[This question paper contains 8 printed pages.]

**Your Roll No.....**

**Sr. No. of Question Paper : 4397** **G**

Unique Paper Code : 32341302

Name of the Paper : Operating Systems

Name of the Course : **B.Sc. (H) CS**

Semester : III

Duration : 3 Hours Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt any **4** questions from **Section B**.
4. Parts of a question must be answered together.

## SECTION A

1. (a) Which of the CPU scheduler affects the degree of multiprogramming? (1)

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(b) In which of the access methods, the file is viewed as a numbered sequence of block or record so that, one may read block 14 then block 59, and then can write block 13? (1)

(c) In a general graph directory structure write possible solutions to avoid infinite search loop. (2)

(d) Write the bit vector representation for free space list for a disk (10 blocks) where blocks 2, 3 and 6 are free and rest of the block are allocated. (1)

(e) Briefly explain any two main advantages of multiprocessor systems. (2)

(f) A non-preemptive kernel is free from race conditions on kernel data structures. Then why would anyone favor a preemptive kernel over a non-preemptive one? (2)

(g) Why usage of an Application Program Interface (API) is preferred over system calls for writing programs? (2)

(h) Consider the following code segment and give output with justification. (Assuming all appropriate header files are included) (2)

```
int main()
{
    fork(); fork();
    fork(); fork();
    printf("hello\n");
    return 0;
}
```

(i) Consider a paging system with the page table stored in memory.

(i) If a memory reference takes 125 nanoseconds, how long does a paged memory reference take? (1)

(ii) If we add Translation Lookaside Buffer (TLBs) and 80% of all page table references are found in the TLBs, what is the effective memory access time? Assume that the time taken to access a TLB is 20 nanoseconds. (2)

(j) Consider the following segment table : (2)







| Segment | Base | Length |
|---|---|---|
| 0 | 500 | 600 |
| 1 | 1200 | 250 |
| 2 | 400 | 50 |

What are the physical addresses for the following logical addresses? Justify your answer.

(i) 0, 300

(ii) 2, 100

(k) What is VoIP? Explain with an example. (2)

(l) Using semaphores, explain how can we achieve the condition of having statement 'x' of process PI to be executed only after statement 'y' of process P2? (2)

(m) Can a cache be made as large as the disk? Justify your answer. (2)

(n) Consider a disk pack with 4 surfaces, 32 tracks per surface and 64 sectors per track. 512 bytes of data are stored in a bit serial manner in a sector. Calculate the capacity of the disk pack and also, the number of bits required to specify a particular sector in the disk. (2)

(o) What is a page fault? (1)

(p) Write any two pieces of process information that changes during context switch? (2)

(q) Out of Peer-to-Peer and client-server networks, which one is more reliable. Justify your answer. (2)

(r) Write any two ways of deadlock handling. (2)

(s) Under what circumstances the process will become

(i) Zombie

(ii) Orphan (2)

## SECTION B

2. (a) Consider the following set of processes, with the length of CPU burst time given in milliseconds : (6)

| Process | Arrival Time | Burst Time | Priority |
|---|---|---|---|
| P1 | 0 | 2 | 2 |
| P2 | 1 | 5 | 1 (Highest) |
| P3 | 4 | 3 | 3 |
| P4 | 5 | 1 | 4 |

(i) Draw Gantt chart for Shortest Job First algorithm and calculate turnaround time for every process.

P.T.O.





(ii) Draw Gantt chart for Priority based (preemptive) algorithm and calculate waiting time for every process.

(b) Given is a system with 128KB of memory (assuming no memory initially allocated). Show the memory layout at intermediate stages for best-fit allocation algorithm for the following given sequence of requests by the processes. (4)

| Process Number | Nature of Request | Amount of memory requested (in KB) |
|---|---|---|
| P0 | Allocation | 30 |
| P1 | Allocation | 10 |
| P2 | Allocation | 15 |
| P3 | Allocation | 22 |
| P0 | Deallocation | - |
| P2 | Deallocation | - |
| P4 | Allocation | 8 |
| P5 | Allocation | 10 |

3. (a) A system has three processes P1, P2 and P3 and four resources R1, R2, R3 and R4. There are two instances each of R1, R2 and R4, and one instance of R3. Given the edge set E = {R1 → P1, R2 → P2, P1 → R3, R1 → P2, P3 R1, R2 → P3, R3 → P3}.

(i) Draw the resource allocation graph. (3)

(ii) Is the system in a deadlock state? If yes, then which processes are in the deadlock else identify the sequence in which the processes will be executed. (2)

(b) "It is more economical to create and context switch threads in comparison to processes". Justify this statement. Write any three programming challenges in writing multithreaded programs for multicore systems. (2+3)

4. (a) Give the structure of processes in Peterson's solution and explain how mutual exclusion and progress is preserved. (4)

(b) Consider the following page reference string

0 3 1 5 7 6 5 7 2 2 7 0 4 7 3 2 1 2 1

How many page faults would occur with First-in, First-out (FIFO) and optimal page replacement algorithms assuming three frames? All frames are initially empty. (6)

5. (a) Consider a logical address space of 64 pages with 2 KB frame size mapped onto a physical memory of 256 KB. (2+4)







(i) How many bits are there in the logical and physical addresses?

(ii) How many bits will be used by page offset and page number in logical address?

(b) Compare and contrast the following : (4)

(i) Symmetric and Asymmetric multiprocessing

(ii) Microkernel and Monolithic approach of Operating System design

6. (a) Suppose a disk drive has 200 cylinders numbered from 0 to 199. The request for track 46 is being serviced and is moving towards track 199 and the disk request queue contains read/write requests for the sectors on tracks 113, 156, 22, 132 and 196, respectively. Represent the head movements diagrammatically and also calculate the total number of head movements needed to satisfy the requests in the queue, using : (6)

(i) First Come First Serve (FCFS)

(ii) Shortest Seek Time First (SSTF)

(b) Which are the two address space possibilities for the child process after the execution of fork() system call. (2)

(c) What issues will be faced by operating systems if it resides in read only memory (ROM) as in cellular phones and tablets? (2)

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