3 (Sem–4/CBCS) CSC HC 1

2023

COMPUTER SCIENCE

(Honours Core)

Paper : CSC–HC–4016

(Design and Analysis of Algorithms)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. *(a)* Define dynamic programming. 1

(b) Insertion sort is faster than merge sort. 1

(State True ***or*** *False)*

(c) Routing in network relies on algorithm. 1

(State True ***or*** *False)*

(d) Quick sort is a 1

(i) greedy algorithm

(ii) divide and conquer algorithm

(iii) dynamic programming algorithm

(iv) backtracking algorithm

(Choose the correct option)

(e) What is the advantage of recursive approach than an iterative approach ? 1

(i) Consumes less memory

(ii) Consumes more memory

(iii) Less code and easy to implement

(iv) More code has to be written

(Choose the correct option)

(f) What is the time complexity of depth first search algorithms ? 1

(i) $O(VE)$

(ii) $O(E \log V)$

(iii) $O(V \log E)$

(iv) $O(V + E)$

(Choose the correct option)

(g) When we say that an algorithm X is asymptotically more efficient than Y it means ? 1

(i) X will always be better for small inputs

(ii) X will always be better for large inputs

(iii) Y will always be better for small inputs

(iv) X will always be better for all inputs

(Choose the correct option)

2. (a) What do you mean by amortized analysis ? 2

(b) Analyse the time complexity of the following segment 2

```
for (i=0; i<N; i++) {
    for (j=N/2; j>0; j--) {
        sum ++ ;
    }
}
```

(c) What is minimum spanning tree ? Name the algorithms used for constructing minimum spanning tree. 1+1=2

(d) State the rules followed by a red black tree. 2

3. Answer ***any three*** of the following : 5×3=15

(a) Distinguish between dynamic programming and greedy method.

(b) Explain how recursive algorithms are analysed with an example.

(c) What are the advantages and disadvantages of divide and conquer approach ?

(d) Define theta (θ) notation. Prove that the function $f(x)=5x^4+7x+3$ is $\theta(x^4)$. 2+3=5

(e) Prove that running time of binary search algorithm in worst case is $O(log_2 N)$.

4. (a) Write the algorithm for merge sort and analyse its complexity for all cases. 4+2+2+2=10

Or

Use quick sort technique to sort the numbers 7 11 14 6 9 4 3 12 in ascending order. Illustrate the output of each pass clearly. 10

(b) Given a test $T[0....N-1]$ and a pattern $P[0....M-1]$ where $N > M$, write an algorithm to print all occurrence of $P[\ ]$ in $T[\ ]$. 10

Or

Write algorithms for insertion and deletion in a red black tree. 5+5=10

(c) Write algorithm for breadth-first search and mention its time and space complexity. Discuss the difference between breadth-first search and depth-first search algorithms. 5+5=10

Or

Discuss the differences between Kruskal's and Prim's algorithms. Apply Prim's algorithm to find the minimum spanning tree for the following graph : 5+5=10