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RAMAIAH Institute of Technology

(Autonomous Institute, Affiliated to VTU)
(Approved by AICTE, New Delhi & Govt. of Karnataka)
Accredited by NBA & NAAC with 'A+' Grade

SEMESTER END EXAMINATIONS – AUGUST 2024

Program : **B.E. – CSE (Cyber Security) / CSE (Artificial Intelligence and Machine Learning)**
Semester : **IV**
Course Name : **Operating Systems**
Max. Marks : **100**
Course Code : **CY45 / CI45**
Duration : **3 Hrs**

Instructions to the Candidates:

- Answer one full question from each unit.

UNIT - I

1. a) Define operating system and list the basic services provided by operating system. CO1 (10)
   b) Explain layered approach of OS. Mention its advantages and disadvantages. CO1 (06)
   c) Differentiate between API and system call. CO1 (04)

2. a) Differentiate between multiprogramming and time sharing system. CO1 (06)
   b) Describe dual mode operation of computer system with neat diagram. CO1 (08)
   c) Illustrate how the operating system has been evolved from serial Processing to multiprogramming system. CO1 (06)

UNIT - II

3. a) Consider the following set of processes, with the length of the CPU burst given in milliseconds: CO2 (07)

Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	3
P4	1	4
P5	5	2

The processes are assumed to have arrived in the order P1, P2, P3, P4, Ps, all at time 0.

i. Draw four Gantt charts that illustrate the execution of these processes using the following scheduling algorithms: FCFS, SJF, nonpreemptive priority (a smaller priority number implies a higher priority), and RR (quantum= 1).

ii. What is the turnaround time of each process for each of the scheduling algorithms in part i?

   b) What resources are used when a thread is created? How do they differ from those used when a process is created? CO3 (07)
   c) With a neat diagram, illustrate the process state diagram and explain each state. CO3 (06)

4. a) Illustrate with an example the multilevel feedback queue scheduling algorithm. CO2 (07)
   b) Describe inter-process communication using message passing model. CO3 (07)
   c) Draw a process control block (PCB) and explain each field. CO3 (06)

UNIT - III

5. a) Consider the following set of co-operative concurrent processes P0, P1, P2, P3 sharing a common resource R1. Propose a solution to solve the critical section problem using hardware instruction Test&set ( ). Justify that the proposed solution will satisfy all the necessary requirement to solve the critical section problem. CO3 (08)

   b) Solve Bounded buffer problem by using semaphores. CO3 (07)

   c) Differentiate between unsafe state and dead lock state. Describe the necessary conditions for a deadlock situation to occur. CO3 (05)

6. a) With an example illustrate how resource allocation graphs can be used to detect deadlock. CO3 (05)

   b) Considering a system with five processes P0 through P4 and three resources of type A, B, C. Resource type A has 10 instances, B has 5 instances and type C has 7 instances. Suppose at time t0 following snapshot of the system has been taken as show in table 6 (b): CO3 (08)

Process	Allocation	Max	Available
	A B C	A B C	A B C
P_0	0 1 0	7 5 3	3 3 2
P_1	2 0 0	3 2 2	
P_2	3 0 2	9 0 2	
P_3	2 1 1	2 2 2	
P_4	0 0 2	4 3 3	

Table 6(b)

   i. What will be the content of the Need matrix?

   ii. Is the system in a safe state? If yes, then what is the safety sequence?

   c) Propose a solution to reader writer problem using semaphores. CO4 (07)

UNIT- IV

7. a) Consider a main memory with three-page frames and the following sequence of page references: 3, 8, 2, 3, 9, 1, 6, 3, 8, 9, 3, 6, 2, 1, 3. How many page faults would occur for the following page replacement algorithm? Remember that all frames are initially empty, so your first unique pages will cost one fault each. CO3 (06)

      i. FIFO page replacement algorithm
      ii. LRU page replacement algorithm
      iii. Optimal page replacement algorithm.

   b) Memory access to a byte involving paging technique will consume more time. Describe how this can be addressed using TLB's. CO3 (07)

   c) If the logical address space of a process is greater than 32 bits, suggest a suitable technique to implement the page table. CO3 (07)

8. a) Differentiate between internal and external fragmentation. Given five memory partitions of 100 KB, 500 KB, 200 KB, 400 KB, and 600 KB (in order), how would each of the first-fit, best-fit, and worst fit algorithms place processes of 219 KB, 425 KB, 110 KB, and 426 KB (in order)? Which algorithm makes the most efficient use of memory? CO2 (07)

   b) For the following page reference string: 1,2,3,4,1,2,5,1,2,3,4,5. Calculate the number of page faults using FIFO and LRU page replacement algorithms for memory with 3 and 4 frames. CO2 (08)

c) Consider the following segment table: CO2 (05)

Index	Starting address	Length (in bytes)
0	660	248
1	1752	422
2	222	198
3	996	604

Determine the physical address for the following logical address also indicate segment faults if any:

i) 0, 198
ii) 2, 156
iii) 1, 530
iv) 3, 444

UNIT - V

9. a) Describe in detail various file operations in a file system. CO5 (06)
   b) Discuss access matrix method of system protection with domain as objects and its implementation. CO5 (08)
   c) List the common file types along with its extensions and functions. CO5 (06)

10. a) Explain contiguous and linked disk space allocation methods. CO5 (06)
    b) Given the following read/write request in sequence 95,180,34,119,11,123,62,64 with the current position of read/write head on track 50 and total number of track is 200. What is the total seek time by the disk arm using FCFS, SSTF, LOOK and CLOOK algorithm. CO5 (08)
    c) Describe in detail about overview of mass storage structure. CO5 (06)

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