Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech Degree Examination July 2021 (2019 Scheme)

Course Code : CST206
Course Name: OPERATING SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks) Marks

1		Which are the three methods used to pass parameters to operating system ?	3
2		Write three advantages of peer-to-peer system over client server system.	3
3		Differentiate Pre-emptive and Non-pre-emptive scheduling giving the application of each of them.	3
4		Why is context switching considered to be an overhead to the system?	3
5		What are necessary conditions which can lead to a deadlock situation in a system?	3
6		Explain the wait and signal operations used in semaphores.	3
7		How does swapping result in better memory management?	3
8		Explain the concept of virtual memory. Write one memory management scheme which supports virtual memory.	3
9		Compare sequential access and direct access methods of storage devices.	3
10		Write notes on disk formatting.	3

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11	a)	Distinguish among the following terminologies associated with the operating system and explain each of them in detail. (i) Multiprogramming systems (ii) Multitasking systems (iii) Multiprocessor systems.	9
	b)	Explain, how the long-term scheduler directly affects the system performance.	5
12	a)	Explain in detail about the various functions of operating systems.	6
	b)	Write notes on the following operating system structures. (i) Layered approach (ii) Microkernel	8

Module -2

13 a) A writer process like to send some bulk information to a reader process. Explain the IPC mechanism that can be used for this purpose. 8

b) How many child process will be created for the following code ? 6

```
void main() { fork();  fork();  printf("HELLO\n");  fork();
                printf("WELCOME\n"); }
```

How many times HELLO and WELCOME will be printed? Justify your answer.

14 a) Five batch jobs A through E arrive at a computer system in the order A to E at almost the same time. They have estimated running times of 6, 4, 1, 3, and 7 seconds. Their (externally determined) priorities are 3, 5, 2, 1, and 4 respectively, with 5 being the highest priority. For each of the following scheduling algorithms, determine the average process waiting time. Ignore process switching overhead. 12

(i) Round Robin (assume quantum = 2 sec) (ii) First-come first-served

(iii) Shortest job first (iv) Priority scheduling

b) Point out the significance of Zero capacity queue in IPC? 2

Module -3

15 a) Consider the following snapshot of a system with five processes P1, P2, P3, P4, P5 and four resources A, B, C, D. What is the total number of instances of A, B, C, and D? Using Bankers Algorithm check whether the system is in safe state or not. 8

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P1	1	0	2	2	3	2	5	2	3	0	0	1
P2	0	2	1	2	3	4	1	2				
P3	2	4	5	0	2	7	7	3				
P4	3	0	0	0	5	5	0	7				
P5	4	2	1	3	6	2	1	4				

b) What is critical section problem? What are the requirements that need to be satisfied by any solution to critical section problem? Give a solution to a 2 process critical section problem. 6

16 a) Describe the Bounded - buffer problem and give a solution for the same using semaphores. Write the structure of producer and consumer processes. 8

b) Why is deadlock state more critical than starvation? Draw the resource allocation graph (i) with deadlock (ii) with a cycle but no deadlock. 6

Module -4

17 a) Explain with the help of supporting diagram, how translation look-aside buffer (TLB) improves the performance of a paging system. 8

b) With a diagram write the steps involved in handling a page fault. 6

18 a) Consider the page reference string 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6. For a system with 3 frames compute the number of page faults for the following page replacement methods: (i) FCFS (ii) Optimal (ii) LRU. 9

b) Consider the following segment table: 5

Segment	Base Address	Length
0	100	400
1	3700	300
2	700	600
3	2600	500
4	1500	1000

What are the physical addresses for the following logical addresses?

(i) 4, 350 (ii) 2, 100 (iii) 3, 70 (iv) 0, 25 (v) 1, 130

Module -5

19 a) Explain FCFS, SSTF and SCAN disk scheduling algorithms, using the given disk queue of requests: 82,170,43,140,24,16,190. Find the total seek time for each case. Assume that, the disk has 200 cylinders ranging from 0 to 199 and the current position of head is at cylinder 50. 9

b) Explain indexed allocation method with an example. 5

20 a) Explain the different directory structures used in file system. 10

b) Different users may need different types of access to a file or directory. Explain the most general scheme to implement identity dependent access. 4

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech Degree Examination June 2022 (2019 scheme)

Course Code: CST206

Course Name: OPERATING SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks) Marks

1		Describe the role of bootstrap loader in booting a computer system.	3
2		How is distinction of kernel code from user code achieved at hardware level?	3

3		How many times will 'Forked' get printed by the below code and justify your answer.
		`int main() {`
		`  fork();`
		`  fork();`
		`  printf("Forked\n");`
		`  return 0;}`
			3

4		List and explain the various synchronous and asynchronous methods of message passing in IPC.	3
5		What is meant by race condition? Explain with the help of an example.	3
6		Explain the two strategies used to recover from a deadlock.	3
7		Differentiate between compile time and load time address binding.	3
8		Consider a logical address space of 256 pages with a 4-KB page size, mapped onto a physical memory of 64 frames. Find the (i) number of bits in the logical address (ii) number of bits in the physical address (iii) number of bits in the offset part of logical address	3
9		Define seek time, rotational latency and disk bandwidth of disks.	3
10		Explain two level directory structure with the help of a diagram.	3

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11	a)	What is the purpose of a system call? Describe how a system call made by a user application is handled.	7

b) Explain the micro kernel approach to system design with the help of a diagram. How do user programs and kernel services interact in microkernel architecture? 7

12 a) Describe in detail about the various functions of Operating systems. 12

b) What are the advantages of multiprocessor systems? 2

Module -2

13 a) What is meant by context switching? Illustrate the timeline of context switching between two processes using PCBs with the help of a diagram. 6

b) Differentiate between the following schedulers. 8

(i) Short-term and long term scheduler

(ii) Pre-emptive and non-preemptive scheduler

14 a) Assume you have the following jobs shown in the table to execute with one processor. Draw the Gantt chart and calculate the average waiting time and average turnaround time if the system uses the following scheduling algorithms 9

(i) Preemptive priority scheduling (ii) Nonpreemtive priority scheduling

(iii) Non-preemptive Shortest Job first scheduling.

Assume higher priority is indicated with lower numbers.

Process	Arrival Time(ms)	CPU Burst Time(ms)	Priority
P0	0	4	3
P1	2	5	2
P2	3	1	1
P3	4	3	4

b) Explain the different states of a process and transition between them with the help of a diagram. 5

Module -3

15 a) What is a critical section? State and explain the conditions to be satisfied by a solution to the critical section problem. 6

b) Illustrate how resource allocation graph can be used to (i) detect deadlocks and (ii) avoid deadlocks. 8

16 a) Write the algorithm or pseudocode for solving the Dining-Philosophers problem using semaphores. Is the solution prone to deadlocks or starvation? Discuss. 5

b) Given the following snapshot of a system at time T0. 9

	Allocation				Max Required				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	0	0	1	2	0	0	1	2	1	5	2	0
P1	1	0	0	0	1	7	5	0				
P2	1	3	5	4	2	3	5	6				
P3	0	6	3	2	0	6	5	2				
P4	0	0	1	4	0	6	5	6				

Find whether the system is in a safe state using Banker's algorithm. If P1 generates a request for (0,4,2,0), can the request be granted immediately?

Module -4

17 a) Calculate the number of page faults for the following reference string with three page frames, using the following algorithms. 9

9, 2, 3, 1, 2, 5, 3, 4, 6, 9, 9, 1, 0, 5, 4, 6, 2, 3, 0 , 1

(i) FIFO (ii) Optimal (iii) LRU

b) Compare the memory organization schemes of pure paging and pure segmentation with respect to the following issues: (i) External Fragmentation (ii) Internal Fragmentation 5

18 a) Explain how a process larger than the physical memory can be executed with the help of virtual memory. Describe the concept using demand paging. 6

b) How does translation look-aside buffer (TLB) help to speed up the page access? Illustrate address translation using TLB. 8

Module -5

19 a) List and explain the different access methods for files. 4

b) Describe linked and indexed allocation methods for files with the help of neat diagrams. 10

20 a) Suppose that a disk drive has 200 cylinders numbered from 0 to 199 and the current position of the head is at cylinder 100. For the given disk queue of requests: - 20, 89, 130, 45, 120 and 180, draw the head movement in FCFS, SSTF, CSCAN disk scheduling algorithms and compute the total head movements (in cylinders) in each. 9

b) Describe the general scheme of using three classifications of users in connection with file access control with the help of an example. 5

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech Degree Supplementary Examination June 2023 (2019 scheme)

Course Code: CST206

Course Name: OPERATING SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks) Marks

1		What are the operations taking place when a system call is executed?	3
2		What are multiprocessor systems? What are the advantages of multiprocessor systems?	3
3		Write the difference between process and thread.	3
4		Differentiate between the two common models of interprocess communication.	3
5		Write the three requirements that a solution to critical–section problem must satisfy.	3
6		Explain the priority inheritance protocol for solving the priority inversion problem.	3
7		What do you understand by external and internal fragmentation in case of memory management schemes.	3
8		Explain the concept of demand paging?	3
9		Explain the linked allocation of file allocation with merits and demerits.	3
10		Point out the differences between C-SCAN and C-LOOK scheduling algorithms.	3

PART B

(Answer one full question from each module, each question carries 14 marks)

Module – 1

11	a)	Explain the essential properties of the following types of Operating systems: i) Batch operating system ii) Time sharing operating system iii) Real time operating system iv) Distributed operating system	10
	b)	Explain the layered approach of the operating system structure.	4

12 a) Explain any four Kernel data structures with suitable examples. 8

b) Justify the statement "Operating System can be viewed as a government, resource allocator and a control program". 6

Module – 2

13 a) With the help of a diagram, explain the operations taking place when the CPU switches from one process to another. 7

b) Explain how the logical communication link is established and the messages are passed in case of direct and indirect communication, in a message passing system. 7

14 a) For the following set of processes draw the Gantt chart and find the average waiting time for : 9

(i) FCFS (ii) SJF (iii) SRTF

Process	Arrival time (in sec)	Burst Time(in sec)
P1	0	4
P2	1	2
P3	2	5
P4	3	4

b) Explain the working of multi-level feedback queue scheduling. 5

Module -3

15 a) Consider a system with four processes P1, P2, P3, P4 and four types of resources R1, R2, R3, R4. The maximum number of instances of resources of each type are 5, 7, 7 and 7 respectively. What will be the order of processing of jobs if the allocated matrix and the maximum demand matrix are as given below. 8

	Allocated Matrix				Maximum Claim			
	R1	R2	R3	R4	R1	R2	R3	R4
P1	2	1	3	2	3	5	6	4
P2	0	0	1	2	1	3	4	6
P3	1	2	1	1	1	4	3	2
P4	1	1	0	2	2	3	1	2

	b)	Explain how semaphores can be used to solve Readers-Writers problem.	6
16	a)	State dining philosopher's problem and give a solution using semaphores. Write structure of philosopher.	8
	b)	Explain the methods for deadlock prevention.	6

Module -4

17	a)	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 Find the number of page faults if there are 4-page frames, using the following page replacement algorithms (i) LRU (ii) FIFO (iii) Optimal.	9
	b)	With the help of an example explain the concept of shared pages in a paging system.	5
18	a)	Memory is divided into fixed partitions of sizes 100KB, 500KB, 200KB, 300KB, 600KB in the order and all these partitions are available. Suppose processes of size requirements 212KB, 417KB, 112KB, 426KB are arrived in the system in that order. Show how the first fit, best fit and worst fit algorithms works to place processes into partitions. Which is the best algorithm?	8
	b)	Explain the concept of a hashed page table with a diagram.	6

Module -5

19	a)	Explain FCFS, SSTF and SCAN disk scheduling algorithms, using the given disk queue of requests: 20, 89, 130, 45 and 180. Assume that, the disk has 200 platters ranging from 0 to 199 and the current position of head is at cylinder 100.	9
	b)	Explain the different methods used for keeping track of free disk space.	5
20	a)	There are 4 domains (D1, D2, D3, D4) and 4 objects (files – F1, F2, F3, F4). A process executing in D1 can read and write files F1, F3 and F4. A process in D4 can read F1, read & write F3 and execute F2. A process in D2/D3 can read F2 and execute F4. A process in D1 can switch to D2 or D4. A process in D4 can switch to D3. Draw the access matrix showing all these details.	7
	b)	How can we make a new magnetic disk ready for use (to store files)?	7

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (R,S) / S2 (PT) (R,S) Examination June 2023 (2019 Scheme)

Course Code: CST 206

Course Name: OPERATING SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1	What are the major activities of an operating system with regard to file management?	(3)
2	Write the operations taking place during the booting of a system.	(3)
3	Explain the different buffering mechanisms used in message passing systems?	(3)
4	Define the parameters for multilevel feedback queue scheduling? How it is better compared to multilevel queue scheduling?	(3)
5	What are the three conditions to be satisfied by a solution to critical section problem?	(3)
6	Explain with an example the improper usage of semaphore causing deadlocks?	(3)
7	Differentiate Logical address Space and Physical Address Space	(3)
8	Explain the terms (i) Dynamic Loading (ii) Dynamic Linking	(3)
9	Discuss the steps in handling a page fault?	(3)
10	How is disk formatting done?	(3)

PART B

Answer any one question from each module

Module 1

11	(a)	What is an Operating System? Explain any 3 types of Operating System.	(7)
	(b)	What is a system call? What are the different ways to pass parameters to system call? List basic types of system call with examples.	(7)

OR

12	(a)	Write notes on the following operating system structures. (i) Microkernel structure (ii) Simple Structure (iii) Layered Structure	(8)
	(b)	Describe the differences between symmetric and asymmetric multiprocessing. What are the advantages and disadvantages of multiprocessor systems?	(6)

Module 2

13 (a) Define process. With the help of a neat diagram explain different states of process. (7)

(b) With an example, illustrate the interprocess communication using Shared memory (7)

OR

14 (a) Assume you have the following jobs in a system that to be executed with a single processor. Now, (8)

Process ID	Arrival Time	Burst Time (ms)
P0	0	75
P1	10	40
P2	10	25
P3	55	30
P4	95	45

i) Create a Gantt chart illustrating the execution

ii) Find the average waiting time

Iii) Find the average turnaround time

For the above processes, when the system uses

a) Preemptive Scheduling b) RR Scheduling (Time Quantum = 15 ms)

(b) What are threads? What are the benefits of multithreaded programming? List the ways of establishing relationship between user threads and kernel thread. (6)

Module 3

15 (a) Explain Dining Philosophers Problem. Give a solution for the problem using monitors. (6)

(b) What do you mean by deadlock? What are the four necessary conditions for a deadlock to occur? Describe various deadlock prevention mechanisms. (8)

OR

16 (a) What is a semaphore? Describe how semaphores can be used as a process synchronisation mechanism? (7)

(b) Consider the following snapshot of the system with five processes P1. P2, P3,P4,P5 and four resources A, B, C, D. Using Bankers Algorithm, check whether the system is in safe state or not. (7)

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P1	1	0	2	2	3	2	5	2	3	0	0	1
P2	0	2	1	2	3	4	1	2				
P3	2	4	5	0	2	7	7	3				
P4	3	0	0	0	5	5	0	7				
P5	4	2	1	3	6	2	1	4				

Module 4

17 (a) With the help of a diagram explain how logical address is translated to physical address in case of segmentation scheme. (5)

Consider the following segment table of a process.

Segment	Base	Limit
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

Compute the resultant physical addresses for the following logical addresses.

(i) 0, 430 (ii) 1, 10 (iii) 2,500 (iv) 3, 400 (v) 4, 112

(b) Consider the following page reference stream, R=3, 2, 4, 3, 4, 2, 2, 3, 4, 5, 6, 7, 7, 6, 5, 4, 5, 6, 7, 2, 1. Assuming demand paging with three frames, how many page faults would occur for the following page replacement algorithms. (9)

i) LRU replacement ii) FIFO replacement iii) Optimal replacement

OR

18 (a) Define Demand Paging. Explain Swapping with a neat diagram. (6)

(b) Consider a fixed partitioned memory management scheme with fixed partitions are 150K, 300K, 550K, 400K, 250K and 200K (in order). Five processes are ready for execution each with memory requirement as P1(240K), P2(120K), P3(380K), P4(300K) and P5(350K). Write the allocation in each of the following cases and calculate the internal fragmentation and external fragmentation (if any) in each case. (8)

(i) First Fit (ii) Best Fit (iii) Worst Fit

Module 5

19	(a)	List out the logical structures of a directory with figures.	(5)
	(b)	With neat sketches illustrate the following disk space allocation algorithms (i) Contiguous allocation (ii) Linked allocation (iii) Indexed allocation?	(9)

OR

20	(a)	Discuss Protection. Write notes about the protection strategies provided for files.	(6)
	(b)	Consider a disk queue with requests for I/O to blocks on cylinders 98, 183, 41,122, 14, 124, 65, 67. The head is initially at cylinder number 53. The cylinders are numbered from 0 to 199. Find out the total head movement incurred while servicing these requests, if following scheduling algorithms are used-(i) FCFS (ii) SSTF (iii) C-SCAN (iv) LOOK	(8)

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