B.E. Computer Science and Engineering Third Year First Semester Examination 2024

Time: 3 hours **Full Marks: 100**

OPERATING SYSTEM

Group A [Total Marks: 30]

Question no. 1 is COMPULSORY

[A (CO1:5), B (CO2:5), C (CO3:5), D (CO4:5), E (CO5:10)]

1.

A) How will you map operating system to a computer system? How does microkernel differ from monolithic kernel?

B) Why is *busy waiting* termed as *busy*? When does *page fault* occur?

C) The following disk requests are received by the disk controller at the same time [Disk requests come in the form {sector number, cylinder number, platter number}]:

[150, 98, 0], [120, 37, 4], [160, 14, 1], [202, 124, 3], [236, 65, 5], [138, 67, 2]

Currently head is positioned at sector number 100 of cylinder 32. Using First Come First Served (FCFS), find out the no. of times the direction of the move changes.

D) Construct the *capability list* using the following information: <Domain, Object, right-set> as given below: {D1,O1, read & execute}, {D1, O3, execute}, {D1, D2, switch}, {D2,O1, write}, {D2, O2, write & execute}, {D2, O4, execute}, {D2, D1, switch}, {D3,O2, execute}, {D3, O3, write}, {D3, D2, switch}

E) How is filesystem organized in Unix? What is inode (Unix) and what are its contents?

Group B [CO2: Total Marks: 30]

Answer Question No. 2 (Compulsory)

Answer Question No. 3 OR Question No. 4.

2. [4+2+4+5=15]

A) What are the requirements for the solution of *critical-section problem*?

B) What are the contents of Process Control Block (PCB)?

C) How does SCAN disk scheduling technique work? Compare SCAN with CSCAN.

D) Which free space management (disk) technique/s would be suitable for Contiguous file allocation technique? Justify your answer.

(Page 2: Group B contd.)

3. [(4+2)+2+2+2+(1+2)=15]

A) (i) Consider a system with four processes as shown below with corresponding arrival time and execution time:

Process	Arrival time	Execution time
P_0	0	6
P_1	2	4
P_2	5	7
P_3	8	4

Calculate waiting time and turnaround time of each process using *Shortest Job First (SJF)* scheduling policy. Show the scheduling decisions using Gantt chart. Mention any assumption/s that you take.

(ii) What are the implementation difficulties with SJF scheduling?

B) Why is *thread* referred to as lightweight process?

C) What is *compaction*?

D) Why do you think you need *monitors* to solve some synchronization problems while some others can be solved with *semaphores*?

E) What are the problems with *Contiguous File allocation* technique? How is this problem dealt with in *Linked file allocation* technique?

4. [(4+2)+3+2+(2+2)=15]

A) (i) Consider a system with four processes as shown below with corresponding arrival time and execution time:

Process	Arrival time	Execution time
P_0	0	6
P_1	2	4
P_2	5	7
P_3	8	4

Calculate waiting time and turnaround time of each process using *First Come First Served (FCFS)* scheduling policy. Show the scheduling decisions using Gantt chart. Mention any assumption/s that you take.

(ii) What are the problems with FCFS scheduling?

B) How can *deadlock* be prevented by not allowing the *Hold and Wait* condition? What are the problems with that situation?

C) Will the number of blocks (in secondary memory) required be same for a file allocated through (i) linked file allocation technique, (ii) indexed allocation technique? Justify your answer.

(Page 3 Group B Q4 Contd.)

D) How can sharing be achieved in *Segmentation* memory management scheme? How is the sharing different from *Paging* memory management?

Group C [CO3: Total Marks: 30]
Answer Question No. 5 OR Question No. 6.

5. [(3+3+2)+(2+3)+4+8+5=30]

A) For 3 page frames consider the following reference string:

7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1

How many page faults does the Least Recently Used (LRU) page replacement algorithm produce? What will be the number of page faults if number of page frames is increased to 4? Comment on your findings. Justify properly.

B) What are the causes of *thrashing*? How can you relate *locality of reference* and *working set model*?

C) How is *inverted page table* implemented? What is the advantage? What may be the disadvantage?

D) Consider the current *Allocation matrix* for 4 processes with 2 types of resources:

P1: (1, 3); P2: (4, 1); P3:(1, 2) and P4: (2, 0)

and the pending *Request matrix*: P1: (1, 2); P2: (3, 3); P3: (1, 7) and P4: (5, 1)

with *Availability Vector* as: R1(1), R2(4)

Find out whether the request of P2 can be granted and show the steps of the Banker's and other resource allocation algorithms that you use to arrive at your answer.

E) Disk requests come into the disk driver for cylinders [210, 151,6] ,[190, 223,4], [120,128,3], [150,109,5], [100,238,5], [120,142,1], [135,243,2] in that order. A seek takes 1.5 msec per cylinder move. What is the total seek time to execute all requests for the following disk scheduling policies: (i) Shortest Seek Time First and (ii) C-SCAN (initially moving up from cylinder 0 towards cylinder 299). In all cases disk arm is initially at cylinder 117. Assume the disk arm flies back to cylinder 0 at a rate of 0.5 msec per cylinder. Compare the seek times and comment.

6. [(3+3+2)+3+3+3+8+5=30]

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

For First in First Out (FIFO) page replacement algorithms with 3 frames, what is the number of page faults? What will be the number of page faults if number of page frames is increased to 4? Comment on your findings. Justify properly.

(Page 4: Group C Q6 contd.)

B) What are the similarities and/or differences between *Many to many* multithreading model and *Two-level* multithreading model?

C) How is kernel memory allocated using *slab allocation technique*?

D) How is the logical address interpreted in *Paged Segmentation* scheme?

E) Consider the current *Allocation matrix* for 4 processes with 2 types of resources:

P1: (1, 3); P2: (4, 1); P3:(1, 2) and P4: (2, 0)

and the pending *Request matrix*: P1: (1, 2); P2: (3, 3); P3: (1, 7) and P4: (5, 1)

with *Availability Vector* as: R1(1), R2(4)

Find out whether the request of P3 can be granted and show the steps of the Banker's and other resource allocation algorithms that you use to arrive at your answer.

F) Disk requests come into the disk driver for cylinders [210, 151,6] ,[190, 223,4], [120,128,3], [150,109,5], [100,238,5], [120,142,1], [135,243,2] in that order. A seek takes 2 msec per cylinder move. What is the total seek time to execute all requests for the following disk scheduling policies: (i) First Come First Served (FCFS) and (ii) LOOK (initially moving up from cylinder 0 towards cylinder 299). In all cases disk arm is initially at cylinder 117. Assume the disk arm flies back to cylinder 0 at a rate of 0.5 msec per cylinder. Compare the seek times and comment.

Group D [CO4: Total Marks: 10]

Answer Any 2(Two) Questions from the following

7. [5X2=10]

A) What is *Access Matrix*? What are the different implementations of *Access Matrix*?

B) What do you mean by *domain*? What does *Capability list* specify?

C) Differentiate between *Symmetric Key Cryptosystem* and *Asymmetric Key Cryptosystem*.

D) What is *Access control*? What is *Access Control list*?