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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: III - THEORY EXAMINATION (2024 - 2025)

Subject: Operating Systems

Time: 3 Hours　　　　　　　　　　　　　　　　　　　　　Max. Marks: 100

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A　　　　　　　　　　　　　　　　　　　　　　　　　　　　20

1. Attempt all parts:-

1-a.　　　Which of the following is a primary goal of an Operating System?(CO1,K1)　　1

　　(a)　Resource management

　　(b)　Software development

　　(c)　Network security

　　(d)　Data storage

1-b.　　　Which of the following architectures supports multiple CPUs working together?(CO1,K1)　　1

　　(a)　Single-tasking OS

　　(b)　Multiprocessor OS

　　(c)　Real-time OS

　　(d)　Distributed OS

1-c.　　　Which scheduler determines which processes are admitted into the system for processing? (CO2,K2)　　1

　　(a)　Long Term Scheduler

　　(b)　Short Term Scheduler

　　(c)　Medium Term Scheduler

　　(d)　I/O Scheduler

1-d.　　　Which algorithm is also known as shortest remaining time first? (CO2,K1)　　1

　　(a)　FCFS

    (b)   SJF

    (c)   SRTF

    (d)   Priority Scheduling

1-e.   Which of the following is required for a solution to the critical section problem?   1
(CO3,K1)

    (a)   Mutual exclusion

    (b)   Deadlock

    (c)   Synchronization delay

    (d)   Infinite processes

1-f.   The Dining Philosophers problem involves which of the following? (CO3,K2)   1

    (a)   Multiple processes competing for a single resource

    (b)   A shared buffer between multiple producers and consumers

    (c)   Philosophers eating and thinking while sharing a set of chopsticks

    (d)   A sleeping barber with customers

1-g.   How does demand paging work?(CO4,K2)   1

    (a)   Pages are loaded into memory only when required

    (b)   All pages are loaded at once

    (c)   Pages are swapped to disk for performance

    (d)   None of the above

1-h.   Belady's Anomaly is   (CO4,K1)   1

    (a)   A phenomenon where increasing the number of page frames can result in more page faults

    (b)   A method to optimize page replacement

    (c)   An error in memory binding

    (d)   None of the above

1-i.   File management function of the operating system includes i) File creation and   1
deletion ii) Disk scheduling iii) Directory creation iv)Mapping file in secondary
storage (CO5,K3)

    (a)   i, ii and iii only

    (b)   i, iii and iv only

    (c)   ii, iii and iv only

    (d)   All i, ii, iii and iv

1-j.   To organise file systems on disk which is True? (CO5,K1)   1

    (a)   they are split into one or more partitions

    (b)   information about files is added to each partition

    (c)   they are made on different storage spaces

    (d)   all of the mentioned

2. Attempt all parts:-

2.a.   Explain is the role of the short-term scheduler in detail (CO1,K1)   2

2.b.	Differentiate between kernel mode and user mode. (CO2,K1)	2
2.c.	Write the role of synchronization in interprocess communication? (CO3,K1)	2
2.d.	Differentiate between fixed and variable partitions in memory allocation (CO4,K1)	2
2.e.	Define sequential access and its common use case. (CO5,K1)	2

SECTION-B 30

3. Answer any <u>five</u> of the following:-

3-a.	Differentiate between Multitasking operating system and multiprocessor operating system. (CO1,K1)	6
3-b.	Write the command of creating a file ,copying a file and moving a file in linux with an example.(CO1,K2)	6
3-c.	Write the 4 process management command of the Linux and write the syntax of it.(CO2,K1)	6
3-d.	Differentiate between Preemptive and Non Preemptive Scheduling with examples. (CO2,K1)	6
3.e.	Analyze the critical section problem and evaluate its impact on process synchronization.(CO3,K2)	6
3.f.	Consider page reference string 1, 3, 0, 3, 5, 6, 3 with 3 page frames.Find the number of page faults using FIFO and LRU Page Replacement Algorithm.(CO4,K2)	6
3.g.	Describe the challenges in ensuring consistency in distributed systems.(CO5,K2)	6

SECTION-C 50

4. Answer any <u>one</u> of the following:-

| 4-a. | Describe the architecture of an operating system and explain the role of the kernel in managing system resources.(CO1,K2) | 10 |
| 4-b. | Describe the basics of Shell Scripting in Linux, including variables, control structures, and functions. Provide examples to illustrate their usage.(CO1,K3) | 10 |

5. Answer any <u>one</u> of the following:-

| 5-a. | Given the following processes with their arrival times and burst times, and a time quantum of 4 units, calculate the waiting time, turnaround time, and average waiting time and average turnaround time for Round Robin scheduling:(CO2,K3) | 10 |

Process	Arrival Time	Burst Time
P1	0	5
P2	1	3
P3	2	8
P4	3	6

Simulate the Round Robin process execution by cycling through the processes with a time quantum of 4 units.
a.Calculate the completion time, waiting time, and turnaround time for each process.
b. Calculate the average waiting time and average turnaround time.

5-b.	Explain the concept of Process Performance Criteria in an operating system. Discuss the Process Transition Diagram, Process Control Block (PCB), and the role of different types of schedulers (Long-Term, Mid-Term, and Short-Term).(CO2,K2)	10

6. Answer any <u>one</u> of the following:-

6-a.	A system has 3 types of resources (A, B, C), with a total of 10, 5, and 7 units available, respectively. There are 5 processes (P1, P2, P3, P4, P5). The allocation matrix is given below:(CO3,K4)	10

Process	A	B	C	Max A	Max B	Max C
P1	2	1	3	3	2	4
P2	3	2	2	4	3	3
P3	1	3	2	3	3	3
P4	2	1	1	3	2	3
P5	1	2	2	2	2	3

The system is currently in the following state:

Available: (2 A, 1 B, 2 C)
Using the Banker's Algorithm, determine if the system is in a safe state.
If not, explain why and calculate the sequence of safe execution (if possible).

6-b.	Explain the purpose and usage of lock variables in process synchronization. How do lock variables help in managing access to critical sections? Discuss their advantages and disadvantages.(CO3,K2)	10

7. Answer any <u>one</u> of the following:-

7-a.	Explain the memory hierarchy and differentiate between local and physical memory space and explain the contiguous memory management technique.(CO4,K1)	10
7-b.	Given a page reference string: (CO4,K4) 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2 and 3 page frames, apply the FIFO page replacement algorithm and calculate the number of page faults. Then, apply the same algorithm with 4 page frames and compare the results. Does Belady's Anomaly occur in this scenario? Explain and differentiate between Belady's Anamoly and Thrashing.	10

8. Answer any <u>one</u> of the following:-

8-a.	Explain how virtual machines achieve isolation and resource sharing. Discuss the mechanisms used by hypervisors to manage these tasks.(CO5,K2)	10
8-b.	A disk has the following characteristics: Rotational latency: 4 ms Seek time: 10 ms (average)	10

Data transfer rate: 100 MB/s Calculate the total disk access time for a read operation. Assume that the disk has no additional overhead.Differentiate between HDD and SDD.(CO5,K3)