**PSG COLLEGE OF TECHNOLOGY**

**DEPARTMENT OF APPLIED MATHEMATICS AND COMPUTATIONAL SCIENCES**

**M.Sc (SS) – DESIGN AND ANALYSIS OF ALGORITHMS**

**WORK SHEET - I**

1. Which of the following conjectures are correct and which are incorrect? Give a short justification for each answer.

a) 5n6 + n3 + n2 log n − n = O(n6)

b) 10n3 + 5n log n = O (n3)

c) log(n3) = O (log n)

2. Determine the solutions of the following recurrences in O- notation. You may assume that n is a power of some suitable constant (for example n is a power of 2 in the first recurrence). In all cases, T (1) = 1.

a) T (n) = 2T (n/2) + n3

b) T (n) = T (9n/10)+ n

3. Determine the exact solution of the recurrence T (n) = T (n/4) + 1 by using substitution. Consider T(1) = 1 as the base criteria and you may assume that n is a power of some suitable constant.

4. Draw the recursion tree for T (n) = 4T (n/2)+ cn, where c is a constant, and provide a tight asymptotic bound on its solution. Verify the bound by substitution method.

5. Analyse the time complexity of the following non recursive algorithms

1. for ( i=0 ; i<n ; i++ )

m += i;

1. for ( i=0 ; i<n ; i++ )

        for( j=0 ; j<n ; j++ )

             sum[i] += entry[i][j];

1. for ( i=0 ; i<n ; i++ )

        for( j=0 ; j<i ; j++ )

            m += j;

1. i = 1;

while (i < n) {

  tot += i;

  i = i \* 2;

}

1. i = n;

while (i > 0) {

  tot += i;

  i = i / 2;

}

1. for ( i=0 ; i<n ; i++ )

   for( j=0 ; j<n ; j++ )

        for( k=0 ; k<n ; k++ )

            sum[i][j] += entry[i][j][k];

1. for ( i=0 ; i<n ; i++ )

        for( j=0 ; j<n ; j++ )

             sum[i] += entry[i][j][0];

1. for ( i=0 ; i<n ; i++ )

        for( j=0 ; j< sqrt(n) ; j++ )

            m += j;

1. Enigma(A[0..n − 1, 0..n − 1])

//Input: A matrix A[0..n − 1, 0..n − 1] of real numbers

**for** i ←0 **to** n − 2 **do**

**for** j ←i + 1 **to** n − 1 **do**

**if** A[i, j ] != A[j, i]

**return false**

**return true**

6. Solve the recurrence T (n) = 2T (n/2 + 17) + n using substitution method.

7. Use limits to compare the order of growth of

1. 3x2 and x2+5
2. x and ln x
3. Show that 5n2-6n=Θ(n2).
4. For each of the following recurrences, give an expression for the runtime T (n) if the recurrence can be solved with the Master Theorem. Otherwise, indicate that the Master Theorem does not apply.

1. T (n) = 3T (n/2)+ n2

2. T (n) = 4T (n/2)+ n2

3. T (n) = T (n/2) + 2n