Subject Code: CSE303 Enrollment No....A2305220069

MID TERM EXAMINATION-September 2022

Analysis and Design of Algorithm

Time: 01Hr **Maximum marks: 30**

Note: Attempt questions as per Instructions

SECTION-A (Attempt **Any Two** questions out of three, Each of **05 Marks**)

Q.1 Consider the following two conditions (i) and (ii) for asymptotic positive function f(n), g(n) and h(n):

$(i)\ f(n) = \Omega(g(n))\ and\ g(n) \neq \Omega(f(n))$

$(ii)\ f(n) = \Omega(h(n))\ and\ h(n) = \Omega(f(n))$

Find which of the following statement are **TRUE/FALSE** based on (i) and (ii) conditions.

a) $f(n) * h(n) = O(g(n) * h(n))$

b) $Max\{f(n), g(n)\} = \Theta(f(n) + g(n))$

c) $g(n) * h(n) = \Omega(h(n))$

Q.2 Consider a weighted complete graph G of 5 vertex set $\{V_1, V_2, V_3, V_4, V_5\}$ such that the weight of the edge (V_i, V_j) is $3|i-j|$. Find the weight of a minimum spanning tree of G using Prim's Algorithm.

Q.3 Find the optimal solution of the following instance of knapsack problem (fractional):

Number of objects n=5, Capacity of Knapsack (M)=14

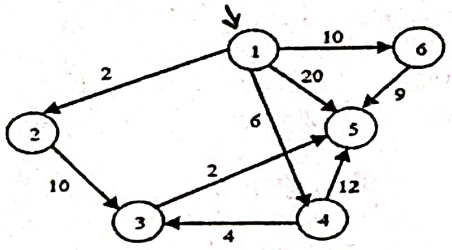
Items (I_i)	I_1	I_2	I_3	I_4	I_5
Profits (p_i)	15	12	9	16	17
Weights (w_i)	2	5	3	4	6

SECTION-B (Attempt **Any One** question, out of two, **Each of 10 Marks**)

Q.1.(a) Write a $PARTITION(A, p, r)$ algorithm of Quicksort which partition the given input array $A[p, \ldots, r]$ to set pivot element (say $A[r]$). Find its time complexity also.

(b) Explain how V. Strassen's matrix multiplication method is used to multiply 2 matrices of size $(n \times n)$ in less than $O(n^3)$ time.

Q.2 Apply Dijkstra's algorithm on the following graph G to find shortest path from vertex [1] to other vertices of G . Step by step calculate *shortest path estimate* of d[ ] value for each vertex of G and order of vertices gets included in set S.



SECTION-C (Compulsory, 10 Marks)

Q.1 (a) Solve the following recurrences: |6+4=10|

(i) $T(n) = 2T\left(\frac{n}{2}\right) + n^2 log^2 n$

(ii) $T(n) = \begin{cases} 1 & n = 0 \\ T\left(\frac{n}{2}\right) + T\left(\frac{2n}{5}\right) + 7n & n > 0 \end{cases}$

(b) Write the recurrence relation and time complexity of the problem listed below

S. No.	Problem	Recurrence relation (Worst Case)	Time complexity
1	Binary search		
2	V. Strassen's Matrix multiplication		
3	Quicksort		

4	`int p = 0;`
	`for(i = 1; p <= n; i++)`
	`{ p = p + i; }`		