

Bachelor Level/ Second Year/ Third Semester/ Science  
**Computer Science and Information Technology (Csc. 203)**  
(Operating System)

Full Marks: 60  
Pass Marks: 24  
Time: 3 hours

*Candidates are required to give their answers in their own words as far as practicable.*  
The figures in the margin indicate full marks.

**Section A**

**Attempt any two questions:**

(2x10=20)

1. Define the term semaphore. How does semaphore help in dining philosophers problem?
2. Explain how file allocation table (FAT) manages the files. Mention the merits & demerits of FAT system. A 200 GB disk has 1-KB block size, calculate the size of the file allocation table if each entry of the table to be 3 bytes.

**OR**

Suppose that a disk has 100 cylinders, numbered 0 to 99. The drive is currently serving a request at cylinder 43, & previous request was at cylinder 25. The queue of pending request, in FIFO order is:

86, 70, 13, 74, 48, 9, 22, 50, 30

starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all pending request for each of the following disk scheduling algorithms?

- a) FCFS
  - b) SCAN
3. Write short notes on:
    - a) Least recently used page replacement algorithm
    - b) Segmentation
    - c) Associative memory

**Section B**

**Attempt any eight questions:**

(8x5=40)

4. What is an operating system? Differentiate between time sharing & real time operating system.
5. Why thread is necessary? In which circumstances user-level thread is better than Kernel level thread?
6. Explain about hierarchical directory systems with diagrammatic examples.
7. How can you define the term process scheduling? Differentiate between I/O bound process & CPU bound process.
8. A system has two process & 3 resources. Each process needs a maximum of two resources, is deadlock possible? Explain with answer.
9. What do you mean by interrupt? Explain the working mechanism of interrupt controller.
10. Define the term indefinite postponement. How does it differ from deadlock?
11. Explain the mapping of virtual address to real address under segmentation. Compare the throughput (overall performance) of SCAN with SSTF.

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**Section A**

**Attempt any two questions:**

(2x10=20)

1. What is System Calls? Explain the system call flow with the help of a block diagram.

**OR**

What do you mean by file systems? What are the major difference between file system interfaces & file system implementation? Explain.

2. Write short notes on:

- a) Disk Scheduling Algorithms.
- b) Error Handling & Formatting.
- c) File Operations.

3. 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. How many page faults would occur for the LRU replacement, FIFO replacement & optimal replacement algorithms? Assuming three, five or seven frames? Remember all frames are initially empty, so your first unique pages will all cost one fault each.

**Section B**

**Attempt any eight questions:**

(8x5=40)

- 4. Differentiate between personal computer operating systems & mainframe operating systems.
- 5. When do page fault occur? Describe the actions taken by an OS when a page fault occurs.
- 6. List four necessary conditions for deadlock. Explain each of them briefly what would be necessary (in the operating system) to prevent the deadlock.
- 7. Draw & describe the 3-state process model.
- 8. Does window have any concept of process hierarchy? How does parent control the child?
- 9. What is the problem with thread implementation in user space when any of the threads get blocked while performing I/O operation?
- 10. Explain why two level & scheduling is commonly used.
- 11. What are the main motivations & issues in primary memory management?
- 12. Explain the disk management with example.

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**Section A**

**Attempt any two questions:**

(2x10=20)

1. List the essential properties for the Batch-Oriented and Interactive operating system. For each of the following application which system (Batch or Interactive) is more suitable? State the reason.
  - a) Word processing.
  - b) Generating monthly bank statements
  - c) Computing pi to milling decimal places
  - d) A flight simulator
  - e) Generating mark statement by University

**OR**

"Using Semaphore is very critical for programmer" Do you support this statements? If yes, prove the statement with some fact. If not, put your view with some logical facts against the statement."

2. Round-robin scheduling behaves differently depending on its time quantum. Can the time quantum be set to make round-robin behave the same as any of the following algorithms?  
If so how? Proof the assertion with an example.
  - a) FCFS
  - b) SJF
  - c) SRTN
3. A disk has 8 sectors per track and spins at 600 rpm. It takes the controller time 10 ms from the end of one I/O operation before it can issue a subsequent one. How long does it take to read all 8 sectors using the following interleaving system?
  - a) No interleaving
  - b) Single interleaving
  - c) Double interleaving

**Section B**

**Attempt any eight questions:**

(8x5=40)

4. What is critical section problem? Why executive critical section must be exclusive? Explain.
5. What must user program be prohibited from writing to the memory locations containing the interrupt vector?
6. What are the difference between the trap and interrupt? What is the use of each function?
7. What is deadlock? State the conditions necessary for deadlock to exit. Give reason, why all conditions are necessary.
8. A Computer with 32-bit address uses a two-level table. Virtual address are split into a 9-bit top level page table field, 11-bit second-level page table field and offset. How large the pages? How much maximum space required when page tables loaded into memory of each entry required 4 byte.
9. What do you mean by memory fragmentation? Distinguish between the internal and external fragmentation.
10. Under what circumstances do page fault occur? Describe the action taken by operating system when page fault occurs.
11. How many bits would be needed to store the free-space list under the following condition if a bitmap were used to implement?
  - a) 500,000 blocks total and 200,000 free blocks.
  - b) 1,000,000 blocks total and 0 free blocks.
12. Which one suited, polling/interrupt, for the following types of system? Give reason.
  - a) A system dedicated to controlling single I/O devices.
  - b) A work station running as heavily used web server.

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**Section A**

**Attempt any two questions:**

(2x10=20)

1. Define the essential properties of following types of operating systems.
  - a) Batch
  - b) Interactive
  - c) Time Sharing
  - d) Real Time
  - e) Handheld

**OR**

Why some process requires high priority? What would happen if all processes have same priority? Mention merits and demerits of assigning priority on process.

2. Given references to the following pages by a program,  
0, 9, 0, 1, 8, 1, 8, 7, 8, 7, 1, 2, 8, 2, 7, 8, 2, 3, 8, 3  
How many page faults will occur if the program has three page frames for each of the following algorithms?
  - (a) FIFO
  - (b) Optimal
  - (c) Second Chance
  - (d) LRU
3. For the processes listed in following table, draw a Gantt chart illustrating their execution and calculate the average waiting time using:
  - a) First-Come-First-Serve
  - b) Shortest-Job-First
  - c) Shortest-Remaining-Time-Next
  - d) Round-Robin (quantum = 2)
  - e) Round-Robin (quantum= 1)

<u>Processes</u>	<u>Arrival Time</u>	<u>Burst Time</u>
A	0.00	4
B	2.01	7
C	3.01	2
D	3.02	2

**Section B**

**Attempt any eight questions:**

(8x5=40)

4. Explain Peterson's concept for the solution of critical section problem.
5. Show how sleep and wakeup solution is better than busy waiting solution for critical section problem.
6. Describe how multithreading improves performance over a single-threaded solution.
7. Explain how priority scheduling works. In how many ways priority can be assigned?
8. What do you mean by deadlock prevention? Mention the mechanism for deadlock prevention.
9. Two separate systems, one implemented in bitmap and another in linked list to manage the fragmentation of 256 MB memory. For bitmap, allocation units are of 512 bytes. For linked list, each holes or segments are of 32KB, and each node in the list needs a 32 bits. How many bytes of storage is required for each method? Which one is better in terms of memory space required?
10. Distinguish between paging and segmentation. Why many systems use the combination of both?
11. Compare bitmap and linked list implementation of disk free-space management. How much space is required in memory to store bitmap for 20GB hard disk with 2KB block size?
12. How does DMA increase system concurrency? How does it complicate the hardware design?

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**Section A**

**Attempt any two questions:**

(2x10=20)

- For the processes listed in following table, draw a Gantt chart illustrating their execution using:
  - First-Come-First-Serve
  - Shortest-Job-First
  - Shortest-Remaining-Time-Next
  - Round-Robin (quantum = 2)
  - Round-Robin (quantum= 1)

<u>Processes</u>	<u>Arrival Time</u>	<u>CPU Time</u>
A	0.000	3
B	1.001	6
C	4.001	4
D	6.002	2

What is the turnaround time for each algorithm?

**OR**

What do you mean by disk management? What the major difference between error handling and formatting.

- How many page faults occur for each of the following page replacement algorithms for the reference string 0 1 7 2 3 2 7 1 0 3 with four page frames and eight pages. Suppose all frames are initially empty.
  - Optimal replacement
  - FIFO replacement
  - LRU replacement
  - Clock replacement
- Suppose that the disk drive has 50 cylinders, numbered from 0 to 49. The drive currently serving the request at cylinder 20 and the previous request was at cylinder 25. The queue of pending request is 10, 22, 20, 2, 40, 6 and 38 in the order. A seek takes 6msec per cylinder moved. How much seek time is needed for the following disk-scheduling algorithms?
  - First-Come, First-Served
  - Shortest Seek Time First
  - SCAN
  - LOOK

**Section B**

**Attempt any eight questions:**

(8x5=40)

- Define the essential properties of following types of operating systems.
  - Batch
  - Interactive
  - Time sharing
  - Real time
  - Handheld
- Describe how multithreading improve performance over a singled-threaded solution.
- “Using Semaphore is very critical for programmer”. Do you support this statement? If yes. Prove the statement with some fact. If not. Put your view with some logical facts against the statement.
- Students working at individual PCs in a computer laboratory send their files to be printed by a server which spools the files on its hard disk. Under what conditions may a deadlock occur if the disk space for print spool is limited? How many the deadlock be avoided?
- What are Segmentation and Paging? Why they are sometimes combine into one scheme?
- What are the differences between the trap and interrupt? What is the use of each function?
- What is “device independence”? Define.
- Explain how file allocation table (FAT) manage the files. Mention the merits and demerits of using FAT.
- Write short notes on (any two):
  - System programs
  - Race condition
  - Windows file system

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**Section A**

**Attempt any two questions:**

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1. How thread based execution minimizes the context switching problem of process based execution? Explain the different multithreading model.
2. What is page fault? Consider the following page reference string; 3, 3, 5, 4, 7, 1, 5, 5, 1, 4, 3, 7, 6, 3, 4, 1. How many page faults would occur for each of the following page replacement algorithms assuming 4 page frames?
  - a) LRU page replacement
  - b) FIFO page replacement
  - c) Optimal page replacement
  - d) Clock replacement
3. Suppose the head of a moving- head disk with 200 tracks, numbered 0 to 199 is currently serving request at tracks 143 and has finished a request at track 125. The queue it requests is kept in the FIFO order 86, 147, 91, 177, 94, 150, 102, 175, 130. What is the total head movement needed to satisfy these request for the following disk-scheduling algorithms?
  - i. FCFS
  - ii. SSTF
  - iii. SCAN
  - iv. LOOK

**Section B**

**Attempt any eight questions:**

(8x5=40)

4. How operating is as a resource manager? Explain.
5. For each of the following transitions between the processes states, indicate whether the transition is possible. If it is possible, give an example of one thing that would cause it.
  - a) Running -> Ready
  - b) Running -> Blocked
  - c) Blocked -> Running
6. Define file and directories. Explain about protection mechanism.
7. Differentiate between internal and external fragmentation with example.
8. What are the segmentation and paging? Why they are combined into one scheme?
9. What is DMA? Explain how it works.
10. What do you understand by deadlock detection and recovery? Discuss.
11. Explain how file allocation table (FAT) manage the files. Mention the merits and demerits of using FAT.
12. Write short notes: (Any two)
  - a) Best Fit vs. Worst Fit
  - b) Swapping
  - c) Semaphores

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**Section A**

**Attempt any two questions:**

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1. What is race condition? Calculate Average Waiting and Average Turnaround time of the given set of processes in table below using SJF and RR scheduling algorithm. [Note: Quantum time for RR = 3]

Process id	Arrival Time	Execution Time
A	0	8
B	2	14
C	9	19
D	19	7
E	25	15

2. What is deadlock? Explain various conditions for deadlock. Discuss the Bankers algorithm of multiple resources for avoidance of deadlock with suitable example.
3. How physical address is generated from logical address? Explain the process of system call with suitable diagram.

**Section B**

**Attempt any eight questions:**

(8x5=40)

4. What is an operating system? Differentiate between time sharing and real time operating system.
5. How does process differ from program? Explain process state with the help of block diagram.
6. Explain how multithreading improve performance over a single threaded solution.
7. Describe how Peterson's solution preserve mutual exclusion in process CR execution.
8. Given a references to the following pages by program,  
1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.  
How many page faults will occur if the program has three page frames available to it and uses LRU replacement?
9. What is deadlock? State the conditions necessary for deadlock to exist. Give reason, why all conditions are necessary.
10. What is Fragmentation? Differentiate between internal and external fragmentation.
11. How does DMA increase system concurrency? How does it complicate hardware design?
12. Write short notes on:
- (a) Disk formatting
  - (b) Memory Mapped I/O

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