SEMESTER 2
2022-2023

CS240FZ
Operating Systems, Communications and Concurrency

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Time allowed: 2 hours

Answer at least **seven** questions
Your mark will be based on your best **seven** answers

All questions carry equal marks

Instructions

	Yes	No
Log Books Allowed		X
Formula Tables Allowed		X
Other Allowed (*enter details)*		X

General (*enter detail)*

QUESTION 1

What is a process control block(PCB)? Present the 3 typical parts of a PCB and summarize each content. (10 marks)

QUESTION 2

Give a C/pseudo-code solution to demo the pipe communication from a parent to child process. (10 marks)

QUESTION 3

If the following three jobs arrive in the following order (A,B,C) at approximately the same time and: (10 marks)

- TASK A with CPU burst requirement of 18
- TASK B with CPU burst requirement of 6
- TASK C with CPU burst requirement 3

Analyse the scheduling performance of the following algorithms: Round Robin Algorithm (RR, quantum = 1), First Come First Served (FCFS) and Shortest Job First (SJF) under the metrics of waiting time, response time and turnaround time.

QUESTION 4

Describe the generic design requirements of a File System. List and explain some of the basic system calls typically provided for accessing and organizing files. (10 marks)

QUESTION 5

The second readers/writers concurrency problem prioritizes writers and requires that no writer be kept waiting unless a reader has already obtained permission to use the shared item. Define a pseudo-code solution to this coordination problem using semaphores. (10 marks)

QUESTION 6

Give a pseudo code software solution to the n-process mutual exclusion problem indicating the entry code and exit code to be executed by each process. Explain the components of your code. (10 marks)

QUESTION 7

The table below has 5 processes (P_0 to P_4), and 3 types of resource A,B,C. Allocation indicates how many of each type are currently assigned to each process. Max is the maximum number of each resource type that can be requested by a process. Available is the number of currently free resources of each type. (10 marks)

Process	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P0	0	1	0	7	5	3	3	3	2
P1	2	0	0	3	2	2			
P2	3	0	2	9	0	2			
P3	2	1	1	2	2	2			
P4	0	0	2	4	3	3			

Provide the necessary steps to check if this system state is safe from deadlock. Provide the sequence of execution of the processes.

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QUESTION 8

Describe how a demand paged memory architecture works. What are the advantages of demand paged memory architectures. (10 marks)

QUESTION 9

Describe three space allocation techniques that a file system could use for allocating free space to files. Comment on the data structures needed to implement these allocation techniques and the efficiency of the file processing operations. (10 marks)