Subject Code: KCA203

PAPER ID-421311

Roll No: | | | | | | | | | | | | | |

MCA
(SEM II) THEORY EXAMINATION 2021-22
OPERATING SYSTEMS

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If you require any missing data, then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2x10 = 20

Qno	Questions	CO
(a)	Describe all operating system services.	1
(b)	Defend timesharing differ from multiprogramming? If so, how?	1
(c)	Discuss the uses of mutex?	2
(d)	Describe race condition for cooperating processes.	2
(e)	Compare and contrast Single-threaded and multi-threaded process.	3
(f)	Distinguish between CPU bounded, I/O bounded processes.	3
(g)	What are the conditions under which a deadlock situation may arise?	4
(h)	What is resource-allocation graph?	4
(i)	Define Belady's Anomaly.	5
(j)	Explain logical address space and physical address space diagrammatically.	5

SECTION B

2. Attempt any *three* of the following: 10x3 = 30

Qno	Questions	CO
(a)	Describe operating system functions. Also, explain monolithic, and microkernel systems.	1
(b)	Define critical section problem. Write the Peterson's solution to solve critical section problem.	2
(c)	Illustrate process states and process transition diagram.	3
(d)	Discuss the following storage placement strategies with suitable examples: (i) Best fit (ii) First fit (iii)Worst fit	4
(e)	What are the three methods for allocating disk space? Explain.	5

SECTION C

3. Attempt any *one* part of the following: 10x1 = 10

Qno	Questions	CO
(a)	Explain the following terms and their working with diagram i) Buffering ii) Spooling iii) Time sharing iv) Distributed system	1
(b)	Differentiate between multiprocessor, multiuser, and Batch operating system.	1

4. Attempt any *one* part of the following: 10x1 = 10

Qno	Questions	CO
(a)	Interpret Dining philosopher problem.	2
(b)	A shared variable x, initialized to zero, is operated on by four concurrent processes W, X, Y, Z as follows. Each of the processes W	2

MCA
(SEM II) THEORY EXAMINATION 2021-22
OPERATING SYSTEMS

	and X reads x from memory, increments by one, stores it to memory, and then terminates. Each of the processes Y and Z reads x from memory, decrements by two, stores it to memory, and then terminates. Each process before reading x invokes the P operation (i.e., wait) on a counting semaphore S and invokes the V operation (i.e., signal) on the semaphore S after storing x to memory. Semaphore S is initialized to two. What is the maximum possible value of x after all process's complete execution?	

5. Attempt any *one* part of the following: 10x1 = 10

Qno	Questions	CO
(a)	Illustrate process states and process transition diagram.	3
(b)	Consider the set of 4 processes whose arrival time and burst time are given below-	3

Process No.	**Arrival Time**	**Burst Time**		
		CPU Burst	**I/O Burst**	**CPU Burst**
P1	0	3	2	2
P2	0	2	4	1
P3	2	1	3	2
P4	5	2	2	1

If the CPU scheduling policy is Shortest Remaining Time First, calculate the average waiting time and average turnaround time.

6. Attempt any *one* part of the following: 10x1 = 10

Qno	Questions	CO
(a)	Considering a system with five processes P_0 through P_4 and three resources of type A, B, C. Resource type A has 10 instances, B has 5 instances and type C has 7 instances. Suppose at time t_0 following snapshot of the system has been taken.	4

Roll No: | | | | | | | | | | | | | |

MCA
(SEM II) THEORY EXAMINATION 2021-22
OPERATING SYSTEMS

	<table><tr><th>Process</th><th>Allocation</th><th>Max</th><th>Available</th></tr><tr><th></th><th>A B C</th><th>A B C</th><th>A B C</th></tr><tr><td>P_0</td><td>0 1 0</td><td>7 5 3</td><td rowspan="5">3 3 2</td></tr><tr><td>P_1</td><td>2 0 0</td><td>3 2 2</td></tr><tr><td>P_2</td><td>3 0 2</td><td>9 0 2</td></tr><tr><td>P_3</td><td>2 1 1</td><td>2 2 2</td></tr><tr><td>P_4</td><td>0 0 2</td><td>4 3 3</td></tr></table> Then, I. What will be the content of the Need matrix? II. Is the system in a safe state? If Yes, then what is the safe sequence? III. What will happen if process P_1 requests one additional instance of resource type A and two instances of resource type C?	
(b)	Apply banker's algorithm for a system in which, there are three types of resources: E, F and G. Four processes P0, P1, P2 and P3 execute concurrently. At the outset, the processes have declared their maximum resource requirements using a matrix named Max as given below. For example, Max [P2, F] is the maximum number of instances of F that P2 would require. The number of instances of the resources allocated to the various processes at any given state is given by a matrix named Allocation. Consider a state of the system with the Allocation matrix as shown below, and in which 3 instances of E and 3 instances of F are the only resources available. <table><tr><th colspan="4">Allocation</th></tr><tr><th></th><th>E</th><th>F</th><th>G</th></tr><tr><td>P_0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>P_1</td><td>1</td><td>1</td><td>2</td></tr><tr><td>P_2</td><td>1</td><td>0</td><td>3</td></tr><tr><td>P_3</td><td>2</td><td>0</td><td>0</td></tr></table> <table><tr><th colspan="4">Max</th></tr><tr><th></th><th>E</th><th>F</th><th>G</th></tr><tr><td>P_0</td><td>4</td><td>3</td><td>1</td></tr><tr><td>P_1</td><td>2</td><td>1</td><td>4</td></tr><tr><td>P_2</td><td>1</td><td>3</td><td>3</td></tr><tr><td>P_3</td><td>5</td><td>4</td><td>1</td></tr></table> Find the safe sequence.	4

7. Attempt any *one* part of the following: 10x1 = 10

Qno	Questions	CO
(a)	A system uses 3-page frames for storing process pages in main memory. Assume that all the page frames are initially empty. What is the total number of page faults that will occur while processing the page reference string given below for FIFO, LRU and Optimal Page Replacement algorithm? Also calculate the hit ratio and miss ratio. 4 , 7, 6, 1, 7, 6, 1, 2, 7, 2	5
(b)	Explain the three methods available for allocating disk space?	5