



## Department of CSE Data Science

### UNIT TEST – I

Academic Year 2023-24

Class: TEDS

Semester: VI

Subject: CSDLO6011 High Performance Computing

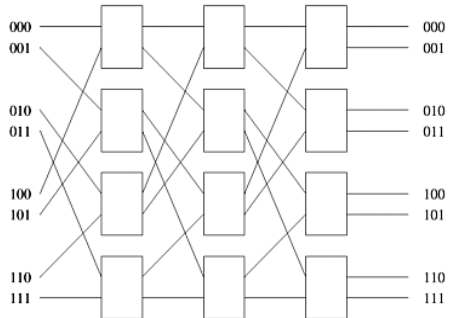
Date: 22<sup>nd</sup> Feb 2024

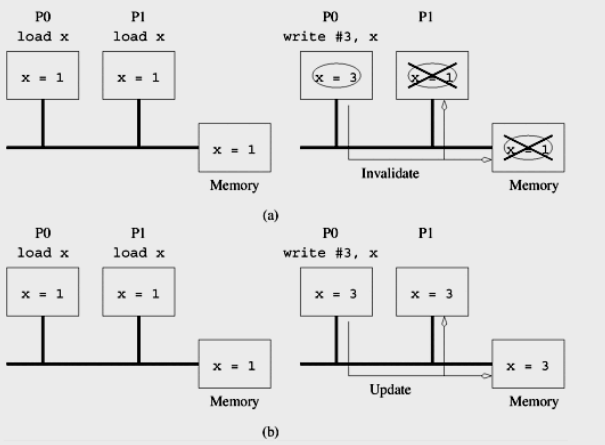
Time: 2:00 to 3:30pm

Max marks: 40

Note the following instructions

1. All questions are mandatory (Q.1, Q.2, Q.3)
2. Draw neat diagrams wherever necessary.
3. Write everything in Black ink (no pencil) only.
4. Assume data, if missing, with justification.

Q. N.	Questions	MARKS	CO	Blooms Taxonomy Level	PO
Q.1	Attempt any two.				
1	Explain Demand Driven Computation. Mention one Advantage and one Disadvantage of this model.	[5]	CO1	L2	
2	Outline the fundamental limits of serial computing.	[5]	CO1	L2	
3	Explain SPMD Model.	[5]	CO1	L2	
4	Compare and Contrast Data and Task Level Parallelism.	[5]	CO1	L2	
Q.2	Attempt any two				
1	 <ol style="list-style-type: none"> <li>1. <b>Identify</b> the above network topology in parallel platforms and explain it in detail.</li> <li>2. <b>Make use of</b> 8 processors to calculate the following for the above network:</li> </ol>	[10]	CO2	L3	PO1, PO12

	a. Diameter a. Bisection Width a. Arc Connectivity a. Cost (No. of links)																																																																						
2	 <p>Consider the following initial state of two processors P0 and P1. If there is a write operation performed on P0 with a new value x=3. <b>Apply</b> Invalidate Protocol to construct the parallel program execution flow with the simple three-state coherence protocol (Shared, Invalid and Dirty). <b>Develop</b> a state machine diagram for invalidate protocol of cache coherence. Also, <b>Explain</b> the Invalidate Protocol for Cache Coherence in Multiprocessor Systems.</p>	[10]	CO2	L3	PO1, PO12																																																																		
3	<p><b>Calculate</b> the communication cost using Store and Forward Routing mechanism for the following scenario: We need to send 20 words from Processor P0 to P7, the path has 14 communication links, the startup time required for the communication is 10s, per-hop time is 12s and time required for transfer of each word is 7s. Also, <b>Explain</b> Communication Costs in Parallel machines with respect to Store and Forward Routing in detail.</p>	[10]	CO2	L3	PO1, PO12																																																																		
Q.3	<b>Attempt any one</b>																																																																						
1	<p>Consider the execution of the query:  <b>MODEL = "CIVIC" AND YEAR = 2001 AND (COLOR = "GREEN" OR COLOR = "WHITE")</b> on the following database:</p> <table border="1"> <thead> <tr> <th>ID#</th><th>Model</th><th>Year</th><th>Color</th><th>Dealer</th><th>Price</th></tr> </thead> <tbody> <tr><td>4523</td><td>Civic</td><td>2002</td><td>Blue</td><td>MN</td><td>\$18,000</td></tr> <tr><td>3476</td><td>Corolla</td><td>1999</td><td>White</td><td>IL</td><td>\$15,000</td></tr> <tr><td>7623</td><td>Camry</td><td>2001</td><td>Green</td><td>NY</td><td>\$21,000</td></tr> <tr><td>9834</td><td>Prius</td><td>2001</td><td>Green</td><td>CA</td><td>\$18,000</td></tr> <tr><td>6734</td><td>Civic</td><td>2001</td><td>White</td><td>OR</td><td>\$17,000</td></tr> <tr><td>5342</td><td>Altima</td><td>2001</td><td>Green</td><td>FL</td><td>\$19,000</td></tr> <tr><td>3845</td><td>Maxima</td><td>2001</td><td>Blue</td><td>NY</td><td>\$22,000</td></tr> <tr><td>8354</td><td>Accord</td><td>2000</td><td>Green</td><td>VT</td><td>\$18,000</td></tr> <tr><td>4395</td><td>Civic</td><td>2001</td><td>Red</td><td>CA</td><td>\$17,000</td></tr> <tr><td>7352</td><td>Civic</td><td>2002</td><td>Red</td><td>WA</td><td>\$18,000</td></tr> </tbody> </table> <p>For the parallel execution of the above query perform the following:</p>	ID#	Model	Year	Color	Dealer	Price	4523	Civic	2002	Blue	MN	\$18,000	3476	Corolla	1999	White	IL	\$15,000	7623	Camry	2001	Green	NY	\$21,000	9834	Prius	2001	Green	CA	\$18,000	6734	Civic	2001	White	OR	\$17,000	5342	Altima	2001	Green	FL	\$19,000	3845	Maxima	2001	Blue	NY	\$22,000	8354	Accord	2000	Green	VT	\$18,000	4395	Civic	2001	Red	CA	\$17,000	7352	Civic	2002	Red	WA	\$18,000	[10]	CO3	L3	PO1, PO12
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	<ol style="list-style-type: none"><li>1. <b>Decompose</b> the problem in multiple tasks</li><li>2. <b>Build</b> a task dependency graph for the tasks identified</li><li>3. <b>Select</b> appropriate mapping of tasks to different processors taking into account data and control dependency</li><li>4. Assume the costs associated with tasks at each level and <b>Calculate</b> the critical path length</li><li>5. <b>Calculate</b> the average and maximum degree of concurrency</li><li>6. <b>Create</b> a task interaction graph based on decomposition you have performed</li><li>7. <b>Comment</b> on the shortest parallel execution time for the decomposition you have done for this problem.</li></ol>																				
2	<p>Consider the following array for a sorting problem using Quick Sort Algorithm.</p> <table border="1"><tr><td>5</td><td>17</td><td>4</td><td>18</td><td>25</td><td>63</td><td>0</td><td>8</td><td>7</td><td>9</td><td>1</td><td>23</td><td>15</td><td>3</td><td>45</td><td>27</td></tr></table> <p>For the parallel execution of the above sorting problem answer the following:</p> <ol style="list-style-type: none"><li>1. <b>Select</b> the most optimal decomposition technique for the above problem and justify the reason for your selection</li><li>2. <b>Decompose</b> the problem using quick sort</li><li>3. <b>Build</b> a task dependency graph for the tasks identified in step 2</li><li>4. <b>Select</b> appropriate mapping of tasks to different processors taking into account data and control dependency</li><li>5. Assume the costs associated with tasks at each level and <b>calculate</b> the critical path length</li><li>6. <b>Calculate</b> the average and maximum degree of concurrency</li><li>7. <b>Create</b> a task interaction graph based on decomposition you have performed</li><li>8. <b>Comment</b> on the shortest parallel execution time for the decomposition you have done for this problem.</li></ol>	5	17	4	18	25	63	0	8	7	9	1	23	15	3	45	27	[10]	CO3	L3	PO1, PO12
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