

## 5. Lab 5: Recursion

### 5.1. Objectives

Apply Recursion in practical mathematical problems.

### 5.2. Problems

#### 5.3. Problem 1: 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. (10 points) Identify the base case(s) of function puzzle(..)
2. (10 points) Identify the recursive case(s) of function puzzle(..)
3. (10 points) 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));

#### 5.4. Problem 2: 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( _____ );
}
```

#### 5.5. Problem 4: 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)
int findsum(int a[], int n)
```

5.6. Problem 6: Write a method that receives two integers and returns the largest common divisor. The formula to calculate the Largest common divisor is shown below:

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

5.7. Problem 8: Write a recursive function to generate all subsets of a given set.

5.8. Problem 10: Use recursion to generate a Sierpinski triangle fractal

[https://en.wikipedia.org/wiki/Sierpi%C5%84ski\\_triangle](https://en.wikipedia.org/wiki/Sierpi%C5%84ski_triangle)

