KATHMANDU UNIVERSITY
End Semester Examination
January/February 2024

26 JAN 2024

Level : B.E/B.Sc.
Year : III
Time : 2 hrs. 30 mins.

Course : COMP 307
Semester : I
F.M. : 40

SECTION "B"
[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. You're assigned to work in an operating system for a real-time distributed system in an organization. Highlight the role of system calls, system programs, and the system structure in this context. Additionally, discuss the significance of a virtual machine in ensuring smooth operation across diverse hardware.

2. Consider a multi-threaded application with two threads, Thread A and Thread B, sharing a common resource. Both threads need access to the resource to perform their tasks. Thread A has a higher priority than Thread B.
   a. Discuss the potential issues that may arise in this scenario related to process scheduling and resource sharing. [2]
   b. Propose a synchronization mechanism to address the issues identified and explain the advantages and disadvantages of your proposed synchronization mechanism. [2]

3. Consider the set of 5 processes whose arrival time and burst time are given below:

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

If the CPU scheduling policy is priority preemptive, calculate the average waiting time and average turnaround time, along with the Gantt chart. (Note: ***Higher number represents higher priority***).

OR

Consider a system with four processes P1 to P4 and four resource types A, B, C and D. Resource type A has 7 instances, resources type B has 6 instances, resources type C has 9 instances and resource type D has 5 instances. At time T0, the system has following matrix of allocation and requirements

Allocation

	A	B	C	D
P1	1	1	1	1
P2	2	0	1	0
P3	2	0	2	2
P4	0	2	1	1

Max

	A	B	C	D
P1	3	1	3	1
P2	2	4	3	2
P3	5	4	2	2
P4	0	3	4	1

At time T1 process P3 made a request for (2, 2, 0, 0) resources. After granting this request, determine whether the system will still be in safe state? Justify your answer.

4. Explore the concept of deadlock recovery in an operating system. Discuss the trade-offs involved in choosing between various recovery strategies, such as process termination and resource preemption.

5. Compare and contrast contiguous allocation and paging as memory allocation strategies. Highlight the key differences, advantages, and disadvantages of each approach in managing memory space.

6. Write in brief about memory mapped I/O and Direct Memory Access.

7. Differentiate between parallel system and distributed system in terms of computing.

SECTION "C"

[2Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. a. Name and describe each of the four necessary conditions for deadlock and illustrate with an example from the dining philosophers problem with an appropriate pseudo code. [3+2]

   b. Describe the various I/O interfaces used in modern operating systems and compare the advantages and disadvantages of these I/O interfaces. [3]

9. a. Discuss in brief about file implementation techniques in computer systems. [3]

   b. Compare and contrast the advantages and disadvantages of demand paging in terms of system responsiveness, resource utilization, and overall efficiency. [2]

   c. Which page replacement algorithm will be better in the following sequence of page requests among FCFS and LRU. [3]
   1 4 3 2 5 7 3 4 1 4 6 7

10. a. Explain Semaphore with a suitable real time example and algorithm. [4]

    b. Implement Bankers' Algorithm where there are 3 resources A, B and C of instances 5, 7 and 4 respectively having the following max and allocation matrix. [4]

Process	Allocation(A,B,C)	Max (A,B,C)
p1	1 2 1	3 3 3
p2	0 0 1	1 2 1
p3	2 1 1	3 2 2
p4	1 1 0	4 2 2
p5	0 2 0	5 5 4

Can Request (1,1,2) by P4 be granted?

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Registration No.:

Date :

SECTION "A"

[20Q. × 0.5 = 10 marks]

Encircle the most appropriate answer.

1. Page replacement algorithm implements the concept of _____ to mitigate page fault ratio.
   a. random access
   b. demand paging
   c. locality of reference
   d. thrashing

2. Which of the following page replacement algorithm has the Belady's abnormality?
   a. FCFS
   b. Optimal
   c. LRU
   d. LFU

3. What could be the constraint of compaction for removing external fragmentation?
   a. Double buffering
   b. I/O response
   c. Kernel buffering
   d. I/O buffering

4. Which of the following can partly reduce external fragmentation?
   a. Paging
   b. Segmentation
   c. Contiguous allocation
   d. None of the mentioned

5. _____ points address of page table in a memory.
   a. Stack pointer
   b. Program counter
   c. Offset register
   d. Page table base register

6. Information about which of the following is not stored in the page table.
   a. Page offset
   b. Base address of each page
   c. Reference bit
   d. Page size

7. What is the main objective of the disk scheduling algorithm?
   a. Minimize disk latency
   b. Minimize seek time
   c. Minimize rotational latency
   d. Minimize seek time and rotational latency

8. Site and link failures in distributed systems are detected by _____.
   a. Hand shaking
   b. Token passing
   c. Polling
   d. Interrupt

9. Users are not aware about the multiplicity of machines in ____.
   a. network OS
   b. both Distributed and Network system
   c. distributed System
   d. grid System

10. Computational migration in distributed Operating system transfer computation across the system through _____.
    a. remote procedure calls
    b. messaging system
    c. load balancing techniques
    d. either RPC or messaging system

11. Logical and physical memory are same in _____
    a. Load and Dynamic address binding techniques
    b. Compile and Symbolic binding techniques
    c. compile and load time address binding techniques
    d. Relocatable address binding techniques

12. Swap memory exists in ____.
    a. Primary memory b. Cache c. RAM d. Secondary memory

13. In the Round Robin algorithm, if quantum size is very small then it can _____.
    a. increase context switching
    b. decrease context switching
    c. increase CPU utilization
    d. enhance I/O jobs.

14. Process executes its instruction in ____ state.
    a. Ready b. Running c. Waiting d. new

15. _____ invokes system calls in the OS kernel.
    a. System call interface
    b. System libraries
    c. Dynamic link libraries
    d. Compiler

16. _____ system structure moves operations from kernel to user space.
    a. Modular b. Layered c. Unix d. Microkernel

17. Total seek time of SCAN(toward the larger) in the request pattern of 16, 24,43,82, 140 and 170 with arm at 45 in the disk is ____
    a. 332 b. 337 c. 339 d. 398

18. In the context of scheduling terminologies, which of the following is true?
    a. WT= TAT+BT b. WT=CT-BT-AT c. WT=CT-BT d. WT=CT-AT

19. Among FCFS, RR with Quantum size of 3 and SJF based on average waiting time, ___ is better in the following process sequence.
    Arrival time sequence: 0, 1, 3
    Burst time sequence: 5, 7, 4
    a. FCFS b. RR c. SJF d. RR and SJF

20. This section contains global and static variables of PCB.
    a. Data b. Heap c. Stack d. Text