

Lab 05

Recursion

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A. Introduction:

You have learnt about Recursion. This lab will help you to apply Recursion in Java programming language.

B. Objectives

Apply Recursion in calculating mathematical expressions

C. Problems:

Use the following function puzzle(..) to answer problems 1 - 3.

```
int puzzle(int base, int limit)
{
    //base and limit are nonnegative numbers

    if ( base > limit )
        return -1;

    else if ( base == limit )
        return 1;

    else
        return base * puzzle(base + 1, limit);
}
```

1. Identify the base case(s) of function puzzle(..)
2. Identify the recursive case(s) of function puzzle(..)
3. Show what would be displayed by the following calls.
 - a. `System.out.print(puzzle(14,10));`
 - b. `System.out.print(puzzle(4,7));`
 - c. `System.out.print(puzzle(0,0));`
4. Complete the Java code to recursively evaluate the sum: $\text{sum} = 1 + 1/2 + 1/3 + \dots + 1/n$, $n > 1$.

```
double sum(int n)          // n>=1
{
    if (_____)
        return _____;

    return _____ + sum(____);
}
```

5. Write a recursive function that computes the sum of all numbers from 1 to n, where n is given as parameter.

```
//return the sum 1+ 2+ 3+ ...+ n
int sum(int n)
```

6. Write a recursive function that finds and returns the minimum element in an array, where the array and its size are given as parameters.

```
//return the minimum element in a[]
int findmin(int a[], int n)
```

7. Write a recursive function that computes and returns the sum of all elements in an array, where the array and its size are given as parameters.

```
//return the sum of all elements in a[]
int findsum(int a[], int n)
```

8. Write a method that receives two integers and returns the largest common divisor. Formula to calculate the Largest common divisor is shown below:

$$\gcd(p, q) = \begin{cases} p & \text{if } q = 0 \\ \gcd(q, p \% q) & \text{otherwise} \end{cases}$$