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RV COLLEGE OF ENGINEERING
Autonomous Institution affiliated to VTU
III Semester B.E. April -2023 Examinations
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
OPERATING SYSTEMS
(2021 SCHEME)

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 FIVE full questions from Part B. In Part B question number 2 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, and 9 and 10.

PART-A

1	1.1	Differentiate zombie process and an orphan process.	2
	1.2	Define race condition. Mention techniques to avoid race condition	2

	1.3	Write the output of the program below
		int main()
		{
		if (fork() || fork())
		fork();
		printf("1 ");
		return 0;
		}
			2

	1.4	A counting semaphore was initialized to 8. Then 6 P (wait) operations and 4 V (signal) operations were completed on this semaphore. Calculate and write the resulting value of the semaphore.	2
	1.5	Suppose a process requests 12KB of memory and memory manager currently has a list of unallocated blocks of 6KB, 14KB, 19KB, 11KB and 13KB blocks. Identify the block allocated by best fit, first fit and worst fit strategy.	2
	1.6	_____ scheduling is more appropriate for a time shared or interactive systems and _____ scheduling is used frequently in long-term or job scheduling.	2
	1.7	Write any two differences between paging and segmentation in memory management schemes.	2
	1.8	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?	2
	1.9	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 the average turnaround time.	2
	1.10	Justify threads are light weight processes.	2

PART-B

UNIT-I			
2	a	Discuss various approaches to design operating system structure.	6
	b	With example program discuss fork(), wait() and execl() APIs for process	

		management.	10

UNIT-II

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 / 7 / 3 P2 / 3 / 2 / 2 P3 / 4 / 3 / 1 P4 / 4 / 1 / 1 P5 / 5 / 3 / 3 i. Draw Gantt charts illustrating the execution of these processes using SJF, Preemptive priority and Round Robin(Time slice=1ms). ii. Compute the waiting times in each of the three schedules and find which of them provides results in the minimal average waiting time and turn around time. iii. Find out the time in which there are maximum number of processes in ready queue in the above scenario	10
	b	Why a thread is called a LWP? Explain the different threading models.	06
		OR	
4	a	Compare process and threads as unit of execution, write a program to illustrate creation of child process and a thread.	10
	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 average waiting time for: (i) FCFS scheduling (ii) Preemptive SJF scheduling.	06

UNIT-III

5	a	What is meant by critical section Problem? Give its general structure. Explain the requirements that must be satisfied by a solution to the critical section problem	10
	b	Implement dining philosopher's problem using monitors. Discuss its use.	06
		OR	
6	a	Discuss the classical readers-writers synchronization problem and write a pseudo code using semaphores	10
	b	Write the pseudo code for TestandSet and Swap prove that it satisfies the conditions for critical section problem.	06

UNIT-IV			
7	a	Discuss the concept of Dynamic linking, Dynamic loading and memory fragmentation with respect to process memory management.	10
	b	Consider the following page reference string 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6 How many page faults will occur for LRU, FIFO, Optimal page replacement algorithms, assuming 5 free frames?	06
		OR	
8	a	With the help of a neat diagram explain the basic paging scheme of memory management. Discuss the hardware support for paging.	10
	b	What is thrashing? What are causes of thrashing? Discuss the ways to prevent it?	06

UNIT-V			
9	a	Compare the contiguous and linked file allocation methods.	06
	b	Write a C program to copy a source file to destination file.	10
		OR	
10	a	Explain different methods of accessing files.	06
	b	With the help of neat diagram discuss the In-memory file-system structures with an example.	10

Signature of Scrutinizer: Signature of Chairman

Name: Name:

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RV COLLEGE OF ENGINEERING
Autonomous Institution affiliated to VTU
III Semester B.E. April -2023 Examinations
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
OPERATING SYSTEMS
(2021 SCHEME)

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 FIVE full questions from Part B. In Part B question number 2 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, and 9 and 10.

PART-A

1	**1.1**	The _____system supports multiple interactive users.	(1)
	1.2	The disadvantage of SJF scheduling is _____ and that of priority scheduling is _____	(2)
	1.3	Define race condition with an example.	(2)
	1.4	The memory manager places a process in the large enough block of unallocated memory in which it will fit. Name the allocation algorithm.	(1)
	1.5	What is demand Paging?	(1)
	1.6	The data structure where the OS will keep all information it needs to manage the process is_____	(1)
	1.7	Sketch how SSTF disk scheduling occurs for a request queue of (cylinder number) 95, 180, 36, 120, 14, 65 when the head starts at 53.	(2)
	1.8	How many Page fault would occur for the given string: 0,1,2,3,0,1,2,3,0,1,2,3,4,5,6,7 using LRU algorithm where page frame is FOUR	(2)
	1.9	Consider a logical address space of 8 pages of 1024 words each mapped onto a physical memory 32 frame. How many bits are there in logical and physical address?	(2)
	1.10	What is Authentication?	(1)
	1.11	List the three disk-space-allocation methods	(1)
	1.12	Explain what is thrashing ?	(2)
	1.13	What are different methods for Handling deadlocks.	(2)

PART-B

UNIT-I			
2	a	Write a program in C language to create a child process and synchronize with the main program	4

	b	Bring out the comparison between long term, medium and short term schedulers.	6
	c	Discuss the benefits of Virtual machine with an example.	6

UNIT-II

3	a	The following processes arrive for execution at times indicated. Process | Arrival Time | Burst Time P1 | 0 | 6 P2 | 4 | 2 P3 | 3 | 7 P4 | 3 | 1 Draw a Gantt Chart and calculate average waiting time for: • FCFS scheduling • Preemptive SJF scheduling.	08
	b	Compare user-level threads and kernel-level threads. Further illustrate different approaches to map user threads to Kernel threads.	08
		OR	
4	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 | 10 | 3 P2 | 3 | 5 | 2 P3 | 4 | 8 | 1 P4 | 4 | 2 | 1 P5 | 5 | 12 | 2 i. Draw Gantt charts illustrating the execution of these processes using Preemptive SJF, priority and Round Robin(Time slice=1ms). ii. Compute the average waiting time, average turn around time and number of context switches in each approach.	10
	b	Write a program to create a pthread to calculate sum of N (non-negative) numbers.	06

UNIT-III

5	a	What is meant by critical section Problem? Give its general structure. Explain the requirements that must be satisfied by a solution to the critical section problem	08
	b	Discuss the classical Reader-Writer synchronization problem and write a pseudo code using semaphores	08
		OR	

6	a	Discuss the classical producer-consumer synchronization problem and write a pseudo code using semaphores	08
	b	Discuss hardware solution to critical section problem with help of the pseudo code and prove that it satisfies the conditions for critical section problem.	08

Signature of Scrutinizer: Signature of Chairman

UNIT-IV			
7	a	Discuss the concept of Dynamic linking, Dynamic loading and memory fragmentation with respect to process memory management.	08
	b	With help of neat diagram briefly discuss the Segmentation memory management scheme. Mention the merits and demerits of Segmentation Scheme.	08
		OR	
8	a	With the help of a neat diagram explain the basic paging scheme of memory management. Discuss the hardware support for paging.	08
	b	Consider the following page reference string 5,6,7,8,5,4,3,1,2,6,7,8,7,5,3,2,1,5,6,7 How many page faults will occur for LRU, FIFO, Optimal page replacement algorithms, assuming 5 free frames?	08

UNIT-V			
9	a	Compare the contiguous, linked and indexed file allocation methods.	08
	b	Discuss the In-memory file-system structures with an example.	08
		OR	
10	a	Explain different methods of accessing files.	08
	b	Write a C program to move a source file to destination file. Briefly discuss the system calls used to implement.	08

Name: Name:

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RV COLLEGE OF ENGINEERING®

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III Semester B. E. Examinations March-2021

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 FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

PART-A

1	1.1	Each process is represented in the operating systems by a _____.	01
	1.2	Write any two major goals of operating systems.	01
	1.3	List the four categories of multi-threaded programming benefits.	02
	1.4	The time taken for the dispatcher to stop one process and start another running process is known as the _____.	01
	1.5	Define Race Condition. Mention techniques to avoid Race Condition.	02
	1.6	Find the drawbacks of semaphores.	02
	1.7	Consider a time-sharing system, which supports 20 terminals (users), each of which run a compiler. If 50kB are required for compiler and 5kB for data storage, find the total amount of memory required to support 20 users.	02
	1.8	Why are page sizes always a power of 2 during paging?	02
	1.9	For a certain system, total number of frames is 64. The size of 2 processes, P_1 and P_2 are 10 and 127 respectively. How much is the allocation for each of theses processes?	02
	1.10	Compare FAT and NTFS.	02
	1.11	_____ is the additional time for the disk to rotate the desired sector to the disk head.	01
	1.12	Write the methods for handling deadlocks.	02

PART-B

2	a	Discuss various schedulers used in Operating Systems.	05
	b	Write a 'C' program to demonstrate the basic Pthreads API for constructing a multi-threaded program that calculates the summation of a non-negative integer in a separate thread.	05
	c	Briefly explain microkernel and modular approaches to design operating system architecture.	06

3	a	Consider the following set of process, with the length of the CPU burst time given in milli seconds: The processes are assumed to have arrived in the order $P1, P2, P3, P4, P5$ all at time 0.	

Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	3
P4	1	4
P5	5	2

i) Draw four Gantt charts that illustrate the execution of these processes using FCFS, SJF, a non-preemptive priority and RR (q=1) scheduling.
ii) What is the turnaround time of each process for each of the scheduling algorithm in part i).
iii) What is the waiting time of each process for each of the scheduling algorithm in part i). 10

b Describe the Dining-Philosophers problem in detail. 06

OR

4 a Suppose that the following processes arrive for execution at time indicated.

Process	Arrival Time	Execution Time
P1	0.0	8
P2	0.4	4
P3	1.0	1

i) What is the average TAT for these processes with FCFS scheduling algorithm.
ii) What is the AWT and ATAT for these processes with preemptive SJF algorithm? 06

b Explain Peterson's solution to the critical section problem. 06

c Discuss process management in Linux Operating system. 04

5 a Consider the following Page reference string:
$1, 2, 3, 2, 5, 6, 3, 4, 6, 3, 7, 3, 1, 5, 3, 6, 3, 4, 2, 4, 3, 4, 5, 1.$
How many page faults will occur for FIFO and Optimal page replacement algorithms, assuming 4 free frames? 06

b Describe memory mapping and protection, memory allocation, and fragmentation issues in contiguous memory allocation. 10

OR

6 a Distinguish logical and physical address space. 05

b With a neat sketch, explain the steps in handling a page fault. 06

c What is meant by Segmentation? Discuss the hardware support for Segmentation. 05

7 a Suppose that the head of the moving head disk with 200 tracks, numbered 0 to 199, is currently serving a request at track 143 and has just finished a request at track 125. The queue of requests is kept in FIFO order-
$86, 147, 91, 177, 94, 150, 102, 175, 130.$
What is the total number of head movements needed to satisfy these requests for the following disk-scheduling algorithms-i) SSTF ii) SCAN iii) LOOK iv) C-SCAN. 10

<table>
<tr><td></td><td>b</td><td>Briefly explain the strategies and schemes for allocation of frames.</td><td>06</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>8</td><td>a</td><td>Consider a system with five processes- P0 to P4and three resources A, B, C. Given that-
Resource type A has 10 instances; Resource type B has 5 instances. Resource type C has 7 instances.
Suppose that at time t_0, the following snapshot of the system has been taken-
<table>
<tr><th rowspan="2">Process</th><th colspan="3">Allocation</th><th colspan="3">MAX</th></tr>
<tr><th>R1</th><th>R2</th><th>R3</th><th>R1</th><th>R2</th><th>R3</th></tr>
<tr><td>P0</td><td>0</td><td>1</td><td>0</td><td>7</td><td>5</td><td>3</td></tr>
<tr><td>P1</td><td>2</td><td>0</td><td>0</td><td>3</td><td>2</td><td>2</td></tr>
<tr><td>P2</td><td>3</td><td>0</td><td>2</td><td>9</td><td>0</td><td>2</td></tr>
<tr><td>P3</td><td>2</td><td>1</td><td>1</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>P4</td><td>0</td><td>0</td><td>2</td><td>4</td><td>3</td><td>3</td></tr>
</table>
Calculate available matrix of resources, find the need matrix and also find the safe sequence.</td><td>10</td></tr>
<tr><td></td><td>b</td><td>Identify options to recover from deadlocks and explain.</td><td>06</td></tr>
</table>

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RV COLLEGE OF ENGINEERING®

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III Semester B. E. Examinations Nov/Dec-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 FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

PART-A

1	1.1	Analyze and write the output of following code:
		
		$int\ main\ (\ )$
		{
		$if\ (fork(\ )\ \&\&\ fork(\ ))$
		{
		$fork(\ );$
		}
		$printf("2\ ");$
		$return\ 0;$
		}
			02

	1.2	Consider two processes $P1$ and $P2$ accessing the shared variables X and Y protected by two binary semaphores SX and SY respectively, both initialized to 1. Complete the entry and exit sections of the following codes such that the processes can update the shared variables correctly without deadlock. $P1: while\ (true) do$ { $\ll entry\ section \gg$ $X = X + 10;$ $y = Y - 20;$ $\ll exit\ section \gg$ } $P2: while\ (true) do$ { $\ll entry\ section \gg$ $y = y + 20;$ $X = X - 10$ $\ll exit\ section \gg$ }	02
	1.3	A disk drive has 100 cylinders, numbered 0 to 99. Disk requests come to the disk driver for cylinders $12, 26, 24, 4, 42, 8$ and 60 in that order. The driver is currently serving a request at cylinder 36. A seek takes 6 msec per cylinder moved. How much seek time is needed for shortest seek time first ($SSTF$) algorithm?	02
	1.4	Suppose a process requests $12KB$ of memory and memory manager currently has a list of unallocated blocks of $6KB, 14KB, 19\ KB, 11KB$ and $13KB$ blocks. Identify the block allocated by best fit, first fit and worst fit strategy.	02

	1.5	Four jobs to be executed on a single processor system arrive at time 0 in the order A, B, C, D. Their burst CPU time requirements are $4, 1, 8, 1$ time units respectively. What is the completion time of A under round robin scheduling with time slice of one time unit?	02
	1.6	Consider a paging system with TLB. If it takes $10\,ns$ search TLB and $150\,ns$ to access the memory what is the effective memory access time with 95-percent hit ratio?	02
	1.7	What is starvation and aging in context of CPU scheduling?	02
	1.8	Applying the LRU page replacement to the reference string : 1 2 4 5 2 1 2 4. The main memory can accommodate 3 pages and it already has pages 1 and 2. Page 1 came in before page 2. Draw the page replacement pattern and determine total number of page faults.	02
	1.9	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 the processes?	02
	1.10	There are three processes $P1, P2$ and $P3$ sharing a semaphore for synchronizing a variable. Initial value of semaphore is 2. Assume that negative value of semaphore tells us how many processes are waiting in queue. Processes access the semaphore in following order : a) $P1$ needs to access critical section b) $P2$ needs to access section c) $P3$ needs to access critical section d) $P2$ exits critical section. Determine the final value of semaphore.	01
	1.11	What are the four necessary and sufficient condition for deadlock to occur.	01

PART-B

2	a	Discuss the advantages of using multiple threads rather than using multiple processes using an example. Write a program to create a thread to compute sum of all the elements of an array.	06
	b	With help of neat diagram discuss the four sequence of actions of a context switch operation in process scheduling.	06
	c	Differentiate user mode and kernel mode of operation in an operating system.	04
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	11	2
$P2$	5	28	0
$P3$	12	2	3
$P4$	2	10	1
$P5$	9	16	4

i) Draw Gantt charts illustrating the execution of these processes using Preemptive SJF, Preemptive Priority and Round Robin (Time slice = $4ms$, considering arrival time as 0 for all processes)

ii) Compute the average waiting time, average turn around time for above approaches. 10

	b	What is the Reader-Writer problem? Write routines to solve Reader-Writer problem using semaphore.	06
		OR	
4	a	Consider the following set of processes with a length of the CPU burst time given in milliseconds $Process$ | $Arrival\ Time$ | $Burst\ Time$ | $Priority$ $P1$ | 7 | 5 | 1 $P2$ | 3 | 7 | 2 $P3$ | 10 | 8 | 1 $P4$ | 0 | 15 | 2 $P5$ | 20 | 3 | 1 Consider that each job has a priority as given in the table above, construct Gantt chart and find average turnaround time with mix of Preemptive SJF and Priority scheduling where Preemptive SJF will reign only when priority is same.	05
	b	Write 'C' routines to provide a deadlock free solution for Dining Philosopher problem.	05
	c	With help of neat diagram explain Linux process scheduling.	06
5	a	With help of neat diagram explain the working of paging memory management scheme.	06
	b	What is virtual memory? List the advantages of using virtual memory. Discuss the demand paging approach used to implement virtual memory with help of a neat diagram.	10
		OR	
6	a	Consider the following page reference string: 7,2,3,1,2,5,3,4,6,7,7,1,0,5,4,6,2,3,0,1 Calculate the page faults for the LRU replacement, $FIFO$ replacement and Optimal replacement algorithms, assuming initially empty three frames.	10
	b	With help of a neat diagram discuss the Segmentation memory management	06
7	a	Suppose a disk with 100 tracks and the disk request sequence (track numbers) is: $45, 20, 90, 10, 50, 60, 80, 25, 70$. Assume that the initial position of the read write head is on track 50. Calculate the distance traversed by the read-write head using Shortest Seek Time First ($SSTF$) algorithm and $SCAN$ (Elevator) algorithm (assuming that $SCAN$ algorithm moves towards 100 when it starts execution).	08
	b	With help of neat diagram discuss how $UNIX$ kernel support open operation on files.	08

8	a	Discuss the policies to recover from deadlock in operating systems	06
	b	Consider the following snapshot of a system:	

Process	*Allocation* *A B C D*	*Max* *A B C D*	*Available* *A B C D*
*P*0	2 0 0 1	4 2 1 2	3 3 2 1
*P*1	3 1 2 1	5 2 5 2	
*P*2	2 1 0 3	2 3 1 6	
*P*3	1 3 1 2	1 4 2 4	
*P*4	1 4 3 2	3 6 6 5	

Answer the following questions using the banker's algorithm:

i) How many instances of resources are present in the system under each type of a resource?
ii) Compute the Need matrix for the given snapshot of a system.
iii) Verify whether the snapshot of the present system is in a safe state
iv) If a request from process *P*1 arrives for (1,1,0,0), can the request be granted immediately? 10

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RV COLLEGE OF ENGINEERING®

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III Semester B. E. Fast Track Examinations Oct-2020

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 FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6.

PART-A

1	1.1	List any four classes of operating system.	02
	1.2	List any four design principles for design of operating system	02

	1.3	Write the ouput of the following program:
		$int\ main\ ()$
		{
		$if\ (fork\ ()::fork\ )$
		$fork();$
		$print\ (“1”);$
		$return\ 0;$
		}
			02

	1.4	Justify the statement, “ thread is a light weight process”	02
	1.5	Differentiate between fork and vfork system calls	02
	1.6	Consider three processes (process id $0,1\ \&\ 2$ respectively) with compute time burst $2,4$ and 8 times units. All processes arrive at time zero. Considering longest remaining time first ($LRTF$), calculate the average turnaround time ($LRTF$).	02
	1.7	Illustrate with example how an improper use of semaphore leads to deadlock.	02
	1.8	Consider a paging system with TLB. If it takes $20\ ns$ to search TLB and $100\ ns$ to access a memory, what is the effective memory access time with 98 percent hit ratio.	02
	1.9	Justify the statement: “Presence of cycle in Resource Allocation Graph is not sufficient condition for dead lock”.	02
	1.10	Differentiate between monolithic level & microkernel	02

PART-B

2	a	Discuss various approaches to design operating system structure.	06
	b	Write a program to demonstrate following $UNIX$ system calls: i) Fork ii) Wait iii) Exec (any variant).	06

	c	Give a proper insight into "How evolution in computing influenced different classes of operating system".	04
3	a	Compare process scheduling protocols- First came first serve ($FCFS$), shortest job first, priority and round robin on basis of their performance and algorithm complexity.	06
	b	Give solution for the following critical section problem: i) Producer consumer problem ii) Dining philosopher problem.	10
		OR	
4	a	Consider a following set of processes with a length of the CPU burst time given in milliseconds. $Process$ | $Arrival\ Time$ | $Burst\ Time$ | $Priority$ P_1 | 0 | 7 | 3 P_2 | 3 | 2 | 2 P_3 | 4 | 3 | 1 P_4 | 4 | 1 | 1 P_5 | 5 | 3 | 3 i) Draw Gantt chart illustrating the execution of these processes using shortest job first (preemptive), priority (preemptive) and round robin (time slice = $2\ ms$) ii) Compute average waiting, average turnaround and average response time.	10
	b	Describe the process scheduling in linear operating system.	06
5	a	Given five memory partitions of $100\,KB, 500\,KB, 200\,KB, 300\,KB$ and $600\,KB$ in order, how would first fit, best fit and worst fit algorithms place processes of $212\,KB, 417\,KB, 112\,KB$ and $426\,KB$ in order? Which algorithm makes the most efficient use of memory?	08
	b	With a neat diagram explain the basic paging scheme of memory management. Also discuss the hardware support for paging.	08
		OR	
6	a	What are logical and physical address space? Justify how memory management helps programmer to have larger logical address compared to available physical memory.	08
	b	Consider the following page reference string: 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6 How many page facility will occur by $LRU, FIFO$ and optimal page replacement algorithms, assuming 5 free frames.	08
7	a	What is thrashing? What are the causes for thrashing? Discuss the mechanism to prevent it.	06

	b	Suppose on a disk with 5000 cylinders, number 0 to 4999. The drive is currently serving a request at cylinder 143. The queue of pending requests in $FIFO$ order is $B6, 1470, 913, 1774, 948, 1509, 1022, 1250, 130$ starting from the current position what is the total number of disk moves for the following algorithms i) shortest seek time first ($SSTF$) ii) $SCAM$ iii) $LOOK$.	10
8	a	What is deadlock? Explain. Discuss different ways of handling deadlock.	08
	b	Consider the following snapshot of a system.	

$Process$	$Allocation$				Max			
	A	B	C	D	A	B	C	D
P_0	0	0	1	2	0	0	1	2
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

The available resources are $A = 1, B = 5, C = 2$ and $D = 0$.

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 (0 4 2 0), can the request be granted immediately. 08

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RV COLLEGE OF ENGINEERING®

(An autonomous Institution affiliated to VTU)

IV Semester B. E. Examinations April/May-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 FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

PART A

1	1.1	List any two classes of operating systems.	02
	1.2	What is the purpose of system call?	01
	1.3	When a process is waiting to be assigned to a processor, then it is said to be in _____ state.	01
	1.4	Define convay effect and its consequence.	02
	1.5	Draw the Gantt chart for the following using Round-Robin (*RR*) scheduling algorithm.	

Process	*Burst time*
P_1	24
P_2	3
P_3	3

Assume time Quantum = 4 milliseconds. 02

	1.6	What is the advantage of semaphore over other hardware-based solutions in solving critical section problem?	01
	1.7	List the conditions for deadlock situation to occur.	02
	1.8	Given the resource allocation graph with cycle, what are the conditions to determine whether there is a deadlock or not?	02
	1.9	Give one difference between logical address space and physical address space.	01
	1.10	Given the following reference string: 7,0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1. Determine the number of page faults using *FIFO* page replacement.	02
	1.11	Given the following disk queue with requests for *I/O* to block on cylinders. 98,183,37,122,14,124,65,67. If the disk head is initially at cylinder 53. Draw the scheduling diagram for *FCFS* disk scheduling.	02
	1.12	Suppose a process requests 10 *kb* of memory and memory manager currently has a list of unallocated blocks of 6*kb*, 15*kb*, 20*kb*, 11*kb* and 16 *kb* blocks. Identify the block allotted by best fit, first fit and worst fit strategy.	02

PART B

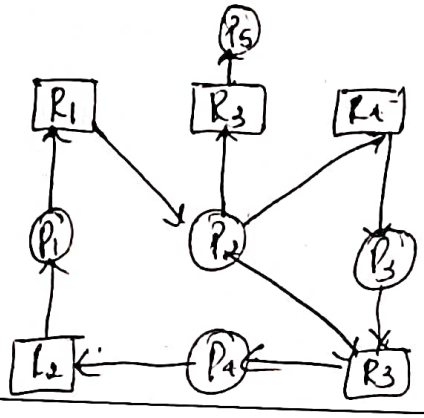
2	a	Explain the distinguishing features of the following operating systems: i) Batch processing. ii) Real time.
	b	With neat diagram, explain the process control block in detail.
	c	Define User Thread and Kernel Threads. Differentiate between single-threaded process and multithreaded process.
3	a	Define *CPU*-scheduling and the circumstances under which scheduling decisions may take place.
	b	An operating system uses *SJF* scheduling and priority scheduling algorithm. Consider the burst times, priority for the following process. Draw the Gantt chart and calculate waiting time, turnaround time, average waiting time and average turnaround time for the process.
	c	What is the critical section problem? Mention the requirements that must be satisfied by a critical section problem solution.
		OR
4	a	The following processes arrive for execution at times indicated. Draw Gantt chart and calculate waiting time and turnaround time for: i) *FCFS* scheduling ii) Perspective *SJF* scheduling.
	b	Why is a thread called *LWP*? Explain different threading issues. Bring out the concept of thread pool.
5	a	Explain the following synchronous problems with algorithms: i) Bounded-Buffer problem. ii) Peaders-Writers problem.
	b	Consider a system with five processes P_0 through P_4 and three resource types A, B, C. Resource type A has 10 instances, resource type B has 5 instances and resource type C has 7 instances. Consider the following snapshot of system.

	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P_0	0	1	0	7	5	3	3	3	2
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			

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 P_1 arrives for (1,0,2) can the request be granted immediately?

OR

a	Explain the method of recovery from deadlock in detail.	06
b	Design a starvation and deadlock free solution dining philosopher problem using any synchronization construct.	06
C	For the given resource-allocation graph, construct a wait-for-graph and determine whether there is a deadlock or not.	04



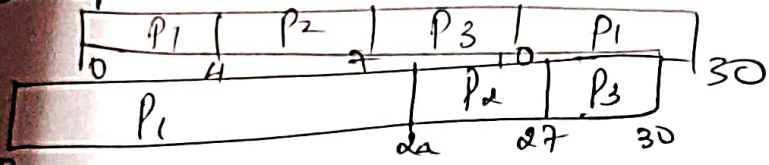
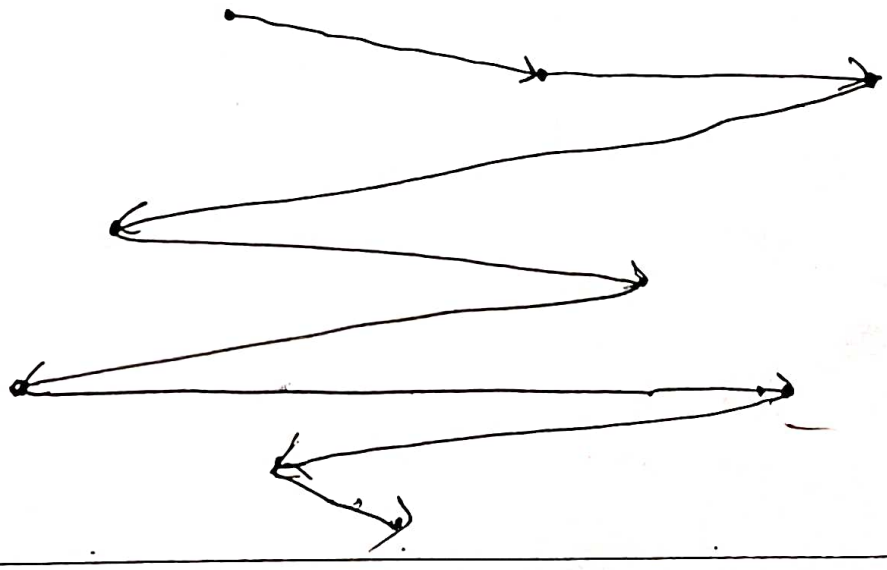
5+1

a	Define Paging and explain the following: i) Demand paging. ii) Fragmentation. iii) Copy on write.	08
b	Consider the following page reference string: 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6 How many page faults will occur for *FIFO*, optimal page replacement and *LRV* page replacement, assuming 3 free frames?	08
a	Suppose that the head of a moving hard disk with 200 tracks, numbered 0 to 199, is currently serving a request at track 143 and has just finished a requests at track 125. The queue of requests is kept in *FIFO* order. 86,147,91,177,94,150,102,175,130 What is the total number of disk movements needed to satisfy these requests for the following disk-scheduling algorithms? i) *FCFS* → 565 ii) *SSTF* → 162 iii) *LOOK* → 125 iv) *SCAN*. → 209	08
b	Explain any two file access methods.	04
c	Explain any two file allocation methods.	04

Tue 9 a-1,00, 1.30 to 3.30
Wed a-11
Thu - a-1

SCHEME AND SOLUTION

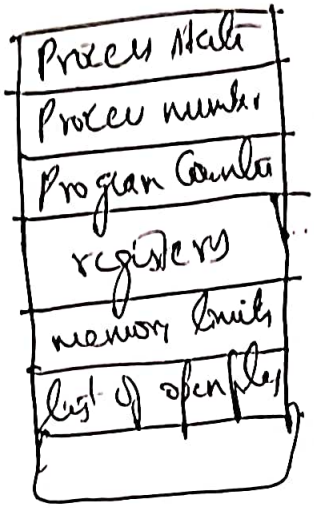
CODE: 16CS45 COURSE: Operating Systems. UG

		Marks
1.	Batch processing, Time sharing. (1M each)	-2M.
2.	provides an interface to the services made available by operating system.	-1M-
1.3	Ready.	-1M.
1.4	Convoy effect: all process waiting for one big process to complete. Consequence: lower CPU utilization (1M+1M)	-2M-
1.5		-2M- -1M.
1.6	Easy to use.	-2M
1.7	Mutual exclusion, Hold and wait, No preemption, Circular wait.	-2M-
1.8	Resource with single Instance and Multiple Instance.	-1M-
1.9.	Logical Address: generated by CPU Physical Address: seen by memory unit	-2M-
1.10.	page faults = 15. -1M- Procedure - -1M-	
1.11	0 14 37 53 65 67 98 122 124 183 199 	-2M

SCHEME AND SOLUTION APR/MAY

COURSE CODE: 16CS45 COURSE: Operating Systems

Question No	
1(a)	Best fit: 11KB, Worst fit: 20KB, First fit: 15KB
	PART-B
2.a	Batch processing – 3M Real Time – 3M.
b.	Diagram – 2m Explanation – 3m.



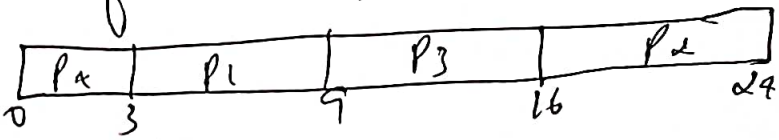
c. User Threads definition – 1m
Kernel Threads definition – 1m.

Differences:

Single Thread	Multithread
(i) heavy weight	Light Weight
(ii) performs the task at a time	performs multiple task
(iii) Waiting time by client is more	less. – (3m)

3.a. CPU-scheduling definitions: (2m).
Decisions for scheduling : (2m)

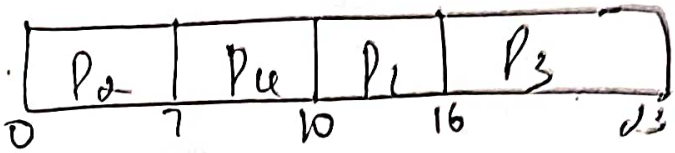
b. SJF:



(4m+4m)

AWT = 7 milliseconds.

Priority:



4. Critical section problem definition - (2m) (4m)
   (i) Mutual exclusion
   (ii) Progress
   (iii) Bounded Waiting
   } (3m)

5)a) (i) Bounded - Buffer problem - (2m)
   Algorithm - (2m) (4m)

   (ii) Readers - Writers problem - (2m)
   Algorithm - (2m)

5) b) Need Matrix:

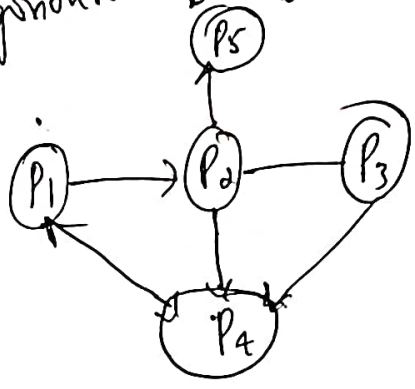
	Need	
	A	B	C
P_0	7	4	3
P_1	1	2	2
P_2	6	0	0
P_3	0	1	1
P_4	4	3	1 - (4m)

System is in safe state - (1m)
Request (1,0,2) Can be served. - (2m) - (3m)

6)a) process Termination - 3m (6m)
   Resource Preemption - 3m (6m)

b) Algorithm to be written - (4m)

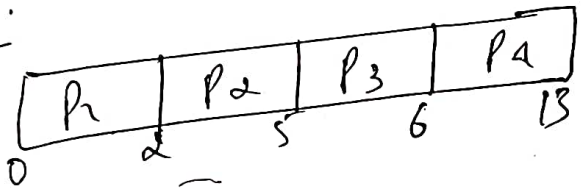
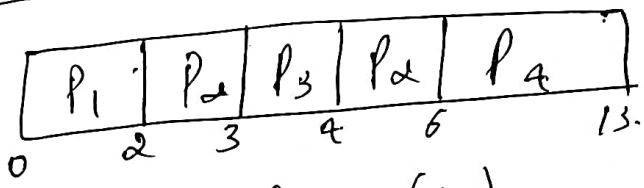
c)



) Reason for calling Thread as LWP - (2m)

Threading Issues - (4m)

Thread Pool - (2m)

		Marks
	Mutual Exclusion Hold and Wait No preemption Circular wait — 2m each	8m
	FCFS: — (4m)  	(8m)
	Preemptive SJF: — (4m)  	
2a.	Paging Definition : (2m) (i) ~~Hierarchical paging~~ (ii) ~~Hashed page table~~ (iii) ~~Inverted page Table~~ } (6m) Demand paging fragmentation copy on write	8m
b.	FIFO page replacement – 2m Optimal – 3m LRU – 3m	(8m)
2	(i) FCFS – 2m (ii) SSTF – 2m (iii) LOOK – 2m (iv) SCAN – 2m	(8m)

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Question No	
b.	Sequential Access Direct Access } 2m each
c.	Contiguous Allocation Linked Allocation } 2m each

end