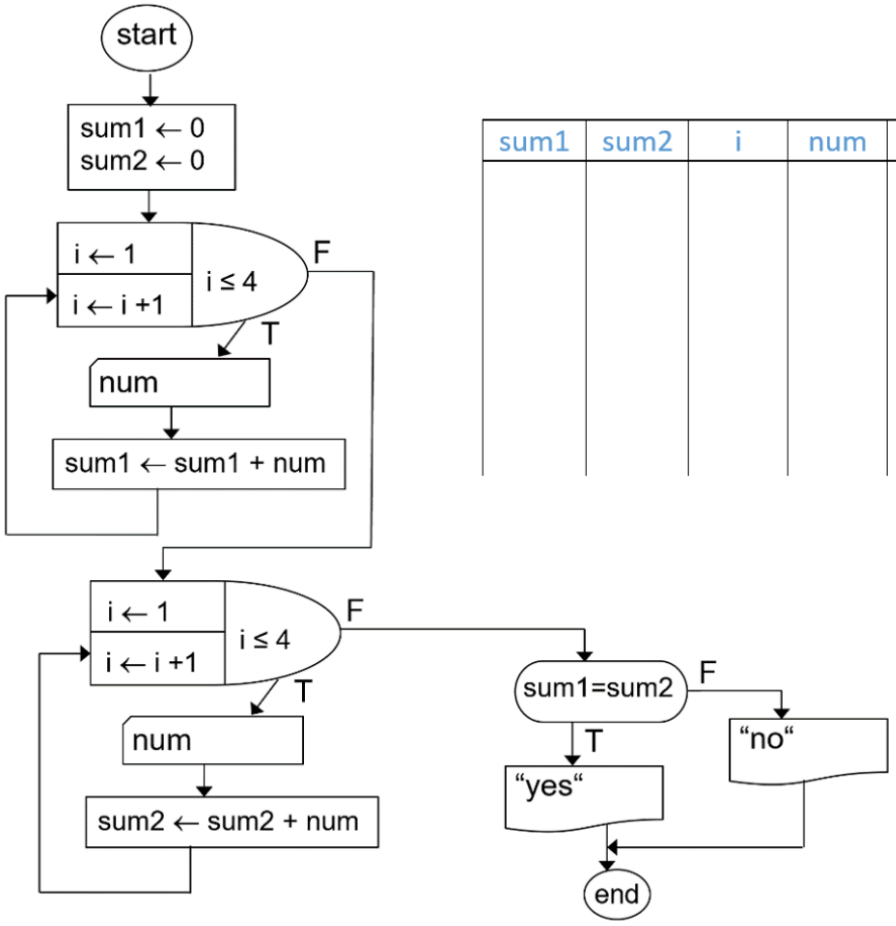
IMPORTANT: You are required to provide preconditions and postconditions for each solution you provide.

Ex 1) Trace the following flowchart for when input is 15 and complete the trace table. Also, write pre-post-conditions for this flowchart.



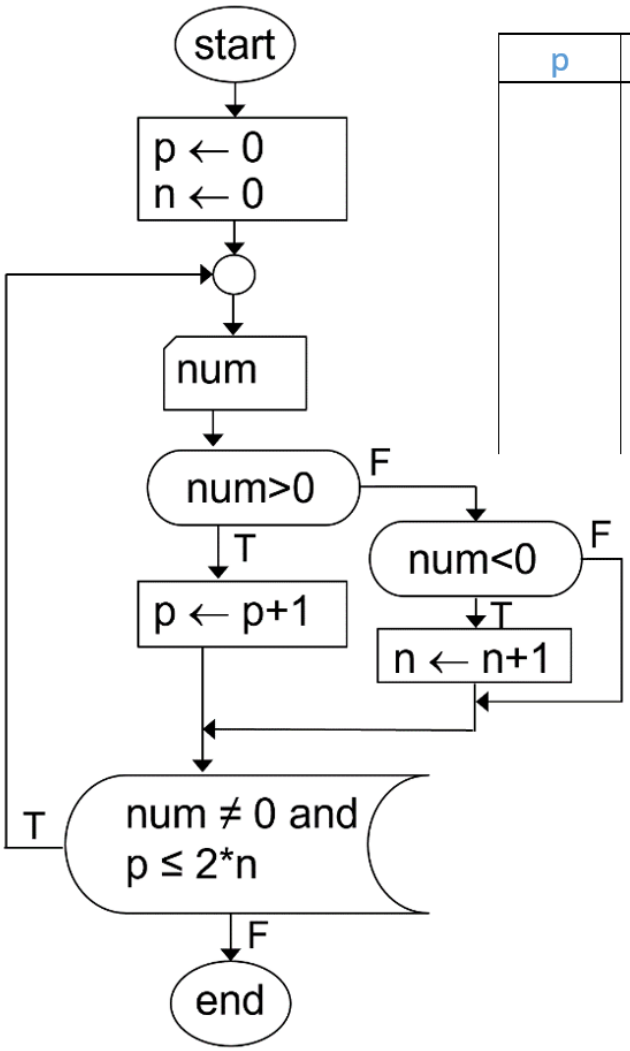
num	prime	d	output

Ex 2) Trace the following flowchart for when input values are 12, 3, 5, -2, 11, 15, 1, 1, and complete the trace table. Also, write pre- post-conditions for this flowchart.



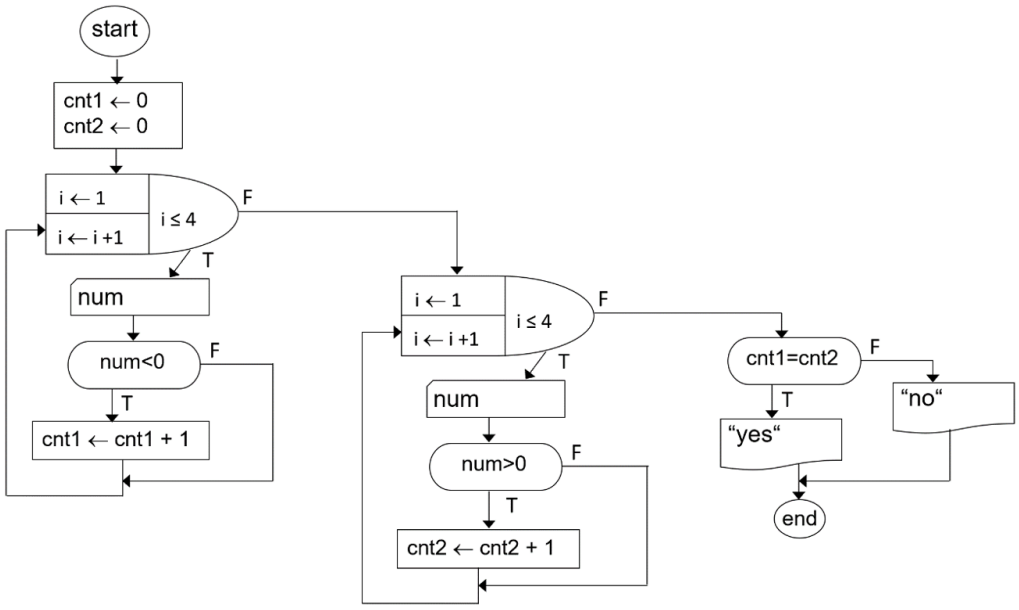
sum1	sum2	i	num	output

Ex 3) Trace the following flowchart for when input values are -10, 1, 3, 2, -11, -13, -1, 1, -3, 2, 0 and complete the trace table. Also, write pre- post-conditions for this flowchart.

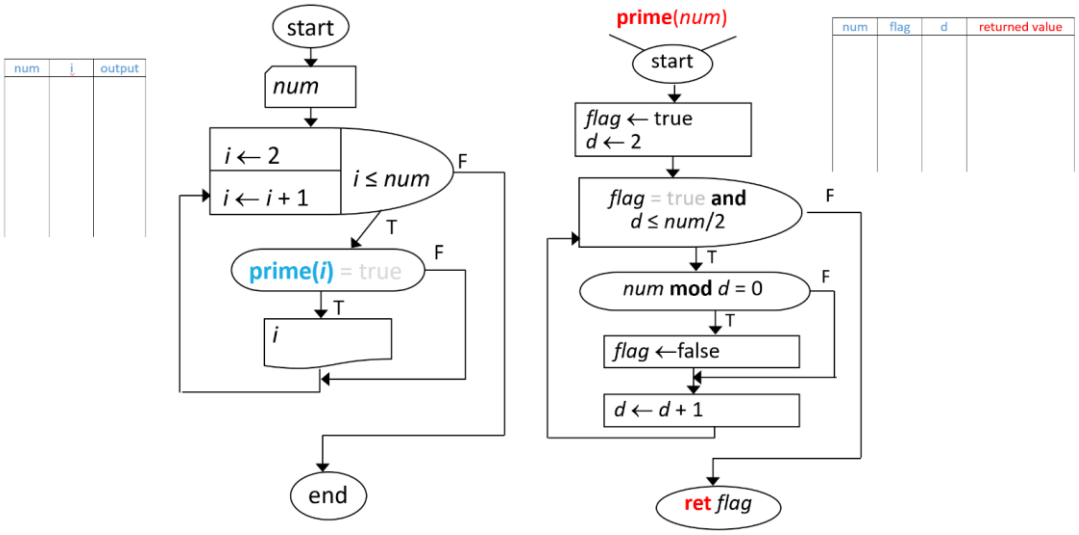


p	n	num	output

Ex 4) Trace the following flowchart for when input values are 12, -2, -3, 6, -11, 3, 1, -1 and complete the trace table. Also, write pre- post-conditions for this flowchart.



Ex 5) This exercise uses sub-algorithms. Trace it for when input value is 6 and complete the trace tables. Also note that there are two variables name num, one in the main algorithm and another in the sub-algorithm. Write pre- post-conditions for each of these algorithms (the main one and the sub-algorithm).



Ex 6) Devise an algorithm to receive a positive number, n, and output all prime numbers that are smaller than n and have a digit 7. For example, if n is 100, the program should output 7, 17, 37, 47, 67, 71, 73, 79, and 97.

Your solution should have a main algorithm and two sub-algorithms, let's call them prime(num) and has7(num). You may reuse the prime sub-algorithm of Ex 5. You do not

need to verify (e.g. by tracing) it though because you did it in Ex 5. You need to trace your has7 algorithm. You should provide pre- and post-conditions for all your 3 (sub)algorithms.

Part 2

Create a `lab06<yourname>.html` file supported by a `lab06<yourname>.css` and a `lab06<yourname>.js` files. In your html file, you should have 6 buttons with captions Problem 1, Problem 2, …, Problem 6. Then, you implement all 6 flowcharts in your `lab06<yourname>.js`. When each button is clicked, the event handler should execute the corresponding algorithm that you have in your JavaScript file.

G. AFTER-LAB TASKS (THIS PART WILL NOT BE GRADED)

To review what you have learned in this lab as well as to expand your skills further, we recommend the following questions and extra practice:

1) Revisit other flowcharts you have drawn/seen in the course and trace them for some sample inputs.

2) Devise an algorithm to receive a positive number, n, and output all prime numbers that are smaller than *n* and all their digits are prime too. For example, if n is 100, the program should output 2, 3, 5, 7, 23, 37, 53, and 73.

3) Add all algorithms and programs that you have drawn throughout the semester in your **Learning Kit** Project. You would need to show that to your TA at the beginning of Lab 07 next week. Your Learning Kit project should include at least 30 problems by then.

Please feel free to discuss any of these questions in the course forum or see the TAs and/or Instructor for help.