COMPTNG 20A
Spring 2020
Midterm
5/8/2020
Time Limit: 50 Minutes

This exam contains 6 pages (including this cover page) and 10 questions.
The maximum number of points is 100.

The exam is open-book, open-note, and open-Internet. You can use `java` and IDEs. The only restriction is you **must not communicate or collaborate with other students in the class** during the 24-hour exam period. This includes that you may not post question on forums etc. You may email the instructor or TA with any clarifying questions about the exam during the exam period; the teaching team will not respond to general/conceptual questions but can make clarifications or answer questions about logistics.

Please submit your exam as a single PDF via CCLE.

Grade Table (for staff use only)

Question	Points	Score
1	5	
2	5	
3	5	
4	5	
5	5	
6	5	
7	5	
8	20	
9	25	
10	20	
Total:	100	

1. (5 points) Say that there are three classes: Bunny, Animal, and Kangaroo. What are the likely relationships between these classes?
    A. Animal is the superclass; Kangaroo and Bunny are subclasses of Animal.
    B. Bunny is the superclass; Animal and Kangaroo are subclasses of Bunny.
    C. Kangaroo, Bunny, and Animal are sibling classes.
    D. Animal is a superclass, Kangaroo is a subclass of Animal, and Bunny is a subclass of Kangaroo.

2. (5 points) Which of the following is NOT an advantage to using inheritance?
    A. Code that is shared between classes needs to be written only once.
    B. Similar classes can be made to behave consistently.
    C. Enhancements to a base class will automatically be applied to derived classes.
    D. One big superclass can be used instead of many little classes.

3. (5 points) In a class declaration, the opening left brace (left curly bracket) and the closing right brace (right curly bracket) must occur alone on their own line.
    A. True
    B. False

4. (5 points) A class's name must begin with an upper case letter.
    A. True
    B. False

5. (5 points) Local variables, like class fields, have default values such as zero for integers and floating-point numbers.
    A. True
    B. False

6. (5 points) Neither an abstract class nor an interface can be instantiated as an object.
    A. True
    B. False

7. (5 points) Consider the statement `final int x = 5;`. Which of the following is **not** valid to follow this statement? (Circle your response.)
    A. `final int y = x;`
    B. `int y = x;`
    C. `System.out.println(x);`
    D. `x = y - (int)1.0;`
    E. All are valid

8. (20 points) The following code sample represents a program that should count and print out the number of years between a user-input year (assume less than 3000) and the year 3000 without using subtraction. Your task is to find all compile-time and logical errors in this code. Circle the line number of each line of code where you identify an error. Then, in the blank provided on the next page, rewrite the correct version of the program.

```
1 include java.util.Scanner;
2 public class Test {
3
4 public void main(String[] args)
5 {
6   int nyear;
7   millenium = 3000;
8   int years = 0;
9   System.out.println("Please enter the current year: ");
10  Scanner cin = new Scanner(System.in);
11  nyear = cin.nextInt();
12
13  while nyear != millenium
14  {
15      nyear++;
16      years++
17  }
18
19  System.out.println("Another " +
20     nyear + " years to the millenium.");
21  return 0;
22 }
23
24 }
```

9. (25 points) In a certain game, you roll 2 dice until you get 7. Write a program that uses Monte Carlo to compute the average number of rolls you make until you roll a 7, across N trials (pick any sensible value for N). The average number should be printed out at the end of the program; no other inputs or outputs are necessary.

   Clarification. The dice are standard; they have 6 faces with numbers 1, 2, 3, 4, 5, and 6.

   Clarification. If you roll 7 on the first round, that counts as 1 roll. If you roll 2, 9, and then 7, that counts as 3 rolls.

   Clarification. If you have taken a course on probability and have learned the geometric distribution, you may know that the mathematical answer is 6. This is irrelevant since the point of the problem is to demonstrate your understanding of the Monte Carlo method.

10. (20 points) Write a complete program that prompts the user for a positive floating-point number `x`, computes $f(x)$, and prints the result to the console. Here,

$$f(x) = \frac{x^4 - \sqrt{\cos(x) + \frac{8}{3}x}}{x^2 + 1}$$

If the user enters a non-positive number, the program should keep prompting for input until the user gives a positive number. You do not need to worry about the user entering invalid types of input such as strings.