

EECS 1012: LAB #5 – More Computational Thinking (Feb 4 — Feb 10, 2019)

#Important reminders

- 1) You **must** attend **your assigned** lab session (we will be marking your submission in the lab).
- 2) Do the mini-quiz prelab quiz. It will open on Wednesday by 13:00 and will expire on Thursday by 12:59. It's part of your lab grade. Each lab counts to 2% of your overall grade.
- 3) You must arrive on time – anyone later than 15 minutes may not be admitted to the lab.
- 4) Submitting your lab work to Moodle is required. Otherwise, you receive 0 even if you show the results to your TA.

#Important pre-lab works you need to do before going to the lab

- 1) Download this lab files and read them carefully to the end.
- 2) You should have a good understanding of
 - Iterations: such as *while*, *do while* and *for* loops symbols as introduced in the lecture notes
 - JS prompt box
 - Js operator for division and modulus operator
- 3) don't forget to do the mini-quiz by Thursday at 12:59pm.

1. GOALS/OUTCOMES FOR LAB

- To practice more on **computational thinking** and implement it in js

2. LAB – TASK

- 1) You first and major task in this lab is to draw 7 flowcharts. This task must be done in teams of two (not less not more). While you are done, you should show your flowcharts to the TAs before you go to next part. The TA may ask you to make minor modifications to your flowcharts to demonstrate your computational thinking skills in those contexts.
- 2) Then, you are provided with `ct.html` document and supporting files such as `ct.css` and `ct.js`. Your task is to translate your first 5 flowcharts to js.
- 3) You will generate at least five `html` and `js` files in this process. You should demo each HTML file to the TA. For that, please, have each `html` file open in a different tab so you can show the progression.
- 4) See next pages for details on how to modify your `html` and `js` files.

3. SUBMISSIONS

1) Manual verification by TA

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

The TA will mark your name off a list and ask you to sign that you have been verified.

2) Moodle submission

You will see an assignment submission link on Moodle. Create a **folder** named “**Lab5**” and copy all of your lab materials inside (`img_{09,10,11,12,13,14,15}.jpg`, `ct_Ex{9,10,11,12,13,14,15}.html` and `ct_Ex{9,10,11,12,13,14,15}.js`). This folder should be compressed (or `tar.gz` on the VirtualBox machines) and the compressed file submitted.

Part 1: This exercise must be done in teams of two (not less not more). If you have done it at home, you must discuss it with a peer from your lab before you show your final solution to your TA.

Using a computer program (or a pen and pencil), draw the following flowcharts and write your name on each. By end of this lab, you should take a screenshot (or a picture) from each flowchart and both you and your teammate should submit them to moodle as `img_{09,10,11,12,13,14,15}.jpg` files, where `img_x` is the

flowchart of 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 use the symbols introduced in the slides, for all following 7 exercises.

Another note. In Exercise 9 to 15, you are not allowed to convert numbers to strings or arrays to process them; recursion is not allowed either as we have not covered them yet. In other words, a solution heavily based on strings or arrays or recursion is not acceptable.

- Ex 9) Similar to Example 29. Devise a flowchart to receive a positive integer and output each digit separately. For instance, if the input is 692, the program should output 2, 9, 6,. Another example, if the number is 135429 the program should out put 9, 2, 4, 5, 3, and 1.
- Ex 10) Similar to Example 30. Devise a flowchart to receive a positive number and output how many of its digits are equal to 3. For instance, if the input is 633, the program should output 2, because there are two threes there. Another example, if the input is 14768, the program should output 0.
- Ex 11) Similar to Example 31. Devise a flowchart to receive a positive number and output sum of its digits. For instance, if the input is 63932, the program should output 23, because $6+3+9+3+2$ is 23. Another example, if the input is 23 the program should output 5.
- Ex 12) Similar to Example 32. Devise a flowchart to receive a positive number and output "yes" if it's equal to its reverse; otherwise, output "no". For instance, if the input is 63936, the program should output "yes", because if you read the digits from left to right or from right to left, it's the same number. But, if the input is 632, the program should output "no" because 632 is not the same as 236.
- Ex 13) Devise an algorithm to receive a positive number, as n , and output $n!$ (n Factorial).
- Ex 14) Devise an algorithm to input an integer greater than 1, as n , and output the first n values of the [Fibonacci sequence](#). In Fibonacci sequence, the first two values are 0 and 1 and other values are sum of the two values preceding it. For instance, if the input is 4, the program should print 0, 1, 1, 2,. As another example if the input is 9, the program should output 0, 1, 1, 2, 3, 5, 8, 13, 21,.

By the way, after you are done with Ex 14, learn more about applications of Fibonacci number in real life here: [http://www.ijesi.org/papers/Vol\(6\)9/Version-3/B0609030714.pdf](http://www.ijesi.org/papers/Vol(6)9/Version-3/B0609030714.pdf) . There might be a question on this in the pre-lab mini quiz.
- Ex 15) Devise an algorithm to input a positive integer, as n ,—and by using [] characters—output the figure below that has n rows and each row k has k pairs of []. For instance, if input is 5, the figure on the left (and if the input is 12, the figure on the right) should be generated by the program.

```
[]  
[][]  
[][][]  
[][][][]  
[][][][][]
```

Figure left: n is 5

```
[]  
[][]  
[][][]  
[][][][]  
[][][][][]  
[][][][][][]  
[][][][][][][]  
[][][][][][][][]  
[][][][][][][][][]  
[][][][][][][][][][]  
[][][][][][][][][][][]  
[][][][][][][][][][][][]
```

Figure right: n is 12

Show all your flowcharts to your TA before going to Part 2. The TAs may ask any teammate some questions about the flowcharts, they may also ask you to modify your flowcharts slightly.

Part 2: you are given **ct.html**, **ct.css**, **ct.js** files. By reading these files carefully, you can enhance your learning before diving to details of exercises below. In this part, you translate your flowcharts of Part 1 to js code.

Exercise 9. Copy **ct.html** to a new file named **ct_Ex9.html**. Copy **ct.js** to a new file named **ct_Ex9.js**.

Launch **ct_Ex9.html** with your browser and click on the button, nothing happens. In this exercise, you translate your flowchart of Ex 9 of Part 1 to its equivalent js code. First let's fix some html code:

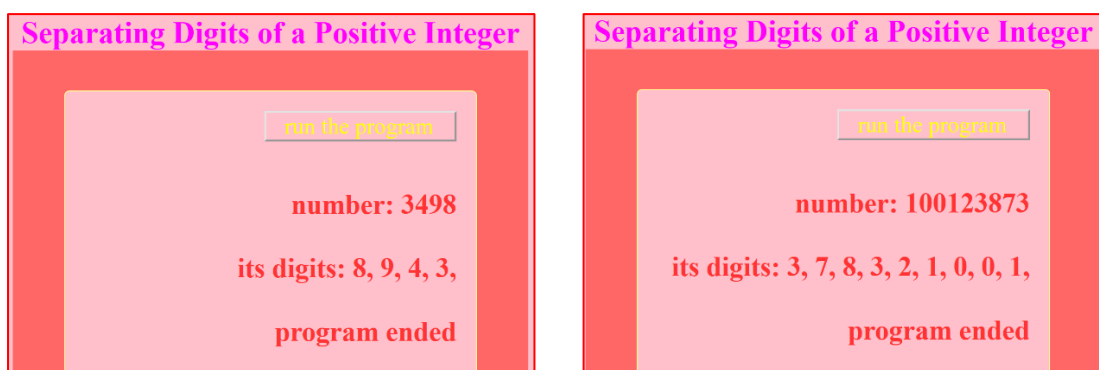
Make four changes to **ct_Ex9.html**, as follows:

- 1) Connect it to **ct_Ex9.js** by fixing the script tag in the head element.
- 2) Correct the header h1 of the document to show "Separating Digits of a Positive Integer"
- 3) Correct the name of the event function of the button to be "problem_09()"
- 4) Add your name to the list of authors of this page.

Also, follow these guidelines in your **ct_Ex9.js**:

- Make sure name of the function is proper.
- Part of the function has been provided for you; if you run your program at this point, it receives a number, but it does not separate the digits, and it stops. You should use your flowchart that you drew in Part 1 to complete the function.
- In your flowchart, you should have a loop, perhaps a while loop (or a do-while), translate it to js starting from line 20 of **ct_Ex9.js**.

Once you are done, run the program, you should see the following results if you enter 3498 or 100123873. If not, debug your code (shift+ctrl+j in firefox).



Before going to next exercise, make sure your JS code is a good match to your flowchart for this problem. If not, you should fix this mismatch.

Exercise 10. Copy **ct_Ex9.html** and **ct_Ex9.js** to new files named **ct_Ex10.html** and **ct_Ex10.js**.

In this exercise, you translate your flowchart of Ex 10 of Part 1 to its equivalent js code.

In the js file of previous exercise, you (should have) separated digits of a number by modulus and division operators. Now, in **ct_Ex10.js**, you need to make the following changes

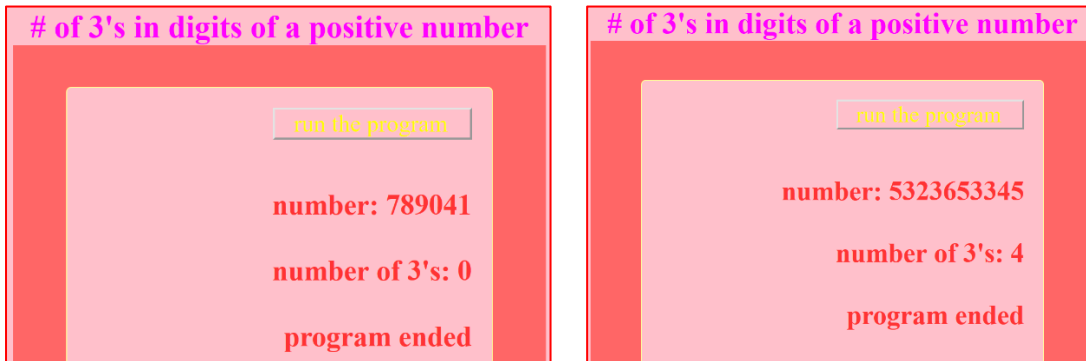
- Name of the function should be **problem10()**
- In line 15, change the output message from "its digits" to "number of 3's"
- Before entering the loop (e.g. in line 19), declare a counter variable and assign 0 to it.

- Inside the loop, after you separated a digit (by modulus operator) check if it's equal to 3 or not, if yes, add to the counter.
- You perhaps had an output box inside the loop in your flowchart of Exercise 9; and, you probably do not have an output box inside the loop in you Exercise 10's flowchart. Instead, you should have an output box after the loop iterations are over to show how many 3's you've counted. If that's the case, translate that output box to a js statement like this:

```
outputObj.innerHTML=outputObj.innerHTML+counter;
```

Also, you need to make 3 changes in your **ct_EX10.html**: script, header h1, and name of the event function.

Once you are done, run the program, you should see the following results if you enter 789041 or 5323653345. If not, debug your code (shift+ctrl+j in firefox).



Before going to next exercise, make sue your JS code is a good match to your flowchart for this problem. If not, you should fix this mismatch.

Exercise 11. Copy **ct_Ex10.html** and **ct_Ex10.js** to new files named **ct_Ex11.html** and **ct_Ex11.js**.

In this exercise, you translate your flowchart of Ex 11 of Part 1 to its equivalent js code.

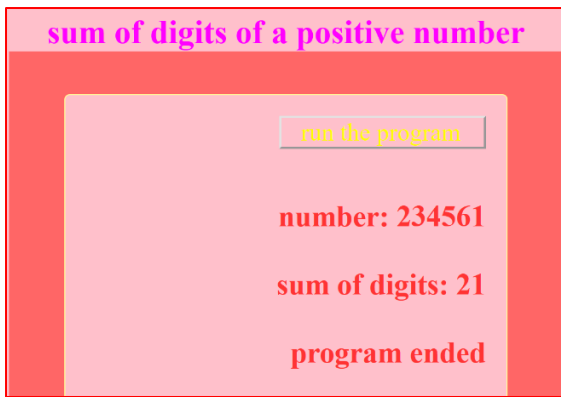
First, in **ct_Ex11.js**, you need to make the following changes

- Name of the function should be `problem11()`
- In line 15, change the output message from "number of 3's" to "sum of digits".
- In line 19 of **ct_Ex10.js**, you had declared a counter variable and assigned 0 to it. Just change name of that to `sum`, because here you do not count anything, you just add the digits together.
- In your flowchart of Ex 10, inside the loop, after you separated a digit (by modulus operator), you checked if it's equal to 3 or not. We no longer need that `if` statement here. Instead, add the separated digit to `sum`.
- You have an output box after the loop iterations are over; but, you are not going to output counter any more, you output `sum`. In that case, the statement should look like this:

```
outputObj.innerHTML=outputObj.innerHTML+sum;
```

Also, you need to make 3 changes in your **ct_EX11.html**, similar to those you made in **ct_Ex10.html**.

Once you are done, run the program, you should see the following result if you enter 234561. If not, debug your code (shift+ctrl+j in firefox).



Before going to next exercise, make sure your JS code is a good match to your flowchart for this problem. If not, you should fix this mismatch.

Exercise 12. Copy **ct_Ex11.html** and **ct_Ex11.js** to new files named **ct_Ex12.html** and **ct_Ex12.js**.

In this exercise, you translate your flowchart of Ex 12 of Part 1 to its equivalent js code.

Several changes that you need to make here are minor changes like what you did in Exercise 11 in **ct_Ex11.html** and **ct_Ex11.js**. So, we do not re-state them again here, to encourage you to make such changes independently and with minimum guidance.

In the loop of your flowchart for Ex 12 of Part 1, you may separate the digits and make the reverse of the input number along the way—i.e., in loop iterations. For instance, assume the input number is 235, before entering the loop, you should declare a variable `reverse` and initialize it to 0 as well as storing the input number in a variable, let's call it `temp`.

In the first iteration of the loop, you will have:

235 modulus 10 is 5; and, the reverse number that you currently have, which is 0, times 10 plus 5 is 5 and you store it in variable `reverse`; then, you reduce 235 to 23 by dividing it by 10.

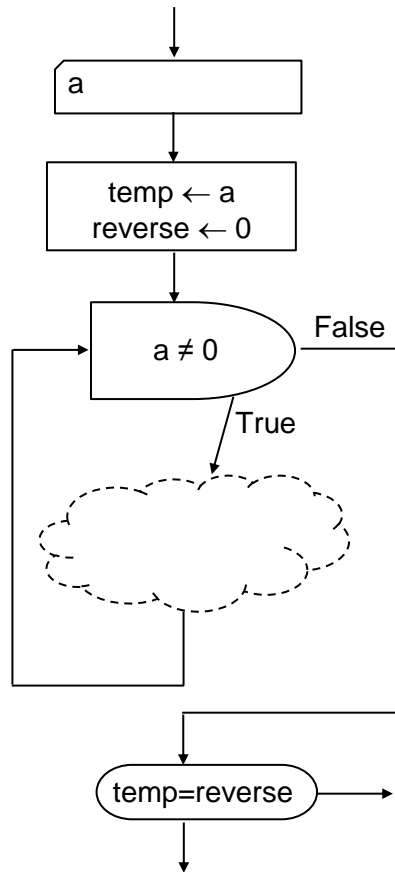
Now, in the second iteration of the loop, you will have:

23 modulus 10 is 3; and, the reverse number that you currently have, which is 5, times 10 plus 3 is 53 and you store it in variable `reverse`; then, you reduce 23 to 2 by dividing it by 10.

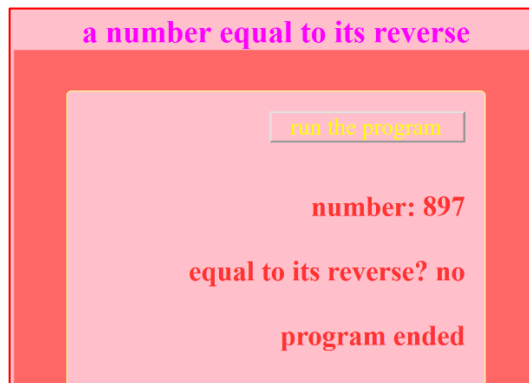
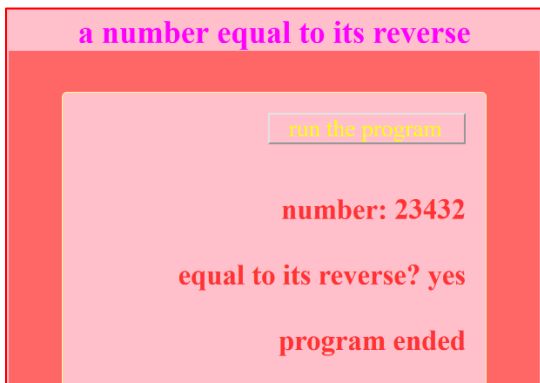
Now, in the third iteration of the loop, you will have:

2 modulus 10 is 2; and, the reverse number that you currently have, which is 53, times 10 plus 2 is 532 and you store it in variable `reverse`; then, you reduce 2 to 0 by dividing it by 10.

Because the number is already reduced to zero, there is no more iteration. In other words, we exit the loop. Now, we should compare the initial number (235) by its reverse (532)—that we built within loop iterations. If they are equal, we output “yes”; otherwise we output “no”. As a hint, below, we show you part of a flowchart that you may have for this exercise. You should be able to write the body of the loop based on example that we explained above.



Once you are done, run the program, you should see the following result if you enter 23432 or 897. If not, debug your code (shift+ctrl+j in firefox).



Before going to next exercise, make sue your JS code is a good match to your flowchart for this problem. If not, you should fix this mismatch.

Exercise 13. Copy `ct_Ex12.html` and `ct_Ex12.js` to new files named `ct_Ex13.html` and `ct_Ex13.js`.

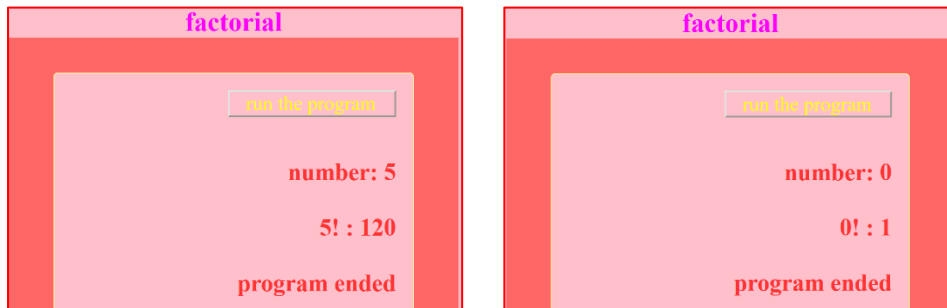
In this exercise, you translate your flowchart of Ex 13 of Part 1 to its equivalent js code.

Several changes that you need to make here are minor changes like what you did in previous exercises in **html** and **js** files. So, we do not re-state them again here, to encourage you to make such changes independently and with minimum guidance. Make sure name of the event function is `factorial()`.

The major difference between the flowchart of this exercise compare to those of previous exercises is that the number of iterations in this exercise is *deterministic*. In other words, we know how many iterations needs to be made—in advance. For instance, for calculating 5!, five iterations is required. No more no less,

whereas in previous exercises we did not know how many digits the input number will have. Therefore, we did not know how many iterations the loop will need. Hence, none of the previous exercises should have been solved with a for loop. Ex 13, though, can be devised with a for loop.

Once you are done, run the program, you should see the following result if you enter 5 or 0. If not, debug your code (shift+ctrl+j in firefox).



Before going to next exercise, make sure your JS code is a good match to your flowchart for this problem. If not, you should fix this mismatch.

Exercise 14. Copy **ct_Ex13.html** and **ct_Ex13.js** to new files named **ct_Ex14.html** and **ct_Ex14.js**.

In this exercise, you translate your flowchart of Ex 14 of Part 1 to its equivalent js code.

Several changes that you need to make here are minor changes like what you did in previous exercises in **html** and **js** files. So, we do not re-state them again here. Just make sure name of the event function is **fibonacci()**, both in your **html** and **js** files.

This exercise can be done with a for loop too, because—as an example—if the input is 10, the loop should iterate exactly 8 times. Note that for the first two values, we do not need to iterate; we already know they are 0 and 1.

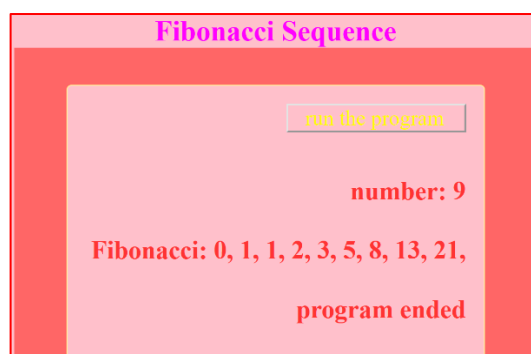
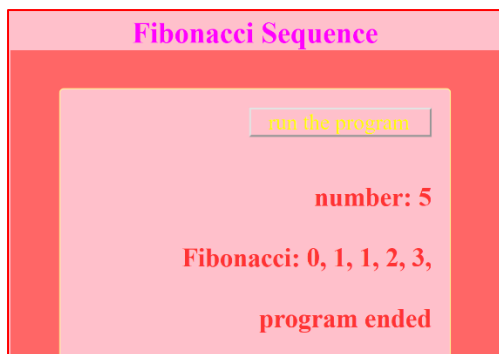
Hint: As a new value, in Fibonacci sequence, can be constructed by sum of the last and 2nd last values, you may want to declare three variables:

```
var secondLast=0;  
var last=1;  
var newValue;
```

Note that **secondLast** and **last** variables are initially 0 and 1, respectively, because that's the way Fibonacci sequence starts.

In the body of the for loop, we calculate **newValue** and update the values for **last** and **secondLast** variables.

Once you are done, run the program, you should see the following result if you enter 5 or 9. If not, debug your code (shift+ctrl+j in firefox).



Before going to next exercise, make sure your JS code is a good match to your flowchart for this problem. If not, you should fix this mismatch.

Exercise 15. Copy `ct_Ex14.html` and `ct_Ex14.js` to new files named `ct_Ex15.html` and `ct_Ex15.js`.

In this exercise, you translate your flowchart of Ex 15 of Part 1 to its equivalent js code.

Several changes that you need to make here are minor changes like what you did in previous exercises in `html` and `js` files. So, we do not re-state them here.

This exercise can be done with `for` loop, as iterations are deterministic. For instance, if input is 5, we need to iterate exactly 5 times to output those 5 rows; also, in each row i , we should put i pairs of `[]`. So, we need to nest one loop inside another.

Note: in this exercise you would need to change text alignment to left. You can do this just in your js code. Also, you would need to make the output font size smaller, let's say to 11px. For these, you can modify the `style` property of `outputObj` just before you enter the loop, like in line 18 and 19.

Once you are done, run the program, you should see the following result if you enter 5 or 9. If not, debug your code (shift+ctrl+j in firefox).

