**Nagarjuna College of Information Technology**

**Full Marks: 60**

**Pass Marks: 30**

**Time: 3 hrs.**

**Shankhamul -09, Lalitpur**

**SET - A**

**Pre-Board Examination 2080**

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| **BIM / Fourth Semester / IT 241: Operating System** |

***Candidates are required to answer the questions in their own words as far as possible.***

**Group A**

**Brief answer questions:**

**Attempt all questions. (10 × 1=10)**

1. What is the primary purpose of an operating system?
2. Name one method for implementing mutual exclusion with busy waiting.
3. What is the key characteristic of FCFS scheduling?
4. What information does Banker's Algorithm use?
5. What is the difference between logical and physical memory addresses?
6. What happens during a page fault?
7. What is the purpose of file naming?
8. What device connects I/O devices to the CPU and manages data transfer?
9. What is a common security problem in operating systems?
10. What is one advantage of distributed systems compared to centralized ones?

**Group B**

**Short Answers Questions**

**Attempt any *FIVE* questions. (5 × 3= 15)**

1. Differentiate between user-level threads and kernel-level threads.
2. Briefly describe the four necessary conditions for deadlock.
3. Compare and contrast fixed-partition and variable-partition memory allocation strategies.
4. **Differentiate between single-level and hierarchical directory systems, explaining how they organize files and directories.**
5. Discuss different I/O techniques: programmed I/O, interrupt-driven I/O.
6. Explain the difference between authentication and authorization in the context of operating system security.

**Group C**

**Long Answer Questions**

**Attempt any *THREE* questions. (3× 5= 15)**

1. Define the concept of lock variables in the context of implementing mutual exclusion. Discuss how lock variables are used to coordinate access to shared resources in concurrent programming.
2. A system uses 3 page frames for storing process pages in main memory. It uses the Least Recently Used (LRU) page replacement policy. Assume that 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- 4 , 7, 6, 1, 7, 6, 1, 2, 7, 2 Also calculate the hit ratio and miss ratio.
3. Briefly explain why use to control access to resources in an operating system.
4. There are five memory holes available with the following sizes: 100 KB, 200 KB, 300 KB, 400 KB, and 500 KB. Three processes need memory allocation:

* Process A: 212 KB
* Process B: 417 KB
* Process C: 112 KB

Using the first-fit, best-fit and worst-fit algorithm, allocate memory to each process and specify the remaining memory in each hole (if any). Explain which fit algorithm is good and why?

**Group D**

**Comprehensive Questions**

**Attempt all question. (2 × 10 = 20)**

1. Define the term seek time and rotational delay in disk scheduling. Suppose that the disk has 100 cylinders, numbered 0 to 99. The drive is currently serving a request at cylinder 43 and previous request was at cylinder 25. The queue of pending request, in FIFO order is: 86, 70,13,74,48,9,50,30 Starting from current head position, what is total distance (in cylinders) that the disk arm moves to satisfy all pending request for each of following disk scheduling algorithms?

a) FCFS  
b) SSTF  
c) SCAN  
d) LOOK

1. Write CPU Scheduling criteria. For the processes listed in following table, draw Gantt chart illustrating their execution and calculate average waiting time and turnaround time using.  
   a) First come First Serve  
   b) Shortest Remaining Time Next  
   c) Priority  
   d) Round Robin (quantum = 1sec)

|  |  |  |  |
| --- | --- | --- | --- |
| Processes | Arrival Time | Brust Time (sec) | Priority |
| A | 0.00 | 7 | 3 |
| B | 2.01 | 7 | 1 |
| C | 3.01 | 2 | 4 |
| D | 3.02 | 2 | 2 |

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**SET - B**

**Pre-Board Examination 2080**

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| **BIM / Fourth Semester / IT 241: Operating System** |

***Candidates are required to answer the questions in their own words as far as possible.***

**Group A**

**Brief answer questions:**

**Attempt all questions. (10 × 1=10)**

1. Explain the concept of a "test and set" lock in synchronization.
2. Name one of the earliest operating systems and mention its key feature.
3. Explain the three main approaches to handling deadlocks: prevention, avoidance, and detection & recovery.
4. What is the difference between logical and physical memory addresses?
5. **What is a page table, and what purpose does it serve in the paging process?**
6. **What is the main disadvantage of using bitmaps for free space management?**
7. What is the main purpose of I/O software?
8. What is the basic role of a DMA controller in enhancing I/O performance?
9. What is the term for unauthorized access to a computer system or its resources?
10. What is a key advantage of a DOS compared to a centralized OS?

**Group B**

**Short Answers Questions**

**Attempt any *FIVE* questions. (5 × 3= 15)**

1. Examine the layered structure of operating systems. Discuss two advantages of using a layered approach in designing operating system structures.
2. How does strict alternation ensure fairness in granting access to the critical section?
3. Describe the Resource Allocation Graph (RAG) and explain how it can be used to detect deadlocks in a system. Illustrate your explanation with a simple example.
4. Explain the key differences between monoprogramming and multiprogramming and discuss the benefits of the latter.
5. **Explain two methods used for file allocation (contiguous allocation and linked list allocation) and highlight their key differences.**
6. Discuss the concept of remote file access in a distributed system and its challenges compared to local file access.

**Group C**

**Long Answer Questions**

**Attempt any *THREE* questions. (3× 5= 15)**

1. Explain the concept of "safe state" in deadlock detection. Describe two methods for recovering from a deadlock situation.
2. Define I/O management system with memory mapped I/O . Consider a disk queue with requests for I/O to blocks on cylinders 82,170,43,140,24,16,190. The head is initially at cylinder number 50 moving towards larger cylinder numbers on its servicing pass. The cylinders are numbered from 0 to 199. Find The total head movement (in number of cylinders) incurred while servicing these requests in following disk scheduling algorithms.

a)FCFS b)SSTF

1. Consider the page reference string of size 12: 1, 2, 3, 4, 5, 1, 3, 1, 6, 3, 2, 3 with frame size 4(i.e. maximum 4 pages in a frame).  
   How many page faults will occur if the program has four page frames for each of following algorithms?

(a) FIFO (b) LRU

1. A system has two process & 3 resources. Each process needs a maximum of two resources, is deadlock possible? Explain with answer.

**Group D**

**Comprehensive Questions**

**Attempt all question. (2 × 10 = 20)**

1. Given the following set of processes, calculate the average waiting time and average turnaround time using the following scheduling algorithms:

* First come first serve
* Shortest job first
* Priority (smaller number higher priority

|  |  |  |  |
| --- | --- | --- | --- |
| Process Id | Arrival Time | Burst Time | Priority |
| P1 | 0 | 4 | 2 |
| P2 | 1 | 3 | 3 |
| P3 | 2 | 1 | 4 |
| P4 | 3 | 5 | 5 |
| P5 | 4 | 2 | 5 |

* Round Robin (quantum = 1 sec)

1. Consider the following snapshot of a system.

Process\_no Allocation Max Available

A B C D A B C D A B C D

P0 1 0 1 2 2 1 2 3 1 2 1 1

P1 0 1 2 1 1 2 3 1

P2 1 2 1 0 2 3 2 1

P3 2 1 0 1 3 2 1 2

Answer the following questions using banker's algorithm.

a) What is the content of the matrix need ?

b) Is the system in a safe state?

c) If a request from process P1 arrives for (0, 2, 1, 0), can the request be granted immediately?