Week 1: Simple programs using control structures, loops

1. Body Mass Index (BMI) is a measure of health on weight. It can be calculated by taking your weight in kilograms and dividing by the square of your height in meters. The interpretation of BMI for different age group is as follows:

BMI	Interpretation
Below 18.5	Underweight
Between 18.5 and 24.9	Normal
Between 25 and 29.9	Overweight
30 or greater	Obese

Write a program that prompts the user to enter a weight in kilograms and height in centimetres. Compute the BMI and display the message accordingly.

Sample Output-1:

```
Enter  weight in KG: 65
Enter  height in cm: 160
BMI = 25.390623092651367
overweight !
```

Sample Output-2:

```
Enter  weight in KG: 60
Enter  height in cm: 165
BMI = 22.0385684967041
normal
```

2. Suppose that the tuition for a university is Rs 50,000 this year and increases 5% every year. Write a program to compute and display the tuition fee for 10 consecutive years.

Sample Output:

```
The fee after 1  year = 52500.0
The fee after 2  year = 55000.0
The fee after 3  year = 57500.0
The fee after 4  year = 60000.0
The fee after 5  year = 62500.0
The fee after 6  year = 65000.0
The fee after 7  year = 67500.0
The fee after 8  year = 70000.0
The fee after 9  year = 72500.0
The fee after 10  year = 75000.0
```

3. Write a java program to accept distance travelled (in kilometre) and the quantity of fuel used (in litre) for a journey and determine the average fuel economy for that journey. Based on this, perform the following two operations for the user:
   - **Fuel estimation:** Estimate the fuel needed for the distance entered by the user.
   - **Distance estimation**: Estimate the distance that can be travelled for the quantity of fuel entered by the user.

   Here is a sample output:

```
Enter the distance(in Km) : 500

Enter the fuel consumed(in Litre) : 20
average fuel economy= 25.0 kmpl


1.Dist estimation
2.Fuel estimation.
Enter your choice(0 to stop): 2

Enter the distance(in Km) :1000
Estimated fuel=40.000000

1.Dist estimation
2.Fuel estimation.
Enter your choice(0 to stop): 1

Enter the fuel consumed(in Litre) : 10
Estimated distance=250.000000

1.Dist estimation
2.Fuel estimation.
Enter your choice(0 to stop): 0
```

4. Develop a Java application to accept number of hours worked, hourly rate and determines the gross pay for an employee according to the following criteria:
   The company pays straight time for the first 40 hours worked by each employee and time and a half for all hours worked in excess of 40 hours.

Sample output-1:

```
Enter the No. of hrs worked :50

Enter the hourly rate :100

The total pay = 5500.0
```

Sample output-2:

```
Enter the No. of hrs worked : 35

Enter the hourly rate : 100

The total pay = 3500.0
```

5. Write a program that lets the user enter the loan amount and loan period in number of years and displays the monthly and total payments for each interest rate starting from 5% to 8%, with an increment of 1/8.

$$monthlyPayment = \frac{loanAmount \times monthlyInterestRate}{1 - \frac{1}{(1 + monthlyInterestRate)^{numberOfYears \times 12}}}$$

Where, monthlyInterestRate = annualInterestRate/12.
Here is a sample run:

```
Loan Amount: 10000 Enter
Number of Years: 5 Enter
Interest Rate          Monthly Payment    Total Payment

5%                     188.71             11322.74
5.125%                 189.28             11357.13
5.25%                  189.85             11391.59
...
7.875%                 202.17             12129.97
8.0%                   202.76             12165.83
```

6. The two roots of a quadratic equation $ax^2 + bx + c = 0$ can be obtained using the following formula:

$$r_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \qquad r_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

b^2 - 4ac is called the discriminant of the quadratic equation. If it is positive, the equation has two real roots. If it is zero, the equation has one root. If it is negative, the equation has no real roots.

Write a program that reads values for a, b, and c and displays the result based on the discriminant. The coefficients a, b and c must be passed as command-line arguments. If the discriminant is positive, display two roots. If the discriminant is 0, display one root. Otherwise, display "The equation has no real roots".

Sample output-1:

```
javac week1_prog6.java
java week1_prog6 1 -5 6
Two roots: 3.000000 and 2.000000
```

Sample output-2:

```
java week1_prog6 1 4 4
only one root: -2.0
```

Sample output-3:

```
java week1_prog6 1 1 4
Roots are imaginary
```

7.Write a java program to convert the input speed from kilometre per hour to meters per second and vice versa. Hint: 1 Kmph = 1000/3600 mps

Sample output:

```
1.km_per_hr to mtr_per_sec
2.mtr_per_sec to km_per_hr.
Enter your choice(0 to stop):1

Enter the speed in km_per_hr :18
speed in mtr_per_sec=5.000000

1.km_per_hr to mtr_per_sec
2.mtr_per_sec to km_per_hr.
Enter your choice(0 to stop): 2

Enter the speed in mtr_per_sec :4
speed in km_per_hr=14.400000
```

Additional Exercises:

1. Write a java program that takes date as input, adds a specified number of days to it, and then displays the resulting date.
2. Write a program to find the LCM and GCD of two numbers.

Week 2: Array manipulation programs

1. Input an array of *n* integers. Reverse all elements of the array and store them in another array.

Sample Output:

```
Number of elements ? 5
Input 5 integers
25  46  123  702  16
Contents of the two arrays
25      52
46      64
123     321
702     207
16      61
```

2. Write a program to read an array of n distinct numbers, and display all the pairs (x,y) such that x>y.

Sample output:

Input: {2,1, 5, 3}

Output: { (2,1), (5,2), (5,1), (5,3), (3,2), (3,1) }

3. Write a java program to find the largest and smallest element in a two-dimensional array. Display the row & column indices of the largest and the smallest element in the given two-dimensional array.

Sample output:

Enter the number of rows and columns of the array: 3 4
Enter the array:

23.5	35	2	10
4.5	3	45	3.5
35	44	5.5	9.6