

**SEMESTER EXAMINATION-2021**  
**CLASS – MCA SUBJECT- PARALLEL PROCESSING**  
**PAPER CODE: MCA-E504**

**Time: 3 hour**

**Max. Marks: 70**

**Min. Pass: 40%**

**Note:** Question Paper is divided into two sections: **A and B**. Attempt both the sections as per given instructions.

**SECTION-A (SHORT ANSWER TYPE QUESTIONS)**

**Instructions:** Answer any five questions in about 150 words (5 X 6 = 30 Marks) each. Each question carries six marks.

Question-1: With suitable example differentiate Data parallelism and control parallelism. [6]

Question-2: Define PRAM model of parallel computation and discuss about its read/write conflict and how it can be handled. [6]

Question-3: Find the time complexity to SPAWN n processors for PRAM. [6]

Question-4: Compute the prefix sums of given numbers using parallel algorithm. Also find the no. of Processing Elements required and no. of steps needed. [6]

A[0]	A[1]	A[2]	A[3]	A[4]	A[5]	A[6]	A[7]	A[8]
3	6	2	5	4	1	9	7	8

Question-5: Discuss the parallel programming features of Sequent C. [6]

Question-6: What are the advantages of Static scheduling? Give Coffman-Graham Scheduling Algorithm. (Example not required). [6]

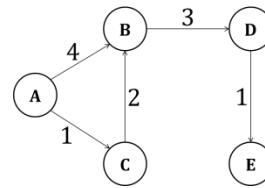
Question-7: When a graph is said to be cubical? State the conditions for dilation-1 embedding of a connected graph G into a hypercube with n nodes. Use these conditions to prove a binomial tree of height 3 can be embedded in a hypercube of dimension 3 such that the dilation is 1. [6]

Question-8: Demonstrate the working of parallel algorithm for the hypercube SIMD model for given numbers. At the end of the algorithm each Processing Element holds the final sum. [6]

A[0]	A[1]	A[2]	A[3]	A[4]	A[5]	A[6]	A[7]
13	16	12	15	14	11	19	17

Question-9: How sequential matrix multiplication algorithm is modified to make it more suitable for efficient parallelization on multicomputer? State the code and discuss the logic. [6]

Question-10: Explain the working of Moore's single source shortest path algorithm for the given graph - [6]



### SECTION-B (LONG ANSWER TYPE QUESTIONS)

**Instructions:** Answer any FOUR questions in detail. Each question carries 10 marks. (4 X 10 = 40 Marks)

Question-11: What are the criteria for a parallel algorithm to become cost effective? Discuss the logic of cost effective algorithm to compute suffix sums of fourteen (14) elements using three (3) processors and compute the complexity of algorithm. [10]

Question-12: Develop an algorithm to sum n-elements for UMA multiprocessor that uses flags. Also write other version of the algorithm that uses critical section and compare them. [10]

Question-13: Prove that a list on  $n = 2^k$  unsorted elements can be sorted by using a network of  $2^{k-2}k(k+1)$  comparators in time  $\Theta(\log^2 n)$  with suitable numerical example of 8 elements. [10]

Question-14: What is Gray Code and how higher order codes are generated from lower order codes? How Gray Codes are used to map rings into Hypercube (give mapping functions)? Also demonstrate the mapping of ring of size eight (8) to hypercube of dimension three (3). [10]

Question-15: What is the lower bound for matrix multiplication on 2-D mesh? State the related theorem and lemma. Also develop the matrix multiplication parallel algorithm for 2-D mesh SIMD model and explain the working for given example. [10]

5	7	9	10
2	3	3	8
8	10	2	3
3	3	4	8

3	10	12	18
12	1	4	9
9	10	12	2
3	12	4	10

[10]

Question-16: State the multiprocessor oriented parallel quicksort algorithm and analyze it. How it can be improved using hyperquicksort discuss in brief. [10]

- Question-17: What is the connected component problem of a graph? Write [10]  
the pseudocode of Nassimi and Sahni's adoption of  
Hirschberg's algorithm for 2-D mesh.
- Question-18: Discuss any two combinational search techniques in detail [10]  
with examples.

**Paper Code: MCA-E504**