

15-110: Principles of Computing

HOMEWORK 01

Due: 6th September, 2020 at 11:59pm

- You need to submit this pdf with your answers to Gradescope.
- You must solve all the questions **individually**.
- Answer the questions in the spaces provided. Make sure that all your answers are visible on the final submission (pdf without forms).
- If you need more space for your answers, contact the course staff (but the one given should be more than enough).

Name:

Andrew ID:

1. (10 points) **Academic Integrity**

Read all the scenarios below and check *all which consists of an academic integrity violation* according to the course policy.

- a) A CA is explaining a solution for a few students at ARC. They write a partial code on the board. The students copy this code to your computer [**YES, NO**].
- b) While googling for commands in python or concepts about the course, you end up on a page with the solution for one of the homework tasks (in python or sequence of steps). You use that as your solution [**YES, NO**].
- c) While having lunch with a friend, you start to talk about 15-110 and you mention that you are lost in one of the homework tasks. Your friend offers to help and writes a piece of code in a paper for you. You take that and try it out [**YES, NO**].
- d) Students are discussing the homework tasks on an online chat, and someone posts their code [**YES, NO**].
- e) A student finds a set of reference solutions from a previous instance of the course, and decides to download it to use as a “backup” [**YES, NO**].
- f) An upper classman provides their solutions from when they took the course [**YES, NO**].
- g) A student hires a tutor because they feel the course is too difficult [**YES, NO**].
- h) A group of students is sitting side by side with their computers solving the homework tasks together [**YES, NO**].
- i) A group of students is discussing a homework task and writing a collective solution on the board. After that, all students go to their computers to type it down [**YES, NO**].
- j) Two students are coming up with a solution to one of the problems in the morning. They do not keep notes and go to class from 10am to 4pm. In the evening, each student goes home to type the solution they discussed, from memory [**YES, NO**].

2. Act like a computer

Follow the sequence of instructions and write what is the answer in the corresponding solution space.

(a) (4 points) Consider the following set of instructions:

1. Assume you get two inputs, x and y
2. Check if x is zero:
 - (a) If yes: the answer is y
 - (b) If no:
 - i. Subtract 1 from x
 - ii. Add 1 to y
 - iii. Go back to step 2

What is the answer if we consider the input to be $x = 4$ and $y = 7$?

Solution:

(b) (5 points) Consider the following set of instructions:

1. Input: x
2. Assume your result is $r = 1$
3. Check if $x = 1$:
 - (a) If yes: the answer is r
 - (b) If no: multiply r by x , subtract 1 from x , and go back to step 3.

What is the answer if we consider the input to be $x = 5$?

Solution:

(c) (6 points) Consider the following set of instructions using variables:

1. Input: n
2. Let $a = 1$
3. Let $b = 1$
4. Check if $n = 0$:
 - (a) If yes: return a
 - (b) If no:
 - Let $t = b$
 - Let $b = a + b$
 - Let $a = t$
 - Let $n = n - 1$
 - Go back to step 4

What is the answer if we give it the input 8 (i.e., n is 8)?

Solution:

3. Act like a programmer

For each of the tasks below, write down the sequence of steps needed to arrive at the correct answer. Be as detailed as possible.

- (a) (5 points) People are often lost in the CMU-Q building. Write down the step-by-step instruction on how to get to the room 2035 starting from the entrance next to the green spine. Imagine that you need to give these instructions to a robot that can recognize objects, but will do *only* what you wrote, and no more.

Solution:

(b) (5 points) A leap year is one that is divisible by 4 and not divisible by 100, except if it is divisible by 400. Write the sequence of steps for deciding whether a year is a leap year or not.

Solution:

- (c) (5 points) Suppose you have an unlimited amount of coins with the values 25, 10, 5, and 1. You need to give x in change to someone, but you want to use the smallest number of coins possible. What is the procedure to do that?

Solution:

4. Puzzles

Solve the puzzles below for training your brain (and getting points).

(a) (2 points) Abdullah has three bags: one contains only white chocolates, the other only dark chocolates, and the third one is a mix of white and dark chocolates. Unfortunately, he has labelled all bags incorrectly. On the outside, you can read:

- Bag 1: White chocolates
- Bag 2: Dark chocolates
- Bag 3: White & dark chocolates

It is possible to figure out the correct labelling by only looking into one bag. How is this possible?

Solution:

(b) (3 points) What is the next number in the following sequence:

1
11
21
1211
111221
312211
13112221
?

Solution: