Learning the java language

Workshop 1:

- How to use primitive Java types, operators on those types, and expressions formed with those types
- How to use loop and other flow control structures
- How to use array

Q1. Write a program that performs the following tasks:

1. Input 4 real numbers a, b, c and x.
2. Calculate S1 = $ax^2 + bx + c$.
3. Calculate S2 = $\sqrt{b^2 - 4ac}$ if b - 4ac > 0, otherwise S2 = 0
4. Re-input a, b and c. Check whether a, b and c are sides of a triangle or not.
5. If a, b, c are sides of a triangle, then calculate its perimeter and area, otherwise display on the screen a message "a, b, c are not side of a triangle". The area is calculated by the Heron formula below:

   S1 = $\sqrt{p(p-a)(p-b)(p-c)}$, where $p = \frac{(a+b+c)}{2}$

Q2. Write a program that performs the following tasks:

1. Input an integer number n, where n > 5 (If n≤ 5 then prompt a user to re-enter). Then calculate
2. S1 = 1 + 2 + 3 + ... + n.
3. S2 = n!
4. S3 = $1+\frac{1}{2}+\frac{1}{3}+...+\frac{1}{n}$.
5. Re-input n. Check whether n is a prime number or not.

Q3. Write a program to accept 2 integer numbers m and n, then:

1. Display all prime common dividers of them.
2. Find the greatest common divider (GCD) of them.
3. Find the least common multiple (LCM) of them.

Q4. Write a program that performs the following tasks:

1. Input an integer number n (check input validation), then
2. Display n in binary number format.
3. Re-input n (not check input validation). Calculate sum of all digits of n.
4. Find the number m, which is the reverse of n.

Q5. Write a program to accept 3 real numbers a, b and c, then
Solve the quadratic equation $ax^2 + bx + c = 0$.

Q6. Write a program to accept 2 integer numbers m and n, where m < n then
Display all palindrom numbers in the interval [m.n]. (A *palindromic number* or numeral palindrome is a number that remains the same when its digits are reversed, e.g. 16461)

Q7. Write a program that performs the following tasks:

1. Write function with prototype
   double myExp(double x, int n);
   which `calculate e^x approximately by the formula:`

   $e^x \sim S = 1 + \frac{x}{1!} + \frac{x^2}{2!} + ... + \frac{x^n}{n!}$

2. Write function with prototype
   double myExp(double x, double epsi);
   which `calculate and return e^x approximately by the formula:`

   $e^x \sim S = 1 + \frac{x}{1!} + \frac{x^2}{2!} + ... + \frac{x^n}{n!}$

   here n is the first integer for which $|\frac{x^n}{n!}| \leq$ epsi is satisfied.

3 . Write function with prototype:
double myPi(double epsi);
which calculates and return the value PI approximately by the formula:

$\pi \sim S = 4 * (1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + ... + (-1)^n \frac{1}{2n+1})$

here n is the first integer for which $|\frac{1}{2n+1}| \leq$ epsi is satisfied.

4. Write function with prototype:
double mySin(double x, double epsi);
which calculates and return the value sin(x) approximately by the formula:

$\sin(x) = \frac{x}{1!} - \frac{x^3}{3!} + \frac{x^5}{5!} - ... + (-1)^n \frac{x^{(2n+1)}}{(2n+1)!}$

here n is the first integer for which $|\frac{1}{2n+1}| \leq$ epsi is satisfied.

5. Write function with prototype:
double myCos(double x, double epsi);
which calculates and return the value cos(x) approximately by the formula:

$\cos(x) = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - ... + (-1)^n \frac{x^{2n}}{(2n)!}$

here n is the first integer for which $|\frac{x^{2n}}{(2n)!}| \leq$ epsi is satisfied.

6. Write a Java program that performs the following operations on an array of integers in the main function:

- Input data (number of elements, the elements of the arrays)

- Display all elements

- Sort all numbers in ascending order

- Find the maximum value

Q8. Write a menu driven program with the options below:
Choose one of the following option:

1. Input 2 *polynomials* $P^n(x)$ and $Q^m(x)$
2. Calculate $P^n(x0)$ và $Q^m(x0)$
3. The *derivatives* of *polynomials*
4. Calculate $P^n(x) + Q^m(x)$
5. Calculate $P^n(x) - Q^m(x)$
6. Calculate $P^n(x) \times Q^m(x)$
7. Calculate $P^n(x) / Q^m(x)$

Q9. Financial Calculator

Design and code a program that performs two financial calculations: future value and present value. Your program prompts for and accepts a principal amount, an interest rate per year, and the number of years. If the number of periods is zero then the calculated amount is a present value (principal).

Suppose P_n is an amount after n years, thus we have

$P_n = P_{n-1} + rate*P_{n-1} = (1 + rate)*P_{n-1}$

It easy to show that

$$P_n = (1 + rate)^n P_0$$

where P_0 is a principal.

Design your program according to structured design principles and include a function that can be used in both calculations as well as in other applications.

Preface your function header with a comprehensive description of the function purpose, the function parameters and the function return value.

The output from your program should look something like:

```
1. Test saving account
principal = 100
Annual rate = 0.1
No of years = 2
principal =  100.00
amount after 2 years =  121.00

2. Investment calculation
future = 121
Annual rate = 0.1
No of years = 2
principle should be =  100.00
Press any key to continue . . .
```

Q10. Write a menu driven program with the options below:
Choose one of the following option:

1. Input a string
2. Split a string into words
3. Remove redundant soaces
4. Check valid name
5. Exit
   Your selection (0->5):

Q11. The correct sentence: *Capitalize* the *First Word* in a *Sentence*, *one space* between *words*, *a space following commas and* periods.