Sample Question Format
(For all courses having end semester Full Mark=50)

KIIT Deemed to be University
Online End Semester Examination(Autumn Semester-2021)

Subject Name & Code: **Operating Systems (CS 2002)**
Applicable to Courses: All brances

Full Marks=50

Time:2 Hours

SECTION-A(Answer All Questions. Each question carries 2 Marks)

Time:30 Minutes
(7×2=14 Marks)

Question No	Question Type (MCQ /SAT)	Question	CO Mapping	Answer Key (For MCQ Questions only)
Q.No:1	MCQ	Which one of the following is not true? A. Kernel is made of various modules which cant be loaded in running operating system B. Kernel remains in the memory during the entire computer session C. Kernel is the first part of os to loaded into memory during booting. D. Kernel is a program that constitutes the central core of os.	CO1	A
	MCQ	System calls are usually invoked by using: A. Polling B. An direct jump C. A priviledged instruction D. A software interrupt	CO1	D
	MCQ	Which of the following is not a function of Operating system? A. Process management B. Coordination between other software and users	CO1	C

<table>
<tr><td></td><td></td><td>C. Anti virus protection
D. Resource management</td><td></td><td></td></tr>
<tr><td></td><td><u>MCQ</u></td><td>Consider the following statements with respect to user-level threads and kernel-supported threads.
I. Context switch is faster with kernel- supported threads.
II. For user-level threads, a system call can block the entire process
III. Kernel-supported threads can be scheduled independentl
IV. Use-level threads are transparent to the kernel
Which of the above statements are true?
A. II,IIIonly
B. II,III,IV only
C. I and IV only
D. All of the above</td><td>CO1</td><td>B</td></tr>
<tr><td><u>Q.No:2</u></td><td><u>MCQ</u></td><td>Which scheduling policy is most suitable for a time-shared operating systems?
<u>A.</u> First come first serve
<u>B.</u> Shortest job first
<u>C.</u> Priority scheduling
<u>D.</u> Round robin</td><td>CO2</td><td>D</td></tr>
<tr><td></td><td><u>MCQ</u></td><td>Consider the following table of arrival time and burst time for three processes P0, P1 and P2.
<table><tr><td>P Id</td><td>Arrival time</td><td>Burst time</td></tr><tr><td>P0</td><td>0ms</td><td>9ms</td></tr><tr><td>P1</td><td>1ms</td><td>4ms</td></tr><tr><td>P2</td><td>2ms</td><td>9ms</td></tr></table>The pre-emptive shortest job first scheduling algorithm is used. Scheduling is carried out only at arrival or completion of processes. What is the average waiting time for the three processes?
A. 6ms
B. 4ms
C. 5ms
D. 9ms</td><td>CO2</td><td>C</td></tr>
<tr><td></td><td><u>MCQ</u></td><td>Which of the following statements are true?
I. Shortest remaining time first scheduling may cause starvation
II. Preemptive scheduling may cause</td><td>CO2</td><td>B</td></tr>
</table>

<table>
<tr><td></td><td></td><td>starvation

III. Round robin is better than FCFS in terms of response time

A. I and II
B. I,II and III
C. III only
D. All of the above</td><td></td><td></td></tr>
<tr><td></td><td><u>MCQ</u></td><td>In which of the following scheduling criteria, context switching will never take place ?
A. Priority
B. Preemptive SJF
C. Non premeptive SJF
D. Round robin</td><td>CO2</td><td>C</td></tr>
<tr><td><u>Q.No:3</u></td><td><u>MCQ</u></td><td>Consider the following set of processes, assumed to have arrived at time 0. Consider the CPU scheduling algorithms Shortest Job First (SJF) and Round Robin (RR). For RR, assume that the processes are scheduled in the order P_1, P_2, P_3, P_4.
<table><tr><td>PId</td><td>Burst time</td></tr><tr><td>P1</td><td>8</td></tr><tr><td>P2</td><td>7</td></tr><tr><td>P3</td><td>2</td></tr><tr><td>P4</td><td>4</td></tr></table>
If the time quantum for RR is 4 ms, then the absolute value of the difference between the average turnaround times (in ms) of SJF and RR (round off to one decimal places) is _____
A. 5.5ms
B. 5.3ms
C. 5.2ms
D. 5.7ms</td><td>CO2</td><td>C</td></tr>
<tr><td></td><td><u>MCQ</u></td><td>consider the 3 processes, S1, S2 and S3 shown in the table
<table><tr><td><u>pid</u></td><td><u>Arrival time</u></td><td><u>Burst Time</u></td></tr><tr><td>S1</td><td>0</td><td>5</td></tr><tr><td>S2</td><td>1</td><td>7</td></tr><tr><td>S3</td><td>3</td><td>4</td></tr></table>The completion order of the 3 processes under the policies FCFS and RRS (round robin scheduling with CPU quantum of 2 time units) are</td><td>CO2</td><td>C</td></tr>
</table>

		(A) FCFS:S1,S2,S3 RR2: S1, S2, S3 (B) FCFS:S1,S3,S2 RR2: S1, S3, S2 (C) FCFS:S1,S2,S3 RR2: S1, S3, S2 (D) FCFS: S1, S3, S2 RR2: S1, S2, S3		
	MCQ	A thread is usually defined as a 'light weight process' because an operating system (OS) maintains smaller data structures for a thread than for a process. In relation to this, which of the followings is TRUE? **A.** On per-thread basis, the OS maintains only CPU register state **B.** The OS does not maintain a separate stack for each thread **C.** On per-thread basis, the OS does not maintain virtual memory state **D.** On per thread basis, the OS maintains only scheduling and accounting information.	CO3	C
	MCQ	Consider three processes (process id 0, 1, 2 respectively) with compute time bursts 2, 4 and 8 time units. All processes arrive at time zero. Consider the longest remaining time first (LRTF) scheduling algorithm. In LRTF ties are broken by giving priority to the process with the lowest process id. The average turn around time is: A. 12 B. 13 C. 14 **D.** 15	CO3	B
Q.No:4	**MCQ**	A counting semaphore was initialized to 10. Then 8 P (wait) operations and 6 V (signal) operations were completed on this semaphore. The resulting value of the semaphore A. 6 B. 6 C. 8 D. 12	CO4	C
	MCQ	When several processes access the same data concurrently and the outcome of the execution depends on	CO4	A

		the particular order in which the access takes place is called _____ **A.** Race ccondition **B.** Data inconsistency **C.** essential condition **D.** critical condition		
	MCQ	If a process is executing in its critical section, then no other processes can be executing in their critical section. What is this condition called? A) mutual exclusion B) critical exclusion C) synchronous exclusion D)asynchronous exclusion	CO4	A
	MCQ	Which of the following for Mutual exclusion can be provided by the A. mutex lock B. binary semaphore C. mutex lock and binary semaphore **D.** none of the above	CO4	C
Q.No:5	**MCQ**	Consider a system having P resources of the same type. These resources are shared by 3 processes M, N and O, which have peak demands of 3, 4 and 6 respectively. For what value of P deadlock will not occur? **A.** 12 **B.** 13 **C.** 14 **D.** 15	CO5	B
	MCQ	Which of the following is NOT a necessary condition for deadlock to occur? A. Hold and wait B. Non prememption C. Bounded waiting D. Circular wait	CO5	C
	MCQ	Which of the following is NOT a valid deadlock prevention scheme? A. No of resources uniquely and never request a lowered number resources than the last one requested B. Releasing all acquired resources before requestiong for new resource C. All requested and required resources will be allocated prior to execution	CO5	D

		D. Never request a new resource after releasing old resource		
	MCQ	A system is in the safe state if _____ A. There exist a safe sequence **B.** the system can allocate resources to each process in some order and still avoid a deadlock **C.** all of the mentioned **D.** none of the mentioned	CO5	B
Q.No:6	**MCQ**	Let the page fault service time be 10ms in a computer with average memory access time being 20ns. If one page fault is generated for every 10^6 memory accesses, what is the effective access time for the memory? **A.** 35ns **B.** 23ns **C.** 30ns **D.** 10ns	CO6	C
	MCQ	Which page replacement policy sometimes leads to more page faults when size of memory is increased? **A.** LRU **B.** Optimal C. LIFO **D.** FIFO	CO6	D
	MCQ	Consider a system where main memory is 32 MB and length of logical address is 32 bit, if size of each page is 1 KB, find the number of offset bit. A. 10 B. 12 C. 14 D. 16	CO6	A
	MCQ	A process to collect all free block spaces to form a large memory chunk for allocating new process is called as A. External fragmentation B. Compaction C. Internal fragmentation D. Local fragmentation	CO6	B
Q.No:7	**MCQ**	A process refers to 5 pages, A, B, C, D, E in the order : A, B, C, D, A, B, E, A, B, C, D, E. If the page replacement algorithm is FIFO, the number of page transfers with an empty internal store of 3 frames is? A. 6	CO6	D

		B. 7 C. 8 **D.** 9		
	MCQ	A virtual memory system uses First In First Out (FIFO) page replacement policy and allocates a fixed number of frames to a process. Consider the following statements. **S1** :Increasing the number of page frames allocated to a process sometimes increases the page fault rate **S2** :Some programs do not exhibit locality of reference **A.** Both S1 and S2 are true and S2 is the reason for S1 **B.** S1 is true and S2 is false **C.** S2 is true and S1 is false **D.** Both are false	CO6	B
	MCQ	In which of the disk scheduling algorithm,the disk head moves from one end to other end of the disk,serving the requests along the way.when the head reaches the other end,it immediately returns to the beginning of the disk without servicing any request on the return trip. A. C-LOOK B. LOOK C. SCAN D. C-SCAN	CO7	D
	MCQ	The content of the matrix Need is in Bankers Algorithm can be evaluated as_____ **A.** MAX-ALLOCATION **B.** MAX-AVAILABLE **C.** ALLOCATION-MAX **D.** ALLOCATION-AVAILABLE		

SECTION-B(Answer Any Three Questions. Each Question carries 12 Marks)

Time: 1 Hour and 30 Minutes
(3×12=36 Marks)

<table>
<tr><th>Question No</th><th>Question</th><th>CO Mapping (Each question should be from the same CO(s))</th></tr>
<tr><td>Q.No: 8</td><td>Assume following processs arrive in the systeam with a single processor.
<table>
<tr><th>Process Id</th><th>Execution time</th><th>Arrival time</th><th>Priority no</th></tr>
<tr><td>P</td><td>55</td><td>0</td><td>4</td></tr>
<tr><td>Q</td><td>20</td><td>10</td><td>3</td></tr>
<tr><td>R</td><td>10</td><td>10</td><td>2</td></tr>
<tr><td>S</td><td>25</td><td>40</td><td>4</td></tr>
<tr><td>T</td><td>65</td><td>55</td><td>1</td></tr>
</table>
(a)What will be the average waiting time and average turn around time if Round Robin CPU scheduling algorithm is followed with a time quantum 15units? [5marks]
(b)Considering the lowest number as the highest priority find the sequence of execution of processes along with individual waiting time of the processes for Preemptive priority Scheduling algorithm. [5marks]
(c)Find the CPU utilization if context switch time is 2unit by following FCFS CPU scheduling algorithm(consider the arrival time given in the question) [2marks]
Conider the following set of processes with length of CPU burst time is given in miliseconds
<table>
<tr><th>Process Id</th><th>Burst time</th><th>Arrival time</th></tr>
<tr><td>P0</td><td>3</td><td>0</td></tr>
<tr><td>P1</td><td>6</td><td>2</td></tr>
<tr><td>P2</td><td>4</td><td>4</td></tr>
<tr><td>P3</td><td>5</td><td>6</td></tr>
<tr><td>P4</td><td>2</td><td>8</td></tr>
</table>
(a) Draw the gantt charts to illustrate the execution of the following processess using Shortest remaining time first(SRTF) CPU scheduling algorithm.(i.e preemptive SJF) [5marks]
(b) Draw the gantt charts to illustrate the execution of the following processess using Round Robin scheduling with a time slice 2ms. [5marks]
(c) What will be the average turn around time (TAT)and avearge waiting time(WT) for both the scheduling</td><td>CO2</td></tr>
</table>

algorithm and find the best algorithm for this problem.[2 marks]

Consider the set of 6 processes whose arrival time and burst time are given below

Process Id	Arrival time	Burst time
P1	0	4
P2	1	5
P3	2	2
P4	3	1
P5	4	6
P6	6	3

(a) If the CPU scheduling policy is Round Robin with time quantum = 2, calculate the average waiting time and average turn around time [5marks]

(b) AVG WT,AVG TAT,Response time for both preemptive and non preemptive SJF [5marks]

(c) Calculate the CPU utilization if FCFS cpu scheduling algorithm is followed with a context switching time as 3ms.[2marks]

Q.No: 9

An operating system uses the Banker's algorithm for deadlock avoidance when managing the allocation of three resource types R0, R1, and R2 to three processes P0, P1, and P2. The snapshot of current system state is shown in the following table. The Allocation matrix shows the number of resources of each type already allocated to each process and the Max matrix shows the maximum number of resources of each type required by each process during its execution.

Process	Max			Allocation		
	R_0	R_1	R_2	R_0	R_1	R_2
P_0	7	3	3	1	0	1
P_1	5	2	1	2	2	1
P_2	6	3	3	2	1	1

There are 3 instances of resource type R0, 2 instances of resource type R1 and 2 instances of resource type R3 still available in the system. Check the system is currently in a safe state. Find out

CO5

which process will complete its execution at end?[10 marks]
(b) What is the difference between RAG and WFG?
[2 marks]

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

(a) Calculate the content of the need matrix?
(b) Check if the system is in a safe state?
(c) Determine the total sum of each type of resource?
[10 marks]
(b) What is the difference between safe state and unsafe state?[2 mark]

(a) Write the necessary conditions for deadlock.
[4 mark]

(b) 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:

Process	Allocation	Max
	A B C	A B C
P_0	0 1 0	7 5 3
P_1	2 0 0	3 2 2
P_2	3 0 2	9 0 2
P_3	2 1 1	2 2 2
P_4	0 0 2	4 3 3

1. What will be the content of the Need matrix?
2. Is the system in a safe state? If Yes, then what is the safe sequence?

[8 marks]

Q.No: 10	(a)Given four memory partitions of 100K, 200K , 300K and 200K size(in order) and three processes of 174K, 212K and 190K(in order). In which partition the 190K process will be loaded if the allocation policy is Best fit?	CO6

[4marks]
(b) Consider a system with byte-addressable memory, 32-bit logical addresses, 4KB page size and page table entries of 4bytes each. What would be the size of page map table in the system?
[6marks]
© Explain how internal fragmentation is different from external fragmentation
[2 marks]

a)If the virtual address space is represented by 32 bits, the page size is 4Kbyte, the size of the physical memory is 64Mbyte and only 2 bits are used as control bits, calculate the size of the page table
[6marks]
b) In the memory four partitions are there of size 4KB, 8KB, 20KB and 2KB (in order) respectively. Total 5 processes arrive at time 0 with memory request size(in Bytes) and usage time (in ms) as given in the following table: Calculate the time at which process P5 will be completed if the Best fit method is used for fixed sized partitioned memory.

Request no	P1	P2	P3	P4	P5
Request size	2K	12K	3K	6K	10K
Usage time	4	10	2	8	4

[6 marks]

(a)Consider a logical address space of 8pages of 1024words in each mapped on to a physical memory of 32 frames. How many numbers of bits are needed for logical address?
[4 marks]
(b) The main memory has been divided into fixed size partitions as-

200KB	400KB	600KB	500KB	300KB	200KB

If there 4 processes(P1,P2,P3,P4) request for the size 357KB,210KB,468KB,491KB.Discuss the allocation of processes following First fit and best fit Algorithm
[6marks]
© What do you mean by demand paging in virtual memory?
[2marks]

Q.No: 11	(a) Consider the page references 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, with 4 page frame. Find number of page fault through LRU and optimal page replacement algorithm. [6 marks] (b)Consider a disk queue with requests for I/O to blocks on cylinders 98, 183, 41, 122, 14, 124, 65, 67. The FCFS scheduling algorithm is used. The head is initially at cylinder number 53. The cylinders are numbered from 0 to 199. Calculate the total head movement (in number of cylinders) incurred while servicing these requests. [6 marks]	CO7

	(a)Suppose the time to service a page fault is on the average 10 milliseconds, while a memory access takes 2 microseconds. Then, what is the result of average memory access time of-a 99.99% hit ratio? [4 marks] (b)Consider a disk with 200 tracks and the queue has random requests from different processes in the order: 55, 58, 39, 18, 90, 160, 150, 38, 184.Initially arm is at 100. Find the Average Seek length using SCAN and C-SCAN algorithm [8 marks]	
	(a)Consider the page reference string of size 12: 1, 2, 3, 4, 5, 1, 3, 1, 6, 3, 2, 3 with frame size 4(i.e. maximum 4 pages in a frame).Calculate total no of page fault and page fault ration for FIFO and LRU cpu scheduling algorithm. [4 mark] (b)Consider a disk with 200 tracks and the queue has random requests from different processes in the order: 55, 58, 39, 18, 90, 160, 150, 38, 184.Initially arm is at 100. Find the Average Seek length using LOOK and C-LOOK algorithm. [8 mark]	