Conditional Programming Lab Assignment

Complete as many of these exercises as possible during class. For each exercise, use several test cases, to check that your code is working correctly.

Level I Exercises

Exercise 1. Write a program that takes an integer as input and checks whether it is greater than or less than 10,000. If the number is greater than 10,000, the program should say that you entered a "large number". If the number is less than 10,000, the program should say that you did not enter a large number. You can decide whether to count 10,000 as "large" or "not large". Use the skeleton code, LargeNumber.java.

Exercise 2. Write a program that tells whether a number is even or odd. For example, if the user enters 5, the program outputs "5 is odd." Start with the skeleton code EvenOdd.java.

Exercise 3. Write a program that decides whether water is liquid at the temperature entered by the user. Remember, water is liquid between 0 and 100 Celsius. For now, you can just say that water is solid at 0 C and is vapor at 100 C. In a subsequent exercise, we will be more careful about this. Use the skeleton code, LiquidWater.java.

Level II Exercises

Exercise 4. Write a program that accepts an input temperature in Celsius, then decides between the following cases for water:

Temperature below 0 Celsius: Water is a solid.
Temperature = 0 Celsius: Solid and Liquid water coexist (ice water).
Temperature is above 0 Celsius but below 100 Celsius: Water is liquid.
Temperature = 100 Celsius: Liquid water and vapor coexist.[1]
Temperature is above 100 Celsius: Water is a gas.

For example, if the user enters 50, the program should output:

> At 50 Celsius, water is a liquid.

Use the skeleton code, WaterState.java/.

Exercise 5. Write a program that decides whether a quadratic polynomial has real roots.

Assume the polynomial has the form: $Ax^2 + Bx + C$, and have the user enter A, B, and C. Use the code titled RealRoots.java to get started.

Hint: Remember that for a polynomial in this form to have real roots, the quantity $B^2 - 4AC$ must be greater than or equal to zero.

[1] Of course, in everyday life, there is always some water vapor above the meniscus of liquid water, because the water mixes into the air. In a system of pure water maintained at 1 atm., the separate gas phase forms at the boiling point, where the vapor pressure is sufficient to cause the system to expand.

Exercise 6. Write a program that decides on the best mode of transportation for a trip or offers multiple possibilities when appropriate. Assume the following are true of the person who will use the program:

Walking is appropriate if the distance to destination is 1 mile or less.
Riding a bicycle is appropriate for distances between 0.5 mile and 10 miles.
Driving a car is appropriate for distances between 2 miles and 500 miles.
Flying is appropriate for distances of 100 miles or more.

Examples of program behavior:

User enters no. of miles:	Program outputs:
0.25	Walking is best.
0.75	Walking or riding a bicycle is best.
1.5	Riding a bicycle is best.
4	Riding a bicycle or driving a car is best.
24	Driving a car is best.
300	Driving a car or flying is best.
1200	Flying is best.

The skeleton code for this exercise is ModeOfTravel.java

Exercise 7. Write a code that accepts x- and y- coordinates from the user, and says which quadrant contains the point. For example, if the user enters 3 for x and -2.4 for y, the program outputs "(3, -2) is in the fourth quadrant." Use skeleton code Quadrant.java.

Level III Exercises

These are meant to challenge your problem-solving skills. Have fun with them, and focus on learning and improvement. No skeleton codes are included for these.

Exercise 8. Write a program that converts a time interval measured in seconds to a time interval measured in hours, minutes, and seconds. Here are examples of how the program should behave:

The user enters	Program outputs
35	35 sec
60	1 min and 0 sec
61	1 min and 1 sec
120	2 min and 0 sec
135	2 min and 15 sec
3625	1 hr and 25 sec
3745	1 hr 2, min, and 25 sec
7500	2 hr and 5 min

Exercise 9. Return to the polynomial from exercise 5. Write a program to output the roots of the polynomial. If the roots are complex, give the answer in terms of i. The quadratic formula will help. Here are some examples of input and output:

input:	output:
A = 1, B = 2, C = 5	x = -1 + 2i and x = -1 - 2i
A = 1, B = -1, C = -12	x = 4 and x = -3
A = 4, B = -16, C = 52	x = 2 + 3i and x = 2 - 3i

To take a square root in Java, use the command `Math.sqrt()`. For example, the following code assigns the square root of 2 to a variable x:

```
x = Math.sqrt(2);
```

Exercise 10. Write a program that takes a character and decides whether it is in the first or the second half of the alphabet. Here are some tips to get you started:

- The Scanner class cannot directly read a character. Instead, you have to read it as a string, then convert it to a character array, then take the character out of that array. This can all be accomplished with the following command:

  ```
  char a = myScanner.nextLine().toCharArray()[0];
  ```

- Java associates a number with each character. In the numbering system, uppercase letters come first (smaller values), and lowercase letters come later (higher values). We can use Boolean operators such as >, <, ==, etc. to compare the characters, just as we do numbers. For example:

  ‘a’ < ‘c’ is true
  ‘Z’ < ‘a’ is true
  ‘Z’ > ‘A’ is true
  ‘Z’ > ‘a’ is false

- To make this easier, start by writing a code that only works for lowercase letters. Once you have that working, try entering some uppercase letters, and you will see that you can get the code to fail. At that point, you can make the code more versatile. It would be great if you could even have the code handle characters that aren’t part of the English alphabet, asking the user to try again.

