This Question Paper contains 3 page(s)

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Name of the Paper	: Operating System
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Maximum Marks	: 75
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Attempt any four questions. All Questions carry equal marks.

Q 1. Consider a paging system with the page table stored in memory. If a paged memory reference takes 300 nanoseconds, how long does a memory reference take and give justification for your answer? Now if we add associative registers, and we have an effective access time of 200 nanoseconds, what is the hit-ratio? Assuming access to the associative register takes 10 nanoseconds.

Now consider the following segment table:

Segment	Base	Length
0	19	40
1	100	44
2	190	100
3	320	280
4	1052	196
5	200	38

What are the physical addresses for the following logical addresses and give explanation for the same.
(1,30), (2,29), (3,340), (4,250),(5,40),(0,44)

Assuming a 1-KB page size, what are the page numbers and offsets for the following address references (provided as decimal numbers): 1250, 5300, and 2500. Show calculation at each step.

Q 2. A system has 3 processes P1, P2 and P3, and 3 resources R1, R2 and R3. There are instances each of R1 and R2, and one instance of R3. Given the edge set

E = {R1 → P1, R2 → P2, P1 → R3, R1 → P2, P3 → R1, R2 → P3, R3 → P3}.

Draw the resource allocation graph. Is the system in a deadlock? If the answer is yes, then mention the processes in the deadlock else identify the sequence in which the processes can execute.

Now consider the following program code and find how many processes are there in the system at line 4 and line 8? Justify your answer

```
Line 1:   #include <stdio.h>
Line 2:   #include <unistd.h>
Line 3:   void main()
Line 4:   {
Line 5:           int i;
Line 6:           for (i= 0; i<4; i++)
Line 7:                   fork();
Line 8:   }
```

A program has just read the first record. The program wants to read the eighth record next, how many records must the program read using (i) Direct Access and (ii) Sequential Access methods? Explain your answer.

Q 3. Consider the following memory address references:

123, 124, 167, 273, 278, 732, 42, 1478, 1420, 324, 368, 841, 974

What will be the reference string corresponding to the addresses given above (assuming page size is of 100 bytes)? And how many page faults will occur using FIFO and LRU page replacement algorithms with this reference string assuming that the process can have only three free frames?

Also suppose there is a system with 200 KB of memory with no memory initially allocated. Given the following sequence of requests by the processes, show the memory layout at every stage for first-fit and best-fit allocation algorithms.

Process Number	**Nature of Request**	**Amount of memory requested (in KB)**
P0	Allocation	20
P1	Allocation	30
P2	Allocation	40
P3	Allocation	40
P0	Deallocation	
P3	Deallocation	
P4	Allocation	40
P5	Allocation	10

If the total number of frames in main memory is 100 and there are 5 processes in the system with the demand as 24, 76, 50, 10 and 40 frames, respectively. What will be the number of frames allocated using the equal and proportional allocation strategies?

Q 4. Consider the following set of processes, with the length of the CPU burst times given in milliseconds:

Processes	Burst Time	Priority	Arrival Time
P0	7	3	0
P1	10	4	1
P2	8	3	2
P3	6	1	3
P4	4	2	4

Draw four Gantt charts illustrating the execution of these processes using FCFS, pre-emptive SJF (equal burst length processes are scheduled in FCFS), a pre-emptive priority (small priority number means high priority, equal priority processes are scheduled in FCFS), and a RR (quantum=3) scheduling.
And calculate average waiting and turnaround time for all above mentioned scheduling algorithms.

Also for each of the following transitions between process states, indicate whether the Listed transitions are possible.
(New→ running), (Running → waiting),(Waiting → terminated)
If it is possible, give an example of one thing that would cause it.

Q 5. Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 400, and the previous request was at cylinder 300. The queue of pending requests, in FIFO order, is

1500, 400, 910, 1400, 940, 1500, 2020, 170, 1300

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, using SSTF, C-LOOK and SCAN disk scheduling algorithms?

Which among the following components Global variables, Registers values,
Files of a program state are shared across different threads in a multithreaded process
And why?

Q 6. And which network configuration LAN or WAN would best suit the following environments: A campus student union, Several campus locations across a state-wide university system, A neighborhood? Explain.

Consider two programmers are working on a joint project. Common Files associated with the project should be stored in their directory. Which directory implementation structure they should use and why? Also differentiate between Absolute and Relative pathname.

Explain what may happen if setting the values of Base and Limit registers are not privileged instructions? Also why is it easy to add a new service in microkernel approach?