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Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science & Engineering
Final Examination, Spring 2026
Course Code: CSE323, Course Title: Operating Systems
Level: 3 Term: 3 Batch: 65

Time: 02:00 Hrs **Marks: 40**

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	In a warehouse system similar to Daraz Bangladesh, a bounded buffer of size 5 is shared between a producer and a consumer. The system uses three shared variables: `in`, `out`, and `count` to manage insertion and removal operations.			**CO2**
	a)	Construct a buffer state table to illustrate the operations of the system. Initially, the buffer is empty. First, the producer inserts 3 items, Then, the consumer removes 2 items, Finally, the producer inserts 4 more items. Show the updates of `in`, `out`, and `count` after each operation.	**[5]**	
	b)	Assuming the producer and consumer execute concurrently, demonstrate how a race condition may occur on the `count` variable. Illustrate your answer using a step-by-step interleaving table showing conflicting updates.	**[5]**	
2.	A system consists of 4 processes (P0–P3) and 3 resource types R1, R2, R3 with Instances: R1(2), R2(3), R3(2). Allocation: R1→P1,P0; R2→P1,P2,P3; R3→P0 Requests: P1→R1; P0→R2,R3; P2→R3; P3→R2,R2 (2 request)			**CO2**
	Draw the Resource Allocation Graph (RAG). Determine whether a deadlock exists. If not, give a possible execution sequence.		**[5]**	
3.	A computer system uses a paging mechanism with a TLB. The following parameters are given: TLB access time = 30 ns Main memory access time = 120 ns TLB hit ratio = 70% Page fault rate = 20% Page fault service time = 8000 ns			**CO3**
	a)	Calculate the Effective Access Time (EAT)	**[2]**	
	b)	If there was no page fault, then calculate the EAT with TLB and without TLB.	**[3]**	
	c)	Briefly explain why TLB is needed and which factor (TLB hit ratio or page fault rate) has a more significant impact on performance in this system. If the system designer can improve either TLB hit ratio to 90% or reduce page fault rate to 10%, which should be prioritized? Justify with calculation.	**[5]**	

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4.	Consider the page reference string: 1, 4, 2, 4, 5, 1, 3, 2, 5, 2, 4, 1, 3.			**CO3**
	a)	For a system with **3 frames**, simulate both FIFO and LRU page replacement algorithms. Compute total page faults for each and determine which algorithm performs better.	**[5]**	
	b)	Using the same reference string and page set {1–5}, construct a modified reference string by changing at most two positions, such that: FIFO with 4 frames produces more page faults than FIFO with 3 frames (Belady's anomaly) Then: Verify your claim with simulation. Explain why Belady's anomaly occurs in your constructed case.	**[5]**	
5.	A computer system uses a magnetic disk with a rotational speed of 6000 RPM and an average seek time of 6 milliseconds. The disk has a data transfer rate of 120 MB per second, and each track contains 250 sectors, with each sector having a size of 512 bytes. At a given moment, the disk head is positioned at track 35. A process requests to read a sector located on track 75.			**CO3**
		Determine the total time required to access and read this sector, taking into account the seek time, rotational latency, and data transfer time.	**[5]**	

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