



Parallel Computing (1080)

P. Pages : 3

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any five** questions out of 8 questions.
5. Assume suitable data if necessary.
6. Draw neat diagrams wherever necessary.

1. a) Explain the following terms with respect to parallel computing : **10**
 - i) Running time of algorithm
 - ii) Cost of algorithm
 - iii) Area, length and period.
- b) Explain with suitable example the unfolding and folding stages of searching on a two – dimensional array of processors. **10**
2. a) Assume that sum of n numbers x_1, x_2, \dots, x_n needs to be computed. **10**
Justify the no. of steps required to solve this on
 - i) sequential algorithm on SIMD computer
 - ii) Tree connected SIMD computer.
 - iii) Tree connected SIMD computer with pipelining.
- b) Consider the odd order input (50, 20, 90, 30, 70, 10, 80, 40). Apply preprocessing steps to this input for converting it first into bitonic sequence and then apply Batcher's sort. Also justify no. of parallel steps required. **10**

3. a) Let $S = \{1, 4, 6, 9, 10, 11, 13, 14, 15, 18, 20, 23, 32, 45, 51\}$ be the sequence to be searched using a CREW 5m SIMD computer with N processors. 10
- i) Assume that $N = 3$ and it is required to find the index K of the element in S equal to 45.
- ii) Assume that $N = 2$ and it is required to find the index K of the element in S equal to 21.
- b) Explain the components of parallel computers using it's general structure. Discuss the general principles of parallel computing. 10
4. a) Let $S = \{25, 14, 36, 18, 15, 17, 19, 17\}$ and $x = 17$ Determine whether there is a value in S equal to x on a tree connected SIMD computer with 8 leaves. How many stages will be required to do this search. What will be time complexity. Also discuss the time complexity if pipelining is done for q such queries. 10
- b) Explain shared memory SIMD architecture, Inter connection network SIMD architecture, compare the same with MIMD architecture. 10
5. a) Explain the properties of perfect shuffle which makes it well adapted for Batcher's Bitonic sort. 10
- b) Write and explain the algorithm for parallel formulation of quicksort on CRCW PRAM. 10
6. a) How the DFT is computed in parallel? Write a parallel algorithm for FFT. How parallelism is achieved to perform the transform. 10
- b) Write short notes on : 10
- i) Shared address space parallel formulation.
- ii) Message passing parallel formulation.
7. a) Assume that we want to multiply two polynomials $f(x) = \sum_{j=0}^{n-1} a_j x^j$ and $g(x) = \sum_{k=0}^{n-1} c_k x^k$ to obtain the product polynomial $h = fg$. What will be time complexity for straightforward product. Write down the steps for the same using FFT and justify time complexity. 10

- b) Discuss the problem of searching item x in a very large computer file consisting of n distinct entries. For this consider following classes of computers. **10**

i) Conventional SISD computer.

ii) EREW SM SIMD

iii) CREW SM SIMD

Justify the same for worst-case and Average case in every class.

8. a) Write and explain the algorithm for CRCW sort and CREW sort. **10**
- b) Explain odd even transpose sort with suitable example. **10**
