Question Paper

Exam Date & Time: 31-May-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH. (INFORMATION TECHNOLOGY) DEGREE EXAMINATIONS - MAY/JUNE 2023
SUBJECT: ICT 2258/IT-2258 OPERATING SYSTEMS

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

Missing data, if any, may be suitably assumed.

1A) Suppose a disk drive has 2000 cylinders numbered 0 to 1999. Consider a disk queue with request for read/write operations to blocks on cylinder: 125, 248, 1228, 434, 121,612, 728, 58, 1436, 888, 928. Assume that disk head is currently at cylinder 641, and the previous request was at cylinder 1369. With neat diagrams show the disk scheduling using LOOK, C-LOOK, SSTF algorithms. Calculate the total head movements and the average seek time for each of these disk scheduling algorithms. (5)

1B) Show the allocation of files in the disk space that has the capacity of 32 blocks (0-31) for the below allocation methods and directory structures. (3)

i) Contiguous allocation with directory structure given by Table 1B.

Table 1Bi

File Name	Start	Length
New.txt	12	3
OS.txt	19	6

ii) Global file allocation table is given by Table 1B ii, while directory structure is depicted in Table 1Biii.

Table 1Bii

0	25
5	20
10	5
15	30
20	-1
25	-1
30	-1
31	-1

Table 1Biii

File Name	start block
New.txt	10
OS.txt	0

1C) Consider the Table 1C with four processes and their arrival time, CPU burst length. (2)

Table 1C

Process	Arrival Time	CPU Burst Time
P1	0	6
P2	3	2
P3	5	4
P4	9	3

Calculate the average turnaround time of the processes if they are scheduled using SJF-non-pre-emptive algorithm. Show the Gantt chart for the processes.

2A) A system implements paging as described. The Logical address space is 64MB, frame size is 2KB. Number of frames in physical memory is 16. (5)
i) How many bits are required for the page offset?
ii) How many entries are there in the page table?
iii) What is the logical address for physical address 2000(decimal)
iv) What is the physical address for logical address 256(decimal)

2B) With a neat figure discuss contiguous, linked and indexed allocation for file. (3)

2C) Consider the segment table Table 2C. Calculate the physical address for each of the logical addresses, and mention if a trap is produced. (2)
i) . < 1 1800> ii) < 2 2000>

TABLE 2C

Segment	Base	Length
0	1952	96
1	660	248
2	1752	422

3A) A system uses 3 page frames for storing process pages in main memory. Assume that all the page frames are initially empty. Using FIFO, LRU and Optimal Page Replacement policies, what is the total number of page faults that will occur while processing the page reference string given below: (5)
4 , 7, 6, 1, 7, 6, 1, 2, 7, 2
Also calculate the hit ratio and miss ratio.

3B) What is the average access time for transferring 512 bytes of data with the following specifications: (3)
- Average seek time = 5 msec
- Disk rotation = 6000 RPM
- Data rate = 40 KB/sec
- Controller overhead = 0.1 msec

3C) Consider a logical address space of 64 pages of 1024 words each, mapped onto a physical memory of 32 frames. (2)
i) How many bits are there in the logical address?
ii) How many bits are there in the physical address?

4A) Consider a system with five processes P1 through P5 and three resource types A,B,C. Resource type A has 12 instances, B has 7 instances and type C has 8 instances. Suppose at time t_0 following snapshot of the system are given in Table 4A. (5)

Table 4A

Process	Allocation			Max		
	A	B	C	A	B	C
P1	0	2	0	7	5	3
P2	2	0	1	3	2	2
P3	4	0	2	9	0	2
P4	3	2	1	3	2	2
P5	1	1	2	4	3	3

i) Is the system in safe state? If yes, what is the safe sequence?
ii) Will the system remain to be in safe state if process P1 requests for additional 3 instance of resource type C and 2 instances of resource type B respectively?
iii) If process P5 requests an instance of A, 2 instances of B after step ii , then can the system be in safe state? If yes, write the safe sequence.

4B) Write any three responsibilities of Operating system in connection with process management and memory management. (3)

4C) A file system with 300GB uses a file descriptor with 8 direct block addresses, one indirect block address, 1 double indirect block address. The size of each disk block is 128bytes. The size of each disk block address is 8bytes. Find the maximum possible file size. (2)

5A) Illustrate with a pseudocode example, how the race condition will occur in process synchronization. (5)

5B) What is the main difficulty that a programmer must overcome in writing an operating system for a real-time environment? Justify with a suitable example. (3)

5C) What resources are used when a thread is created? How do they differ from those used when a process is created? (2)

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