

## 15-110 Hw1 - Written Portion

Name:

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### #1 - Algorithm Tracing - 15pts

The following algorithm outputs multiple numbers.

1. Input a number  $n$
2. Set value  $i$  to 1
3. If  $i$  is less than or equal to  $n$ , do the following. Otherwise, end the algorithm.
  - a. Output the value  $i$
  - b. Add 1 to the value  $i$
  - c. Repeat Step 3 with updated values

If the input  $n$  is 1000, what are the first three numbers this algorithm will output?

|  |
|--|
|  |
|  |
|  |

Briefly describe what the algorithm does in general.

|  |
|--|
|  |
|--|

Now trace the next algorithm on input 27. How many times will Step #2 be evaluated?

1. Input a positive number  $n$
2. If  $n$  is not equal to 1, do the following. Otherwise, go to Step 3.
  - a. If  $n$  is even, divide  $n$  by 2. Otherwise, subtract 1 from  $n$ .
  - b. Output  $n$
  - c. Repeat Step 2 with updated values.
3. Output the string "done".

## #2 - How Python Works - 10pts

Recall the bytecode we discussed in class:

```
LOAD_CONST 0
STORE_NAME 0
LOAD_CONST 1
STORE_NAME 1
LOAD_NAME 0
LOAD_NAME 1
BINARY_ADD
STORE_NAME 2
```

| Literal Table |       |
|---------------|-------|
| id            | value |
| 0             | 5     |
| 1             | 7     |

| Variable Table |      |       |
|----------------|------|-------|
| id             | name | value |
| 0              | x    |       |
| 1              | y    |       |
| 2              | z    |       |

Which corresponds to the code:

```
x = 5
y = 7
z = x + y
```

Say you want to add one additional line to the code, to modify y:

```
y = x * z
```

Which of the following bytecode lines would be added to include this extra line?

- |                                       |  |
|---------------------------------------|--|
| <input type="checkbox"/> LOAD_NAME 0  | <input type="checkbox"/> BINARY_ADD      |
| <input type="checkbox"/> LOAD_NAME 1  | <input type="checkbox"/> BINARY_MULTIPLY |
| <input type="checkbox"/> LOAD_NAME 2  | <input type="checkbox"/> STORE_NAME 0    |
| <input type="checkbox"/> LOAD_CONST 0 | <input type="checkbox"/> STORE_NAME 1    |
| <input type="checkbox"/> LOAD_CONST 1 | <input type="checkbox"/> STORE_NAME 2    |

### #3 - Data Representation - 25pts

For each of the following problems, you must **show your work** to receive full credit.

Convert 18 from decimal to binary.

Convert 29 from decimal to binary.

Convert 1011 from binary to decimal.

Convert 1010101 from binary to decimal.

Convert the following number from binary to ascii. You may wish to refer to this chart:

[www.asciitable.com](http://www.asciitable.com)

1001111 1001011

## Programming Problems

Each of these problems should be solved in the starter file available on the course website. They should be submitted to the Gradescope assignment Hw1 (Programming) to be autograded. Make sure to check the autograder feedback after you submit!

For each of these problems (unless otherwise specified), write the needed code directly in the python file, under the comment and print statement that correspond to the problem. Do not delete the provided print statements- we're using them to autograde.

### #1 - Variable Assignments - 15pts

Write Python code to do the following:

1. Assign the integer 15 to the variable a.
2. Assign the float 3.14 to the variable b.
3. Assign the string "22" to the variable c.
4. Assign the boolean True to the variable d.
5. Reassign the variable a to hold the value 45.
6. Convert c to an integer and assign it to variable e. Don't change the value in c.
7. Compute  $a \text{ modulo } e$  and assign the answer to the variable f.

Feel free to print any of these variables to check your work.

### #2 - Greeting Algorithm - 5pts

Write code to match the following algorithm.

1. Assign the string Kelly to profK.
2. Assign the string Margaret to profM.
3. Write a single print statement that greets both Kelly and Margaret by name. The statement must use the variables profK and profM, as well as at least one additional string.

### #3 - Math Algorithm - 10pts

Write code to match the following algorithm, which finds the slope of a line between two points.

1. Create 4 variables -  $x_1$ ,  $y_1$ ,  $x_2$ , and  $y_2$  - and assign them each to different numerical values.
2. Compute the difference in  $y$  values (using subtraction) and assign it to the variable  $diffY$ .
3. Compute the difference in  $x$  values and assign it to the variable  $diffX$ .
4. Compute the slope ( $diffY$  divided by  $diffX$ ) and assign it to the variable  $m$ .
5. Print the value in the variable  $m$ .

### #4 - Functions - 20pts

Finally, write two functions based on the prompts below. Each function is based on the idea of trying to fill egg cartons with eggs.

First, write the function `fullEggCartons` that takes an integer number of eggs as a parameter and returns the number of egg cartons that can be completely filled by that number of eggs. Note that egg cartons have 12 slots for eggs.

Second, write a print statement that calls the function on three values - 65, 43, and 96 - and prints the answers.

Third, write the function `remainingEggs` that takes an integer number of eggs as a parameter and returns the number of eggs that will not fit in a full carton (that is, the eggs that are leftover from the previous function).

Finally, write a print statement that calls the function on three values - 23, 76, and 51 - and prints the answers.