B. E. (IT) Part-II 5th Semester Examination, 2011

Analysis and Design of Algorithms

Paper code: IT – 506 | Branch: IT
Time – 2 hours | Full Marks – 35

Answer Question 1 and any two from the rest

1. Answer the following questions. 3 × 5
   a. Given two arrays of numbers $a_1, \ldots, a_n$ and $b_1, \ldots, b_n$ where each number is 0 or 1, find the time and space complexity of the fastest algorithm to find the largest *span (i, j)* such that $a_i + a_{i+1} + \ldots + a_j = b_i + b_{i+1} + \ldots + b_j$, or report that there is no such span.
   b. What is the time complexity of the following recursive function?

```
int     DoSomething (int n)
{
        if (n<=2)       return 1;
        else            return(DoSomething(floor (sqrt(n)))+n);
}
```

   c. Two alternative packages A and B are available for processing a database having 10^k records. Package A requires $0.0001\ n^2$ time units whereas package B requires $10\ n\ log_{10}\ n$ time units to process n records. Find the smallest value of k for which package B will be preferred over A.
   d. In quick sort, for sorting n elements, the $(n/4)^{th}$ smallest element is selected as pivot using an O(n) time algorithm. Find the worst case time complexity of the quick sort.
   e. Write a short note on NP Completeness.

2. Design an algorithm for breadth-first search (BFS), and analyze the algorithm. 10

3. Write the Kruskal's algorithm for finding the minimum spanning tree of a connected undirected graph. Show the execution of the algorithm with the help of an example graph having at least 7 nodes. 10

4. Write and explain the Bellman-Ford algorithm for finding the single-source shortest paths. Find the time complexity of the algorithm. 10