III B. Tech I Semester Regular/Supplementary Examinations, March - 2021

OPERATING SYSTEMS

(Common to Computer Science and Engineering, Information Technology)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A (14 Marks)

1. a) List out the popular types of Operating Systems. [2M]
   b) What are the components of a PCB block? [2M]
   c) Why do we need a page table? [2M]
   d) State the Critical Section problem. [3M]
   e) What is the best solution to external fragmentation problem? [3M]
   f) What are the main components of LINUX? [2M]

PART –B (56 Marks)

2. a) Explain the main purpose of an Operating System. [7M]
   b) Compare Serial processing and Batch Processing operating systems. [7M]

3. a) Describe the actions taken by a Kernel to context switch between processes. [7M]
   b) Consider the set of 6 processes whose arrival time and burst time are given below: [7M]

Process	Arrival Time	Burst Time
P1	0	4
P2	1	5
P3	2	2
P4	3	1
P5	4	6
P6	5	3

If the CPU scheduling policy is Round Robin with time quantum = 2. Draw a Gantt chart illustrating the execution of these jobs and calculate the average waiting time and average turnaround time.

4. a) Explain the five major activities of an operating system with regard to memory management. [7M]
   b) What is paging? Explain the steps involved in handling a page fault. [7M]
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5. Considering a system with five processes P0 through P4 and three resources of type A, B, C. Resource type A has 10 instances, B has 5 instances and type C has 7 instances. Suppose at time t0 following snapshot of the system has been taken: [14M]

Process	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 will be the content of the Need matrix?
ii) Is the system in a safe state? If Yes, then what is the safe sequence?
iii) What will happen if process P_1 requests one additional instance of resource type A and two instances of resource type C?

6. a) Explain the three allocation methods in file system implementation. Illustrate with a proper diagram. [7M]
   b) Explain and Compare the following disk scheduling algorithms: [7M]
      i) FCFS ii) SCAN iii) C-LOOK.

7. a) How do the four important Linux kernel modules work? Explain. [10M]
   b) Describe the features of Android. [4M]

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Code No: R1631055 **R16** SET - 2

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2. Answer **ALL** the question in **Part-A**
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PART –A **(14 Marks)**

1. a) What is a Kernel? [2M]
b) What is Context Switch? [2M]
c) What are the disadvantages of single contiguous memory allocation? [2M]
d) Write the differences between Semaphores and Monitors. [3M]
e) How do you solve internal and external fragmentation problems? [3M]
f) What is an Android? [2M]

PART –B **(56 Marks)**

2. a) List and explain the services provided by the operating system to the users/applications and the system. [7M]
b) In what mode system calls are executed? Explain the types of system calls in detail. [7M]

3. a) Describe the key components of process control block. [7M]
b) Four jobs to be executed on a single processor system arrive at time 0 seconds in the order A, B, C, D. Their burst CPU time requirements are 4, 1, 8, 1 time units respectively. Draw a Gantt chart illustrating the execution of these jobs using Shortest Remaining Time First scheduling algorithm and also Calculate the average waiting time and average turnaround time. [7M]

4. Consider the following page-reference string: [14M]
1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6
How many page faults would occur for FIFO, LRU and Optimal page replacement algorithms? Assuming three frames and all frames are initially empty.

5. a) Is the wait and signal operations on semaphores implemented as atomic operations? Justify your answer with proper explanation. [7M]
b) What is Readers-Writer's problem? Give a solution to Readers-Writers problem using Monitors. [7M]

6. a) Why do we need free space management? Explain various methods to achieve free space management. [7M]
b) Suppose the following disk request sequence (track numbers) for a disk with 100 tracks is given: 45, 20, 90, 10, 50, 60, 80, 25, and 70. Assume that the initial position of the R/W head is on track 50. Find out the additional distance that will be traversed by the R/W head when the Shortest Seek Time First (SSTF) algorithm is used compared to the SCAN (Elevator) algorithm (assuming that SCAN algorithm moves towards 100 when it starts execution). [7M]

7. a) Explain the core components of Linux operating system. [7M]
b) Discuss in detail about Android Runtime Application Development. [7M]

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Code No: R1631055 **R16** SET - 3

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PART –A (14 Marks)

1. a) "An interrupt is a system call". Explain. [2M]
   b) Why is inter-process communication needed? [2M]
   c) Compare logical address and Physical address. [2M]
   d) What are the various ways of aborting a process in order to eliminate deadlocks? [3M]
   e) Describe file attributes and file operations. [3M]
   f) List out the popular operating systems for mobile phones. [2M]

PART –B (56 Marks)

2. a) Define Operating System? Explain the key functions of an Operating System. [7M]
   b) Explain about monolithic Kernel operating system. [7M]

3. a) What is meant by Context Switch? How context switching is handled by Operating System? Explain with a neat diagram. [7M]
   b) Assume the following workload in a system: [7M]

Process	Arrival Time	Burst Time
P1	5	5
P2	4	6
P3	3	7
P4	1	9
P5	2	2
P6	6	3

Draw a Gantt chart illustrating the execution of these jobs using Shortest Remaining Time First scheduling algorithm and also Calculate the average waiting time and average turnaround time.

4. a) Discuss Segmentation in detail with hardware implementation and compare it with paging. [7M]
   b) A system uses 3 page frames for storing process pages in main memory. It uses the Optimal page replacement policy. Assume that three frames and all the page frames are initially empty. What is the total number of page faults that will occur while processing the page reference string given below? Also calculate the hit ratio and miss ratio. [7M]

4 , 7, 6, 1, 7, 6, 1, 2, 7, 2.
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5. a) State the Dining philosopher's problem and give a solution for the same using semaphores. [10M]
   b) A system is having 3 user processes P1, P2 and P3. Where P1 requires 21 units of resource R, P2 requires 31 units of resource R, P3 requires 41 units of resource R. Calculate the minimum number of units of R that ensures no deadlock. [4M]

6. a) Explain the following Disk scheduling algorithms: [9M]
      i) SSTF ii) C-SCAN iii) LOOK.
   b) Explain Indexed file allocation method. Also discuss its merits and demerits. [5M]

7. a) Explain in detail about various synchronization mechanisms in Linux Kernel. [10M]
   b) Discuss the two key components of Android runtime system. [4M]

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PART –A (14 Marks)

1. a) Difference between Firmware and Operating System. [2M]
   b) Why do we use multithreading? [2M]
   c) What is meant by Page fault? [2M]
   d) How can test and set instruction be used to implement mutual exclusion? [3M]
   e) What is disk scheduling? List the types of disk scheduling. [3M]
   f) Describe the features of LINUX that made it most popular. [2M]

PART –B (56 Marks)

2. a) Define an operating System and explain the types of operating systems. [7M]
   b) What is a system call? Explain any four types of system calls in detail. [7M]

3. a) What is a process? Draw five state process models and explain in detail about each state. [7M]
   b) Assume the following workload in a system: [7M]

Process	Arrival Time	Burst Time
P1	5	5
P2	4	6
P3	3	7
P4	1	9
P5	2	2
P6	6	3

Draw a Gantt chart illustrating the execution of these jobs using Shortest Job First scheduling algorithm and also Calculate the average waiting time and average turnaround time.

4. a) A system uses 3 page frames for storing process pages in main memory. It uses the Least Recently Used (LRU) page replacement policy assuming that three frames and all the page frames are initially empty. What is the total number of page faults that will occur while processing the page reference string given below? [7M]

4 , 7, 6, 1, 7, 6, 1, 2, 7, 2

Also calculate the hit ratio and miss ratio.

   b) What is the cause for Thrashing? How does the system detect thrashing? Once it detects thrashing, what can the system do to eliminate this problem? [7M]
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5. a) What is synchronization? Explain how semaphores can be used to deal with n-process critical section problem. [7M]
   b) Explain the various ways of aborting a process in order to eliminate deadlocks. [7M]

6. a) What is disk access time? Explain the factors influencing the selection of a disk scheduling algorithm. [10M]
   b) Consider a disk queue with requests for I/O to blocks on cylinders 98, 183, 41, 122, 14, 124, 65, 67. The FCFS scheduling algorithm is used. The head is initially at cylinder number 53. The cylinders are numbered from 0 to 199. Calculate the total head movement (in number of cylinders) incurred while servicing these requests. [4M]

7. a) How the Linux Kernel does handle interrupts? Explain. [7M]
   b) With a neat sketch, explain each and every component of Android architecture. [7M]

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