



Continuous Assessment Test(CAT) – I - JAN 2024

Programme	:	B.Tech. (CSE and Specialisation)	Semester	:	Winter 2023-24
Course Code & Course Title	:	BCSE303L & Operating Systems	Class Number	:	CH2023240501867 CH2023240501869 CH2023240502684 CH2023240502685 CH2023240502686 CH2023240502687 CH2023240503355 CH2023240501871
Faculty	:	PRADEEP K V, BHANU CHANDER BALUSA, PRADEEP K, KIRUTHIKA ANANDAN P, VALLIDEVI K, ANGELIN BEULAH S, SUDHARSON S	Slot	:	D1+TD1
Duration	:	90 Minutes	Max. Mark		50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Use statistical tables supplied from the exam cell as necessary
- Use graph sheets supplied from the exam cell as necessary
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks
1		The Apple Inc company upgrades their Mac Operating System for laptops and desktops every year and releases a newer version. Discuss the new design issues and features that need to be considered by the development team with respect to the enhancement of performance. Also draw and explain the structure of the kernel that can be used in their operating system for obtaining an optimal performance.	10
2		In a Unix-based operating system, Ramesh's task is to create multiple processes as presented in this figure. In the figure, A is the parent process for B and C processes; B is the parent process for D and E processes. Describe the sequence of system calls and its individual functionalities involved in creating and terminating these multiple processes. Write a C program with appropriate system calls to do this task efficiently.	10

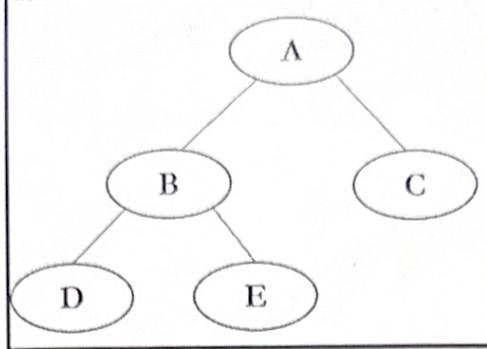


Fig: Processes Hierarchy

3		<p>Describe the thread concept in the context of an operating system and its requirement to distinguish between kernel-level and user-level threads. Discuss the advantages and disadvantages of using threads in an operating system that supports multiple threads.</p>	10																								
		<p>As the number of consumers is high, the producer has decided to maintain the queue to process the request raised by the consumers. Provide the Gantt chart to visualise the optimal order of requests handled by the producer and also estimate the waiting time and delivery time for each consumer for the following scenarios.</p> <p>a) The producer wants to immediately deliver to the consumer who requested in the larger number of quantity, as the profit is high for him. Each quantity requires 2 hours of manufacturing time. (5 Marks)</p> <p>b) The producer wants to deliver the items based on order of request received (5 Marks)</p>																									
4		<p>The requirements of various consumers are listed in the below Table.</p> <table border="1"> <thead> <tr> <th>Consumer ID</th> <th>Quantity required</th> <th>Manufacturing Time</th> <th>Order of request received</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>3</td> <td>6</td> <td>1</td> </tr> <tr> <td>1</td> <td>2</td> <td>4</td> <td>4</td> </tr> <tr> <td>2</td> <td>6</td> <td>12</td> <td>3</td> </tr> <tr> <td>3</td> <td>4</td> <td>8</td> <td>2</td> </tr> <tr> <td>4</td> <td>1</td> <td>2</td> <td>5</td> </tr> </tbody> </table>	Consumer ID	Quantity required	Manufacturing Time	Order of request received	0	3	6	1	1	2	4	4	2	6	12	3	3	4	8	2	4	1	2	5	10
Consumer ID	Quantity required	Manufacturing Time	Order of request received																								
0	3	6	1																								
1	2	4	4																								
2	6	12	3																								
3	4	8	2																								
4	1	2	5																								
5		<p>In an auto repair shop, five cars, labelled A to E, require maintenance and arrive at the mechanic's garage at times 3, 2, 1, 4, and 5 minutes, respectively. Each car has an estimated repair time of 9, 6, 1, 4, and 7 minutes. The objective is to assess the mean turnaround time and waiting time for each car for the following scenarios.</p> <p>a) The cars are allowed to undergo maintenance one after the other, with each car spending 3 minutes in the mechanic's garage during its turn. (5 Marks)</p> <p>b) A car is allowed to undergo maintenance until the newly arrived car repair time is less as compared with its remaining repair time. Accordingly all the cars will complete their maintenance. (5 Marks)</p>	10																								

***** All the best *****



Continuous Assessment Test (CAT) – II - April 2024

Programme	:	B.Tech. (Computer Science and Engineering)	Semester	:	Winter 2023-24
Course Code & Course Title	:	BCSE303L & Operating Systems	Class Number	:	CH2023240501867 CH2023240501869 CH2023240502684 CH2023240502685 CH2023240502686 CH2023240502687 CH2023240503355 CH2023240501871
Faculty	:	PRADEEP K V, BHANU CHANDER BALUSA, PRADEEP K, KIRUTHIKA S, ANANDAN P, VALLIDEVI K, PRABHA B, SUDHARSON S	Slot	:	D1+TD1
Duration	:	90 Minutes	Max. Mark		50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Use statistical tables supplied from the exam cell as necessary
- Use graph sheets supplied from the exam cell as necessary
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks
1		<p>Consider the following resource allocation graph</p> <pre> graph TD R1 --- P1 R1 --- P2 R2 --- P3 R2 --- P4 R3 --- P1 R3 --- P2 R4 --- P3 R4 --- P4 </pre> <p>Check to see if a deadlock exists using a Wait For Graph. If yes, list the processes and resources involved. Explain in detail the recovery process without killing any process. If no deadlock, make the case for why there isn't a deadlock. In either scenario, give a workable flow of steps to demonstrate deadlock free condition.</p>	10
2		Consider a bus ticket reservation system where users are able to enquire bus details, book ticket and cancel ticket. In this scenario, fixed number of tickets is available for a bus, but many users trying to book the tickets. When one user is booking a ticket by filling the details and navigated to	10

	<p>the payment process meaning that the other users need to wait for some time to know the available number of seats. Write an appropriate pseudo code for the given scenario using hardware and software synchronization constructs that can be initialized and accessed only by atomic operations.</p>	
3	<p>Write a program in C to create three processes A, B and C and the task of these individual processes are as follows:</p> <ul style="list-style-type: none"> • Process A: reads the ‘n’ numbers from the keyboard and counts the number of even numbers in it. Then this count will send to the Process B. • Process B: reads the count from Process A and determines the factorial of that count. This factorial result will send to the process C. • Process C: reads the factorial value from process B and determines the read value is prime number or not. 	10
4	<p>A hospital's medical imaging department has 10 Magnetic Resonance Imaging (MRI) machines with variable size of memory for storing patient scan data. These machines' memory partitions are as follows (in order): 170GB, 420GB, 150GB, 490GB, 620GB, 400GB, 250GB, 450GB, 350GB, and 700GB. Assume that ten patients are receiving MRI scans with varying imaging requirements, each producing a specified amount of data that must be saved. These scans produced the following data volumes (in order): 212GB, 417GB, 112GB, 426GB, 350GB, 500GB, 275GB, 400GB, 600GB, and 200GB. Using different allocation algorithms, assign MRI machines to patients based on their projected scan data sizes. Determine and compare both internal and external fragmentation for each technique.</p>	10
5	<p>a. Consider the below given reference string, subject to the order of processor execution 1, 2, 4, 5, 2, 1, 2, 4. Page 1 and Page 2 are already in the main memory, which has space for maximum three pages only. Page 1 arrived ahead of Page 2. How many page faults will occur during processor reference when the least amount of recent used page algorithm is used? And also compute both Hit Ratio and Miss Ratio for the same. (4 Marks)</p> <p>b. A system has 4 page frames with no pages loaded to begin with. Consider the following scenario Case-1: System first accesses 200 distinct pages in sequential order and then access same 200 distinct pages in same order. Case-2: System first accesses 200 distinct pages in sequential order and then access same 200 distinct page in reverse order. Compute the page faults occur in these cases using various page replacement algorithms (atleast 3 algorithms) and comment on it. (6 marks)</p>	10

*****All the best*****



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Final Assessment Test (FAT) - May 2024

Programme	B.Tech.	Semester	WINTER SEMESTER 2023 - 24
Course Title	OPERATING SYSTEMS	Course Code	BCSE303L
Faculty Name	Prof. Bhanu Chander Balusa	Slot	D1+TD1
Time	3 Hours	Class Nbr	CH2023240501869
		Max. Marks	100

General Instructions:

- Write only Register Number in the Question Paper where space is provided (right-side at the top) & do not write any other details.

Section - I

Answer all questions (4 X 10 Marks = 40 Marks)

01. You are part of a team tasked with designing a real-time operating system (RTOS) for controlling the operations of a modern self-driving car. The car's RTOS must handle various tasks simultaneously, including sensor data processing, decision-making algorithms, control of actuators (such as steering, acceleration, and braking), communication with external systems, and ensuring safety-critical operations in real-time. [10]
- i. Outline the key design issues and challenges that your team might face in developing the RTOS for the self-driving car. (5 marks)
 - ii. Discuss how you would address these challenges while ensuring the system's reliability, safety, and real-time performance and also how will you manage system resources efficiently, such as CPU time, memory, and I/O bandwidth, to meet the performance requirements of various tasks while avoiding resource contention? (5 marks)
02. Imagine that you are working on a text editor that needs to save the contents of the document to a file on the disk. Explain how the text editor utilizes system calls to perform file I/O operations. Discuss the specific system calls involved in opening and writing to the file. What parameters are passed to these system calls, and how are they used by the operating system? Give examples for those system calls with respect to that scenario. [10]
03. Let's consider a scenario involving university course registration, where five students are scheduled to register for courses. They arrive at the online registration at varying times, and each student has an estimated duration for completing their registration process. Their order of preference for registration is as follows with the highest preference first accorded to the top-ranked choice. [10]

Courses	Arrival Time (Minutes)	Registration times (Minutes)	Order of preference
OS 1	2	14 16	3
C 2	4	9 13	5
C++ 3	1	10 8 11	2
Java 4	3	8 11	1
Python 5	5	12 17	4

- a) How would you calculate the average turnaround time and waiting time for a scheduling approach where each student gets a time quantum of 5 minutes before moving to the next student? (4 marks)
- b) How might you determine the average turnaround time and waiting time for a scheduling method where students are served based on their priority levels, with the possibility of interrupting? (4 marks)
- c) After calculating the mean turnaround times for both algorithms, determine which one serves the students with minimal delay. (2 marks)
04. Consider a scenario where a suitcase is placed on a table, and five individuals are seated around the table. The suitcase requires two different keys to open: one located on the left side and one on the right side. Each person can only access one key at a time. [10]
- Write a pseudocode to propose a solution using semaphores to ensure that individuals can collaboratively access both keys without encountering deadlock. (5 marks)
 - Write a pseudocode to propose a solution using monitors. (5 marks)

Section - II

Answer all questions (4 X 15 Marks = 60 Marks)

05. In a computer system, there are 5 processes (P1, P2, P3, P4, P5) competing for access to 4 different types of resources (R1, R2, R3, R4). Each process must request and hold a certain number of instances of these resources to complete its tasks. At time t=2ms, the maximum resources that can request by each process and already allocated, available are given below: [15]

Process	Allocation				Maximum				Available (Work)			
	R1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R4
P1	1	1	1	1	1	1	1	2	2	4	2	1
P2	1	2	1	1	2	6	4	1				
P3	0	2	5	4	2	2	5	5				
P4	0	4	2	2	0	5	5	3				
P5	0	0	1	4	0	6	5	6				

- Draw the Resource Allocation Graph. (5 marks)
- Find the need matrix and safe sequence. (8 marks)
- At t=3ms, if P1 requests (0,2,2,3) resources more, will it be allocated immediately? Justify your answer. (2 marks)

06. A reference string representing 20 product IDs (pages) is provided. The reference strings are [15] given below.

Reference String: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6

(a) Evaluate the page replacement algorithms: FIFO, OPTIMAL, and LRU to manage these pages efficiently in memory while minimizing page faults. (12 marks)

(b) Estimate and comment on the miss ratio and hit ratio for each page replacement algorithms. (3 marks)

07. a) Three different computers are configured with three different file systems. Each of these file [15] systems supports only one file access method (contiguous or linked or indexed). Discuss in detail the parameters to be considered to decide the best file access method. (10 Marks)

b) Suppose there are, files named pgm1, stack, count, home, trsh, host, web. The file named 'stack' is starting from the 12th block and the length of the file is 8. Illustrate it with contiguous and indexed allocation scheme (Note: Total No of Blocks are 30). (5 Marks)

08. In a fully automated library, for borrowing the books, user has to search and specify the shelf [15] number, where each book is kept in the separate shelf. As the total number of shelf are too high (ie. 5000 so indexed from 0 to 4999), the book fetch will be done by the robots with the help of movable and foldable arms. Currently the robotic arm is in 120 shelf, the borrow queue for the forenoon is given here

85, 1200, 770, 55, 1080, 650, 20, 564, 286, 500

Starting from the current arm position, what is the total distance (in shelf) that the robotic arm moves in the forenoon for each of the following scheduling algorithms?

i. SCAN (Movement towards higher value) (5 marks)

ii. LOOK (Movement towards lesser value) (5 marks)

iii. C-SCAN (Movement towards higher value) (5 marks)

