

Ain Shams University
Faculty of Science
Department of Mathematics
Computer Science Division
Date: January 10, 2021
Time: 3 hours



Course code/name: COMP 403
"Parallel and Distributed Processing"
Level/Semester: 4/Fall
Programs: CS, pure Math/CS,
Statistics/CS, Physics/CS
Total Marks: 105 Marks

Answer the following Questions

Q1) Choose the correct answer: (15 marks)

1. Parallelism is important for modeling and simulating scientific problems that are
a. Dangerous b. Difficult c. Expensive d. All the previous
2. The ratio between computation and communication is
a. Granularity b. Cost c. Speedup d. Load balance
3. The measure of the fraction of time for which a processing element is usefully employed is
a. Complexity b. Efficiency c. Cost d. Storage
4. The computational model where a single control unit dispatches the same instruction to various processors that work on different data streams
a. SISD b. MISD c. SIMD d. MIMD
5. The parallel computer memory architecture in which the access latency to complete an access to any memory location from any processor is the same
a. UMA b. NUMA c. COMA d. All the previous
6. PRAM model in which it is possible to read from and write to memory cell by several processors
a. EREW b. ERCW c. CREW d. CRCW
7. The amount of time that a computer or a network connection is functioning and usable
a. Scalability b. Availability c. Reliability d. Latency
8. One of the online financial trading distributed application
a. Flickr b. MySpace c. PayPal d. MMOGs
9. The systems with multiple processing units attached to a single memory
a. SM b. GPU c. DS d. All the previous
10. The percentage of employing available resources that is used for performing tasks
a. Optimality b. Consistency c. Visualization d. Utilization
11. The grid layer that defines the communication and authentication protocols required for transactions
a. Fabric b. Resource c. Collective d. Application
12. The process of combining tasks into larger tasks to improve performance is
a. Partitioning b. Communication c. Agglomeration d. Scheduling
13. Decomposition of data associated with a problem, then each task works on a portion of the data is
a. Domain b. Functional c. Task d. Hybrid
14. Communication type which involves data sharing between more than two tasks
a. Local b. Global c. Point to point d. Collective
15. The design model where one or more processes generate work and allocate it to worker processes
a. Data parallel b. Task parallel c. Master-Slave d. Producer-Consumer

Q2) For a list L of length n , write the pseudocode for parallel 2D-Mesh $M_{q,q}$ sorting algorithm, where $n = p = q^2$. Trace the algorithm when sorting $L = \{23, -6, 1, 5, 11, 113, 55, 129, -3, 12, -5, -7, 19, 55, 28, -2\}$. (20 marks)

Q3) Consider the problem of searching for an element X in a vector A of size n . Write an EREW PRAM algorithm to solve this problem using n processors. Measure the efficiency and speedup of your algorithm. Trace your algorithm on the vector $A = \{45, -10, 7, 14, 12, -5, 21, 16\}$, with $X = 12$. (20 marks)

Q4) Compare between each of the following: (15 marks)

1. Parallel and distributed processing.
2. Multiprocessors and multicomputers.
3. OpenMP and POSIX threads multithreaded programming.
4. Blocking and nonblocking message passing.
5. Grid and cloud computing.

Q5) Give an example and draw a diagram to explain each of the following: (15 marks)

1. Distributing elements of a list using the cyclic decomposition on a 1D-Mesh and computing their average.
2. Gathering and scattering operations between processes in a distributed system.
3. Avoiding deadlock when using synchronous message passing.

Q6) For scheduling tasks on grid systems, write the pseudocode of the *Min-Min* batch algorithm. Then, apply it using the given expected completion time matrix (in milliseconds). Finally, discuss if it is better to use another scheduler according to the resulted makespan. (20 marks)

	M_{11}	M_{12}	M_{13}	M_{14}
Task 1	10	19	8	15
Task 2	12	18	7	16
Task 3	13	15	9	14
Task 4	12	19	8	18
Task 5	14	17	10	19

Best wishes

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