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RV COLLEGE OF ENGINEERING®

Autonomous Institution affiliated to VTU

IV Semester B. E. Fast Track Examinations July-19

Computer Science and Engineering

OPERATING SYSTEMS

Time: 03 Hours ***Maximum Marks: 100***

Instructions to candidates:

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer questions 2,7,8 and any one question from 3 and 4, and any one question from 5 and 6 from PART-B

PART A

1	1.1	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. Calculate average turnaround time.	02

	1.2	Analyze the program below and write it's output.
		
		int main( )
		{
		if (fork ( ) || fork ( ))
		fork ( );
		printf ("1 ");
		return 0;
		}
			02

	1.3	A counting semaphore was initialized to 8. Then 6 P (wait) operations and 4V (signal) operations were completed on this semaphore. Calculate the resulting value of the semaphore.	02
	1.4	If the total number of available frames is 50, and there are 2 processes one of 10 pages and the other of 5 pages.Then how much of memory would be proportionally allocated to each of these processes?	02
	1.5	With a neat diagram briefly explain the layout of virtual address space of XV6 process	02
	1.6	Draw process state transition diagram and briefly explain each state.	02
	1.7	Briefly discuss starvation and aging in context of CPU scheduling.	02
	1.8	Assuming 1 KB page size and 32, 768 logical address space size, what are the page numbers and offsets for following address references. i. 3275 ii. 19366	02
	1.9	Identify key differences between Internal and External memory fragmentation	02
	1.10	Consider a paging system with TLB. If it takes 20 ns to search TLB and 100 ns to access the memory what is the effective memory access time with 98-percent hit ratio?	02

PART B

2 a Consider a multiprocessor system and a multithreaded program written using the many-to many threading model. Let the number of user-level threads in the program be greater than the number of processors in the system. Analyze and write the performance implications of the following scenarios.

i. The number of kernel threads allocated to the program is less than the number of processors.
ii. The number of kernel threads allocated to the program is equal to the number of processors.
iii. The number of kernel threads allocated to the program is greater than the number of processors but less than the number of user level threads. 06

b Differentiate user mode and kernel mode of execution in an operating system. 04

c Discuss the microkernel and modular approach to OS design with an example. 06

3 a Consider the following set of processes with a length of the CPU burst time given in milliseconds

Process	Arrival Time	Burst Time	Priority
P1	0	8	3
P2	3	5	1
P3	4	8	2
P4	4	2	2
P5	5	16	1

i. Draw Gantt charts illustrating the execution of these processes using Preemptive SJF, Preemptive Priority and Round Robin (Time slice= 2ms).
ii. Compute the average waiting time, average turn around time and number of context switches in each approach. 10

b Differentiate
- Preemptive and non-preemptive scheduling
- Spinlocks and Semaphores (no busy waiting) 06

OR

4 a Define race condition with respect to cooperating processes. Give an example and mention approaches to avoid race condition. 04

b The following processes arrive for execution at times indicated.

Process	Arrival Time	Burst Time
P1	0	1.5
P2	1.5	3
P3	3	1
P4	3	7.5

		Draw a Gantt Chart and calculate waiting time and turnaround time for: • FCFS scheduling • Preemptive SJF scheduling	06
	c	Describe testandset() instruction and explain how it can be used to provide mutual exclusion that satisfies bounded waiting for N processes.	06
5	a	With help of pseudocode explain the solution to the Classical Reader – Writer problem.	06
	b	Consider the following snap-shot of a system i. What is the content of matrix NEED ii. Is the system in SAFE state? If so give the SAFE sequence iii. If a request from process P1 arrives for (1 0 2), can the request be granted immediately?	10
		OR	
6	a	Discuss the deadlock free solution to classical dining philosopher synchronization.	08
	b	Consider the following snap-shot of a system Using Bankers algorithm to detect deadlock i. Check if there is a safe sequence. If so give the safe sequence. ii. If P2 requests an additional instance of resource type C i.e (0 0 1), is there a safe sequence?	08
7	a	With help of neat diagram briefly discuss the paging memory management scheme. Mention the merits and demerits of paging.	06
	b	What is system thrashing? Discuss the working set model to detect system thrashing? What can the system do to eliminate thrashing.	04
	c	Consider the following page reference string 3,1,4,5,3,4,1,5,3,2,4,5,2,4,1,3,2,5 Calculate the number of page faults will occur for LRU and Optimal page replacement algorithms, assuming 4 free frames? Assume that all frames are initially empty, so your first unique pages will all cost one fault each.	06

	Allocation	Max	Available
	A B C	A B C	A B C
P_0	1 0 1	8 4 4	3 3 2
P_1	1 0 0	2 2 2	
P_2	2 1 1	2 2 2	
P_3	2 0 2	9 0 2	
P_4	1 2 2	5 5 3	

	Allocation	Request	Available
	A B C	A B C	A B C
P_0	0 1 0	1 0 1	2 1 2
P_1	2 0 0	3 0 3	
P_2	3 0 3	1 0 1	
P_3	2 1 1	1 1 0	
P_4	0 0 2	0 0 2	

8	a	Suppose that a disk drive has 5,000 cylinders, numbered through 0 to 4,999. The drive is currently serving a request at cylinder 2,150, and the previous request was at cylinder 1,805. The queue of pending requests, in FIFO order , is: 2,069 1,212 2,296 2,800 544 1,618 356 1,523 4,956 3,681 Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk- scheduling algorithms? a. SSTF c. SCAN d. LOOK e. C-SCAN	08
	b	Explain the booting process steps of XV6 operating system.	04
	c	Describe the different file access methods in a computer system.	04