Problem 1: Introduction – circle the correct answer [3 marks]

i. Select which of the following answers has the terms from the types of memory in order from Smallest to Largest Capacity?

a. Disc Storage, RAM, Cache, CPU Registers

b. CPU Registers, RAM, Disc Storage, Cache

c. RAM, Disc Storage, CPU Registers, Cache

d. RAM, CPU Registers, Cache, Disc Storage

e. CPU Registers, Cache, RAM, Disc Storage

ii. Microsoft Windows is an example of:

a. Hardware

b. Operating System

c. Application

iii. Computational thinking (the concept, not the course) requires a computer

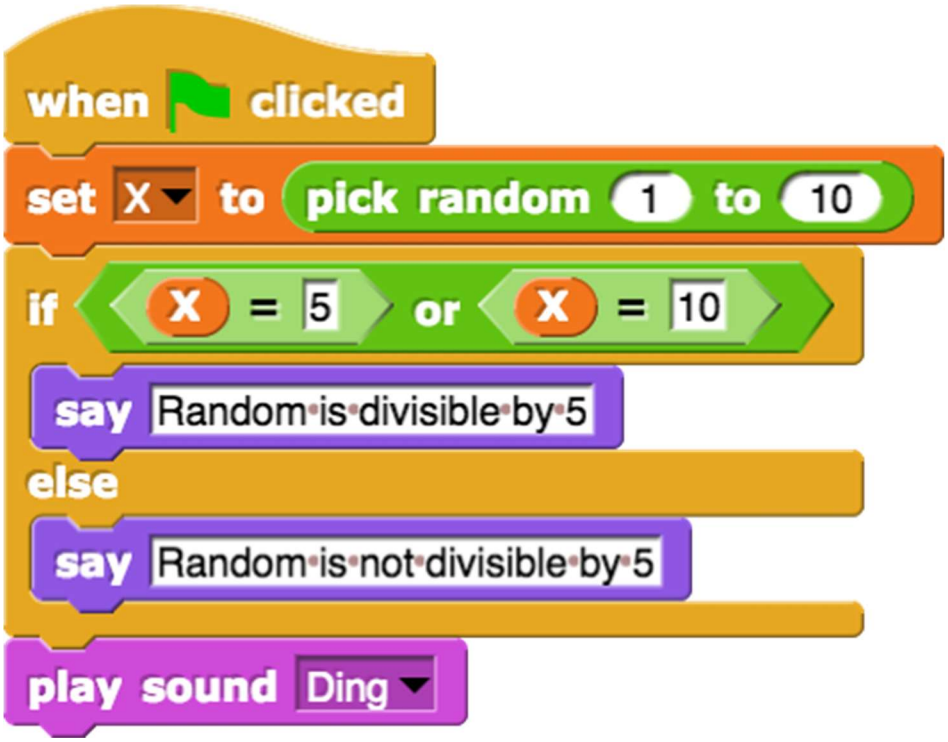
a. True

b. False

Problem 2: Programming with Snap! [2 marks]

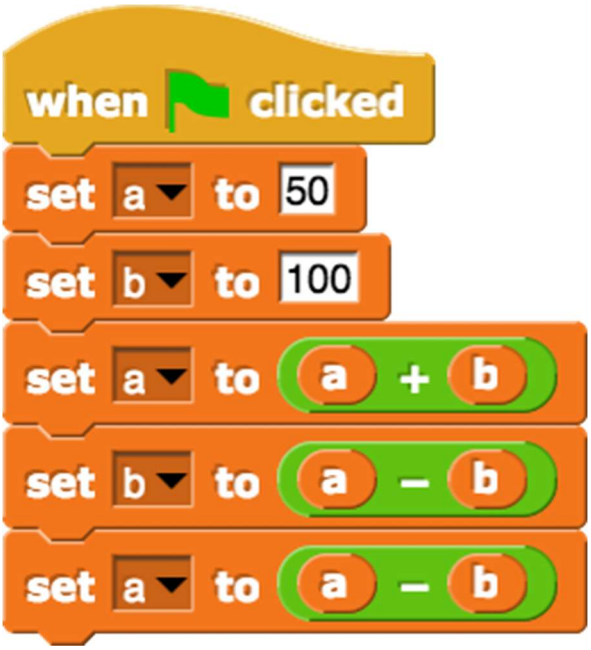
Consider the following code: Note that 

chooses a random number from 1 to 10.



For what values of X does “ding” play? Why?

Problem 3: Fun with variables [4 marks]



a. [1 mark] What is the value of "a" after this code is run?

b. [1 mark] What is the value of "b" after this code is run?

c. [2 marks] In general terms, what does this part of the code do:

Problem 4: Sorting Socks [6 marks]

Assume:

- Any two socks of the same colour match (e.g., all black socks match all other black socks, and you have no special socks for the right or left foot)
- You know the number of socks of each colour when you start.
- All socks have a match (no laundry eating socks for you!)
- Your socks initially start out in a big pile. You can only look at one sock at a time.

Algorithm A:

1. Create one pile for each colour of socks
2. For each sock
    a. Look at each pile until you have found the right colour for it
    b. Place the sock in the pile
3. Match up pairs within each pile. Each time you find a match, ball up the pair and throw it in your sock drawer

Algorithm B:

1. Pick up a sock, call it Sock 1
2. Until there are no socks left in the pile
    a. For each sock in the sock pile (call it Sock 2), see if it matches Sock 1
        i. If it matches
            1. Ball up the pair and throw it in your sock drawer
            2. take the next sock on the pile as Sock 1

        else

            Put Sock 2 in the bottom of the pile

For **space** comparison, count the number of distinct spaces that you need to have before the socks go in the sock drawer (the sock drawer is magical and takes no space). Every sock in a pile takes up one space, e.g., a pile of 4 black socks takes up 4 spaces. Be sure to consider your hands as spaces for balling up the socks along with as many swap spaces as you need. You may reuse your hands as needed as long as they are not otherwise occupied.

For **time** comparison, count the number of times that you have to touch each sock.

For example, consider a pile with two black socks on top and then two white socks.
Algorithm A would result in the following number of times you touch the socks.

1. Pick up the first black sock and put it on the black sock pile
2. Pick up the second black sock and put it on the black sock pile
3. Pick up the first white sock and put it on the white sock pile
4. Pick up the second white sock and put it on the white sock pile
5. Pick up the first black sock from the black sock pile
6. Pick up the second black sock from the black sock pile. Ball up the black socks and throw them in the drawer
7. Pick up the first white sock from the white sock pile
8. Pick up the second white sock from the white sock pile. Ball up the white socks and throw them in the drawer

Thus Algorithm A has a time cost of 8 in this scenario.

Algorithm B would result in the following number of times you touch the socks

1. Pick up the first black sock and call it Sock 1
2. Pick up the second black sock and call it Sock 2. Ball up the block socks and throw them in the drawer
3. Pick up the first white sock and call it Sock 1.
4. Pick up the second white sock and call it Sock 2. Ball up the white socks and throw them in the drawer

Thus Algorithm B has a time cost of 4 in this scenario

a. [2 marks] What is the minimum amount of space needed for algorithm A to do the above scenario where there is a pile of two black socks followed by two white socks? Why?

b. [2 marks] What is the minimum amount of space needed for algorithm B to do the above scenario where there is a pile of two black socks followed by two white socks? Why?

c. [2 marks] In general, which algorithm would you expect to take the least amount of *time*? Why?

Problem 5: Internet [2 marks]

a. [1 mark] Which of the following webpages is more likely to be related to http://www.ugrad.cs.ubc.ca/~cs100/slides/index.html?

a. http://www.ugrad.cs.ubc.ca/~cs100/slides/final/index.html

b. http://www.ugrad.cs.ubc.ca/~cs110/slides/index.html

b. [1 mark] Consider the following webpage: http://cs.ubc.ca/students/undergrad/courses/core-curriculum

Rearrange both the domain name and file directory information from the highest (most general) level to lowest (most specific) level.

a. cs → ubc → ca → students → undergrad → courses → core-curriculum

b. core-curriculum → courses → undergrad → students → ca → ubc → cs

c. ca → ubc → cs → students → undergrad → courses → core-curriculum

d. cs → ubc → ca → core-curriculm → courses → undergrad → students

e. students → undergrad → courses → core-curriculum → cs → ubc → ca

Problem 6: Algorithms and fairness [5 marks]

i. [1 mark] When building a classifier, if the training data is biased in some way then

   a. The test data is biased in the opposite way

   b. The test data is biased in the same way

   c. The test data is unbiased

   d. The biasing of the test data and the training data is not related

ii. [2 marks] Consider the case where Google allows companies to pay to be advertised. List one way that this could cause conscious bias. List one way where this could cause unconscious bias.

iii. [2 marks] Consider programmers at Amazon writing code to decide where to offer one day shipping. Using terms discussed in class and in the readings, state why the programmers may want to consider the racial demographics of those who are in areas they are considering.

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Note that any work that you do on this page will NOT be graded. If you want to do work here you MUST transfer it to the appropriate spot in the rest of the exam. The same holds for the page on the back of the cover sheet.