Design and Analysis of Algorithm

ASSIGNMENT 1 – Basic Concepts of Analysis and Design of Algorithms

1. Define the term algorithm and state criteria the algorithm should satisfy.
2. Describe the role of space complexity and time complexity of a program?
3. Define analysis of an algorithm. State the reason why analysis is required?
4. Describe efficiency of an algorithm.
5. Write use of Asymptotic Notations and explain Asymptotic Notations Big Oh, Omega and Theta.
6. Arrange the given notations in the increasing order of their values. (For clarification provide 4 values for each term for some n)
    a. Log n, n^2, n log n, n, 2^n, n^3, n!
    b. n, n log n, 2^n, log n, sqrt(n), n^2+log n, n^2 , log log n
7. Express following functions in terms of O notation
    a. $n^3/1000 - 100n^2 - 100n + 3$
    b. $20n^3 + 10n \log n + 5$
    c. $5n \log n + 2n$
8. Write time complexity of following algorithmic statements in terms of O (Big Oh) notation With Justification.
    a. Algorithm

```
//Input: int A[n], array of n integers
//Output: Sum of all numbers in array A
int Sum(int A[], int n)
{
 int s=0;
 for (int i=0; i<n; i++)
        s = s + A[i];
 return s;
}
```

    b. $sum = a + b$
    c. $for\ i$=1 $to\ n\ do$
        sum=a+b;
    d. $for\ i$=1 $to\ n\ do$
        $for\ j$ = 1 $to\ n\ do$
            sum=a+b;
    e. l =1
    $while$(l≤n)
        $Print\ \ l$
        l=l∗2
    f. A()
    {
            while(n>1)
            {
                n=n/2;
            }
    }

9. Write characteristics of Best Case, Average case and worst case with example.
10. Define Growth rate. Explain common orders of growth in complexity analysis.
11. For each of the following pairs of functions, either $f(n)$ is $O(g(n))$, $f(n)$ is $\Omega(g(n))$, or $f(n) = \theta(g(n))$. Determine which relationship is correct.
    a. f(n)=n^2 and g(n) = n
    b. f(n)=n and g(n) = n^2
    c. f(n)=n^2 and g(n) = 2^n
    d. $\mathrm{f(n)} = \mathrm{n};\ \mathrm{g(n)} = \log \mathrm{n}^2$
    e. $\mathrm{f(n)} = 2^{\mathrm{n}};\ \mathrm{g(n)} = 10\mathrm{n}^2$