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Thapar Institute of Engineering & Technology, Patiala, Punjab

Department of Computer Science and Engineering

OPERATING SYSTEMS (UCS303): AUXILIARY EXAMINATION

Date: 24-02-2024 & Time: 10:00 am *MM:100 & MT: 180 Hrs*

Note: *Attempt all questions and each sub-part like (a), (b), (c) and (d) for each question at one place. Do mention Page No. of your attempt at front page of the answer sheet. Assume missing data (if any). Show all intermediate computations properly.*

Q1.

a) A system has 5 processes and 4 resource types A, B, C and D. A has 3 instances, B has 14 instances, C has 12 instances and D has 12 instances. The current Allocation and Maximum need are depicted in Table below. Assume that whenever there will be a choice, the process with smaller id will be allocated the resources first. [10]

Process (Process ID)	Allocation				Max			
	A	B	C	D	A	B	C	D
P0 (321)	0	0	1	2	0	0	1	2
P1 (444)	1	0	0	0	1	7	5	0
P2 (554)	1	3	5	4	2	3	5	6
P3 (559)	0	6	3	2	0	6	5	2
P4 (999)	0	0	1	4	0	6	5	6

i. Find out the contents of Need Matrix?

ii. Is the system in safe state? If yes, then find out the safe sequence.

iii. If P2 generates a requests (0, 3, 2, 0), will this request be granted immediately.

b) Suppose that a disk drive has 5000 cylinders numbered from 0 to 4999. The drive is currently serving a request at cylinder 143 and previous request was at cylinder 125. The queue of pending request is 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130. Starting from current head position, what is a total distance (in cylinders) that the disk arm moves to satisfy all a pending requests for each of the following disk scheduling algorithms? [10]

i. FCFS ii. SSTF iii. SCAN iv) LOOK

c) What are the different conditions that can contribute to the occurrence of deadlock in an operating system? [5]

Q2

a) Consider the following pseudo code (Note: Assume that no 'fork' fails) [10]

```
#include<stdio.h>
#include<unistd.h>;
int main(){
fork();
fork() && fork() || fork();
fork();
printf("Auxiliary Exam\n");
return 0;}
```

i. Draw the complete tree showing how fork statements will be executed?

ii. How many times "Auxiliary Exam" will be printed after execution?

	b) With a suitable diagrammatic representation explain in detail the Dining Philosopher Problem along with its constraints and conditions. Also, write the deadlock-free solution (pseudocode) for the said problem using semaphores.	10
	c) A counting semaphore S is initialized to 10. Then, 6 P(wait) operations and 4 V(signal) operations are performed on S. What is the final value of S?	2
	d) Write difference between monolithic kernel and microkernel.	3
Q3	a) In a computer system, the physical memory consists of 16 GB of RAM. The system utilizes a paging scheme for memory management with a page size of 4 KB. Each process has its own page table, and each entry in the page table occupies 8 bytes. Considering a 64-bit virtual address space, answer the following: i. Determine the total number of frames in physical memory. ii. Find the maximum number of pages a process can have in its virtual address space. iii. Calculate the size of each process's page table. iv. If a process's page table is stored in memory, calculate the memory required to store the page table for each process.	10
	b) Explain belady's anomaly, further assume that the system has 3 page frames, initially all are empty. Consider the following page reference stream in the given order. 7, 0, 1, 2, 0, 3, 0, 4, 2, 3. Find out the number of page faults occur using second chance algorithm.	7
	c) Discuss the paging technique, its distinctions from segmentation, and how it addresses external fragmentation problem.	5
	d) A paging scheme uses a Translation Look-aside Buffer (TLB). A TLB-access takes 10 ns and a main memory access takes 50 ns. What is the effective access time (in ns) if the TLB hit ratio is 90% and there is no page-fault?	3
Q4	a) Explain how operating system ensures access control using access matrix, also explain copy, owner and control rights of it.	5
	b) Provide an explanation of the different file access methods along with their respective advantages and disadvantages.	5
	c) Consider the set of 4 processes whose arrival time and burst time are given below-	10

Process No.	Arrival Time	Priority	Burst Time		
			CPU Burst	I/O Burst	CPU Burst
P1	0	2	1	5	3
P2	2	3	3	3	1
P3	3	1	2	3	1

If the CPU scheduling policy is priority Scheduling, calculate the average waiting time. (Lower number means higher priority) and CPU utilization.

d) In a system, the following state of processes and resources are given: (5)

R1 →P2, P2 →R2, P1 →R3, R2 →P1, R3 →P3, P3 →R4, P3 →R2, R4 →P4, P4 →R1

i) Draw a suitable resource allocation graph (RAG)

ii) Draw corresponding wait-for-graph

iii) Identify is there deadlock in system or not.