



SARDAR PATEL INSTITUTE OF TECHNOLOGY

(Autonomous Institute Affiliated to University of Mumbai)

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058, India

BRANCH : COMP. ENGG., DS, AIML

END SEMESTER EXAMINATION

CE206: Operating Systems

S.E. IV

Max. Marks: 100

Time: 3 hours

Instructions

- Carefully read the question and the weight age given, and accordingly strategies your answers. *(Don't write things which are not asked)*
- Make suitable assumptions, if required. Mention those categorically.
- All Questions are Compulsory.
- New Question (not a sub-question) be solved from a new page.
- You may choose any sequence of questions while writing the answers, however, all sub questions must be written in a sequence.
- The last two columns are related to Outcome Based Education. (You don't bother)

Q. No		Questions	MM	BL	CO
Q.1	a	What do you mean by program relocation? Which operating system software does the relocation? What is self-relocating programs?	7	2	1
	b	Write the functions of operating systems? Describe the objectives of multiprogramming and time sharing systems and gives examples of each.	8	2	1
	c	A computer system consisting of a CPU and disk. You are told that each user request has a compute time of 80 milliseconds and on average generates 10 disk requests. You are further told that the service time at the disk is 10 milliseconds. Is the system compute bound or IO bound? What is the maximum number of requests that can be satisfied per second?	5	3	1
Q.2	a	What is the Process synchronization? State various methods to solve the critical section problem.	5	2	3
	b	Consider a process P that needs to save its CPU execution context (values of some CPU registers) on some stack when it makes a function call or system call. Which of the following statements is/are false and why? (a) During a system call, when transitioning from user mode to kernel mode, the context of the process is saved on its kernel stack. (b) During a function call in user mode, the context of the process is saved on its user stack. (c) During a function call in kernel mode, the context of the process is saved on its user stack. (d) During a function call in kernel mode, the context of the process is saved on its kernel stack	2	4	1

	c	<p>What is thread? Why multithreading is required? What are the advantages of thread over process? Justify the web browser is an example of multithreaded clients and the apache web server is example of multithreaded server.</p> <p style="text-align: center;">OR</p> <p>What problem does thread pool solve? Give benefits of thread pool. Explain Signal handling and its types for handling it.</p>	8	3	3
	d	<p>Given a system using the shortest job first algorithm for short term scheduling and exponential averaging with $\alpha=0.5$, what would be the next expected burst time for a process with burst times of 5,8,3 and 5, and predicted burst time of first process is 10?</p>	5		2
Q.3	a	<p>Synchronization in the classical readers and writers problem can be achieved through use of semaphores. In the following incomplete code for readers-writers problem, two binary semaphores mutex and wrt are used to obtain synchronization</p> <pre> wait (wrt) writing is performed signal (wrt) wait (mutex) readcount = readcount + 1 if readcount = 1 then S1 S2 reading is performed S3 readcount = readcount - 1 if readcount = 0 then S4 signal (mutex) </pre> <p>What will be the values of S1, S2, S3, S4, (in that order) to get the correct solution? Justify your answer</p>	10	4	3
	b	<p>If three threads are trying to access a shared variable at the same time. What is this condition? Consider a non-negative counting semaphore S. There are 20 P operations and 12 V operations performed on it. The largest initial value of S for which at least one P operation will remain blocked is ? Justify your answer.</p>	5	4	3
	c	<p>What will be the output of the following code? Draw the tree representing various process. Justify your answer.</p> <pre> #include <stdio.h> #include <unistd.h> int main() { if (fork() fork()) fork(); printf("1 "); return 0; } </pre>	5	4	1

		<p style="text-align: center;">OR</p> <p>What is the output of following code? Draw the tree representing various process. Justify your answer.</p> <pre>#include <stdio.h> #include <unistd.h> int main() { if (fork()) { if (!fork()) { fork(); printf("1 "); } else { printf("2 "); } } else { printf("3 "); } printf("4 "); return 0; }</pre>			
Q.4	a	The time taken to service a page fault is on average 10 milli seconds and memory access time is 20 micro seconds. If the hit ratio is 70 %, calculate average access time?	5	2	4
	b	<p>Given five memory partitions of 100 KB, 500 KB, 200 KB, 300 KB, and 600 KB (in order), these partitions need to be allocated to four process of sizes 212 KB, 417 KB, 112 KB, and 426 KB (in order). If worst fit algorithm is used, show the allocation of memory to processes?</p> <p style="text-align: center;">OR</p> <p>A paging system with a page table in memory every reference to memory takes 100 nano sec(ns). The TLB hit ratio is 85 % and the time needed to search TLB is almost negligible. What is effective access time?</p>	5	3	4
	c	Consider the following snapshot of a system. P0, P1, P2, P3, P4 are the processes and A, B, C, D are the resource types. The values in the table indicate the number of instances of a specific resource (for example: 1 5 2 0 under the last column indicates that there are 1 A-type, 5 B-type, 2 C-type and 0 D-type resources available after allocating the resources to all five processes). The numbers under allocation-column indicate that those numbers of resources are allocated to various processes. The numbers under Max-column indicate the maximum number of resources required by the processes.	10	3	3

		<u>Allocation</u>	<u>Max</u>	<u>Available</u>																		
		<i>A B C D</i>	<i>A B C D</i>	<i>A B C D</i>																		
	P_0	0 0 1 2	0 0 1 2	1 5 2 0																		
	P_1	1 0 0 0	1 7 5 0																			
	P_2	1 3 5 4	2 3 5 6																			
	P_3	0 6 3 2	0 6 5 2																			
	P_4	0 0 1 4	0 6 5 6																			
Answer the following questions using the banker's algorithm:																						
a. What is the content of the matrix Need?																						
b. Is the system in a safe state? Give the safe sequence																						
c. If a request from process P_1 arrives for (0,4,2,0), can the request be granted immediately? if yes then give Avail Matrix and Sequence of process.																						
Q.5	a	Consider a disk pack with 16 surfaces, 128 tracks per surface and 256 sectors per track. 512 bytes of data are stored in a bit serial manner in a sector. Find out the capacity of the disk and number of bits required to specify the sector to specify a particular sector in the disk ?			4	4	5															
	b	On a system with 1000 tracks, numbers 0 to 999, compute the number of tracks the disk arms must move to satisfy all the requests in the disk queue. Assume the last request serviced was at track 345 and the head is moving towards track 0. The queue in FIFO order contains the requests for the following tracks: 123,874,692,475,105,376. Find the total head movement and Perform the computations showing diagrams for the following scheduling algorithms. a) FIFO, b) SSTF, c) SCAN			6	4	5															
	c	The index node (inode) of an operating system file system has 12 direct, one single-indirect and one double-indirect pointers. The disk block size is 4 kB, and the disk block address is 32-bits long. What is the maximum possible file size in GB? (rounded off to 1 decimal place).			5	4	5															
	d	Consider the following CPU processes with arrival times (in milliseconds) and length of CPU bursts (in milliseconds) as given below: <table border="1"><thead><tr><th>Process</th><th>Arrival time</th><th>Burst time</th></tr></thead><tbody><tr><td>P1</td><td>0</td><td>7</td></tr><tr><td>P2</td><td>3</td><td>3</td></tr><tr><td>P3</td><td>5</td><td>5</td></tr><tr><td>P4</td><td>6</td><td>2</td></tr></tbody></table>			Process	Arrival time	Burst time	P1	0	7	P2	3	3	P3	5	5	P4	6	2	5	3	2
Process	Arrival time	Burst time																				
P1	0	7																				
P2	3	3																				
P3	5	5																				
P4	6	2																				

If the preemptive shortest remaining time first scheduling algorithm is used to schedule the processes, find the average waiting time and average turnaround time across all processes in milliseconds?

OR

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

If the CPU scheduling policy is Round Robin with time quantum = 3, calculate the average waiting time and average turn around time.

Process Id	Arrival time	Burst time
P1	5	5
P2	4	6
P3	3	7
P4	1	9
P5	2	2
P6	6	3

Good Luck !!

