King Fahd University of Petroleum and Minerals
Information and Computer Science Department
ICS 102: Introduction to Computer Programming

Semester 2019-2020 (Term 192)
Homework #1
[Posted: Sunday February 02, 2020]
[Due Date: Sunday February 16, 2020 @ 11:59 PM (Midnight)]

<u>**Submission Guidelines:**</u>

Submit a .zip file named **HW1_XXXXXXXXX_YourFamilyName** containing the following files:
HW1_Q1_ XXXXXXXXX.java and HW1_Q2_ XXXXXXXXX.java.

PLEASE DO NOT INCLUDE .class FILES IN YOUR SUBMISSION

where:
　　　　XXXXXXXXX is your 9 digit KFUPM ID.
　　　　YourFamilyName is your family name

Submission should be made through your ICS 102 Blackboard course page under **Assignments** submission link.

Important Notes:
- **Cheating is taken seriously**. Any cheating attempt will result in an F grade in the course.
- **EACH STUDENT IS REQUIRED TO DO THE HOMEWORK <mark>ALONE</mark>**. COPYING FROM ANY SOURCE IS REGARDED AS CHEATING.
- **Submission link will be available until 9:00am for late submission without penalty. Later submission will not be graded.**
- <u>**Submissions via email are not accepted and will be simply ignored**</u>.
- Submission of the homework solution should be in a zipped filed with the format specified above. **Any different formatting/naming will result in reducing the total homework score by half!**
- **You must use proper indentation and meaningful variable names in your programs.**
- **Grades will depend on correctness and fulfilling the problem specifications as well as code readability and following the good programming practices.**

1. The equation of a line can be represented by y = mx + c, where m and c are double numbers. Write a java program that does the following:
   a. Prompts the user to enter the equations of two lines by entering the coefficients m and c and reads the values. Then, prints the two entered line equations.
   b. Identifies and prints out whether the two lines intersect or not. If they intersect at one point, then print the point of intersection. If the two lines are parallel, print that the two lines are parallel. (For parallel lines, the m values are same for the both equations of the lines; if the lines intersect each other there must be one point where the values of x and y axis is same for the both equations; you should use your college level mathematics understanding to solve this problem and implement the java code accordingly)

   Sample output of the program:

   ```
   Enter the coefficients of the first line: 2 3
   The first line equation is: Y = 2.0 X +3.0
   Enter the coefficients of the second line: -0.5 7
   The second line equation is: Y = -0.5 X +7.0
   The two lines intersect at the point (1.6,6.2)
   Press any key to continue . . .

   Enter the coefficients of the first line: 2 2
   The first line equation is: Y = 2.0 X +2.0
   Enter the coefficients of the second line: 2 6
   The second line equation is: Y = 2.0 X +6.0
   The two lines are parallel and do not intersect...
   Press any key to continue . . .
   ```

2. The straight-line distance in kilometers between two locations on earth can be computed by the following two formulas:

$$w = sin^2\left(\frac{LatitudeDifferenceInRadians}{2}\right) + cos(Latitude1\_in\_radians) * cos(Latitude2\_in\_radians) * sin^2\left(\frac{LongitudeDifferenceInRadians}{2}\right)$$

$$distance = earthRadiusInKilometers * 2 * atan2(\sqrt{w}, \sqrt{1-w})$$

Where:

$$earthRadiusInKilometers = 6371\ km$$

$$LatitudeDifferenceInRadians = Latitude1\_in\_radians - Latitude2\_in\_radians$$

$$LongitudeDifferenceInRadians = Longitude1\_in\_radians - Longitude2\_in\_radians$$

Write a java program that prompts for and reads the longitudes and latitudes of two locations on earth. If the input is invalid your program must display an appropriate error message and terminate; otherwise it computes and displays the straight-line distance, in kilometers, between the two locations. Please notice the following:

- Your longitude input for each location must be **four** values:

  integerDegrees   integerMinutes   doubleSeconds   characterPosition
   where characterPosition is either E   or W

- Your latitude input for each location must be **four** values:

  integerDegrees   integerMinutes   doubleSeconds   characterPosition
   where characterPosition is either N   or S

- Your program must convert each input to decimal degrees, where East longitudes are +ve, West longitudes are –ve, North latitudes are +ve, and South latitudes are –ve.
- The format of the program output must be similar to the given examples.

Examples:

input	Decimal degrees
26 13 15.272400 N	**26.220909**
50 11 55.024800 E	**50.198618**
25 44 36.97 S	**-25.743603**
43 10 23.49 W	**-43.173192**

- Your program must use appropriate constants.
-

Note: Your program must be general and it must behave as in the sample program runs below:
Hint:
- A longitude can have values from **0** degrees to **180** degrees inclusive, i.e., **0 ≤ degrees ≤ 180**
- A latitude can have values from **0** degrees to **90** degrees inclusive, i.e, **0 ≤ degrees ≤ 90**
- 1 degree = 60 minutes, 1 minute = 60 seconds.
- A minute can have values in the interval **[0 . . . 60),** i.e., **0 ≤ minutes < 60**
- A second can have values in the interval **[0 . . . 60)**, i.e., **0 ≤ seconds < 60**
- π radians = 180 degrees

Use the following locations to test your program:

Location	latitude				longitude			
Al-Khobar	26	13	15.272400	N	50	11	55.024800	E
Al-Jubail	27	0	5.918400	N	49	39	45.831600	E
Riyadh	24	38	20.223600	N	46	42	51.534000	E
Al-Kaabah	21	25	21.086400	N	39	49	34.255200	E
New York	40	43	15.09	N	74	0	23.52	W
Pretoria	25	44	36.97	S	28	13	42.18	E
Rio de Janeiro	22	54	5.02	S	43	10	23.49	W

Sample Program runs:

```
Enter the latitude of location1: 34   45   13.54 N
Enter the longitude of location1: 56   32   23.37 M
Error: Invalid location1 longitude
```

```
Enter the latitude of location1: 23    40    34.45 S
Enter the longitude of location1: 15    30    12.05 W

Enter the latitude of location2: 57    18   20.564 N
Enter the longitude of location2: 46    25    60.00 E
Error: Invalid location2 longitude
```

```
Enter the latitude of location1: 26    13    15.272400 N
Enter the longitude of location1: 50    11    55.024800 E

Enter the latitude of location2: 21   25   21.086400 N
Enter the longitude of location2: 39   49   34.255200 E

Straight-line distance between Location1 and Location2 = 1181.7 kilometers
```

```
Enter the latitude of location1: 25    44    36.97 S
Enter the longitude of location1: 28    13    42.18 E

Enter the latitude of location2: 22    54    5.02  S
Enter the longitude of location2: 43    10    23.49 W

Straight-line distance between Location1 and Location2 = 7149.8 kilometers
```