## Problem Set 5

**Submission Instruction and Requirement:**

**Due date: 2.30pm 7th June 2019**

1) Name the file in the pattern of "studentid.yourname.ps5", submit a doc/docx/pdf file.
2) Write a report on the tasks you have attempted, label each figure/table properly. You may add figures/tables from this document into your report.
3) Submit the zip/rar file to Blackboard on time.

**Task 1 (8 marks)**

Draw a graph for each of the following expressions.

1) f(n)= n+100
2) f(n)= 4n2
3) f(n)= log10n
4) f(n)= 3n
5) f(n)= n!
6) f(n)= 20n
7) f(n)= 3
8) f(n)= n2/3

Arrange the graphs you have generated from the slowest to fastest. Write down the expressions by the growth rates with respect to n. (Hint: MS-Excel, MATLAB or similar tools can help in drawing the graph).

**Task 2 (4 marks)**

Compare Algorithm A and Algorithm B for calculating factorial of n. State the Big O notation for each algorithm. Are their Big O notations different or the same? Explain why.

| Algorithm A | Algorithm B |
|---|---|
| `int factorial(int n)`<br>`{`<br>`  int i, factorial = 1;`<br>`  for (i = 1; i <= n; ++i)`<br>`  {`<br>`  factorial *= i;`<br>`  // factorial = factorial * i;`<br>`  }`<br>`  return factorial;`<br>`}` | `int factorial(int n)`<br>`{`<br>`  if(n!=1)`<br>`  return n*factorial(n-1);`<br>`}` |

**Task 3 (4 marks)**
Analyse the algorithm given in pseudocode below:

```
While direction = NULL AND j ≤ numberOfPoints
        if dj ≥ (pi + stepSize), then
            Set Direction = UP.
            Plot 'X' at pi at the current columnNumber
            While pi+stepSize ≤ dj
                set pi=pi-1 + stepSize,
                Plot 'X' at pi at the current columnNumber
                Increment i
            Endwhile
        Else if dj ≤ (pi – stepSize), then
            Set Direction = DOWN.
            Plot 'O' at pi at the current columnNumber
            While pi – stepSize ≥ dj
                set pi=pi-1 – stepSize,
                Plot 'O' at pi at the current columnNumber
                Increment i
            Endwhile
            Endif
        Endif
        Increment j.
Endwhile
```

State the Big O notation for the above algorithm. Explain your answer.

**Task 4 (4 marks)**

```
int Fibonacci(int n) {
    if (n <= 1) return n;
    return Fibonacci(n - 2) + Fibonacci(n -  1);
}
```

Analyse the algorithm to calculate Fibonacci number given above.
State the Big O notation for the above algorithm. Explain your answer.
(Hint: try a few values for n to see how fast the recursive call grows)