

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2024

B.Tech-IV Semester (CSE/IT)

COURSE CODE(CREDITS): 18B11CI411

MAX. MARKS: 35

COURSE NAME: Operating Systems

COURSE INSTRUCTORS: Dr. Hari Singh, Dr. Deepak Gupta, Dr. Anita, and Mr. Praveen Modi

MAX. TIME: 2 hrs.

Note: (a) All questions are compulsory.

(b) Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q1(a). Operating Systems are installed in different drives and/or partitions which are also known as boot disks or system disks. The bootstrap program needs to search the file system to find the operating system kernel, load it into memory, and start its execution. [CO1][03 Marks]

(b). What resources are used when a thread is created? How do they differ from those used when a process is created? [CO2][03 Marks]

Q2. PM2. A certain system has shown that the average process runs for a time T before blocking on I/O. A process switch requires a time S , which is effectively wasted (overhead). For round-robin scheduling with quantum Q , Give a formula for the CPU efficiency for each of the following:

(a) $Q = \infty$ (b) $Q > T$ (c) $S < Q < T$ (d) $Q = S$

[CO3][5 Marks]

Q3. A shared variable x , initialized to '1', is operated on by four concurrent processes W, X, Y, Z as follows. Each of the processes W and X reads x from memory, increments by '2', stores it to memory, and then terminates. Each of the processes Y and Z reads x from memory, decrements by two, stores it to memory, and then terminates. Each process before reading x invokes the P operation (i.e., wait) on a counting semaphore S and invokes the V operation (i.e., signal) on the semaphore S after storing x to memory. Semaphore S is initialized to two. What is the maximum possible value of x after all processes complete execution? Justify your answer in detail.

[CO4][05 Marks]

Q4(a). The memory access time using a given inverted page table is always same for all incoming virtual addresses. Is this True/False? Justify.

(b). In a system that uses hashed page tables, if two distinct virtual addresses $V1$ and $V2$ map to the same value while hashing, then the memory access time of these addresses will not be the same.

[CO6][3x2=06 Marks]

Q5. Consider a process is running in the system through memory with access time is 10ms and page fault is generated with every 10^6 memory access. If the disk access time is 20ms to service the page fault, calculate the effective memory access time? **[CO6][03 Marks]**

Q6. Consider the following page reference string: **[CO6][04 Marks]**
1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.

Use the LRU page replacement algorithms with three frames to calculate the number of page faults. Remember that all frames are initially empty, so your first unique pages will cost one fault each.

Q7. Consider the parameter Δ used to define the working set window in the working set model. When Δ is set to a value 5 for a given sequence of virtual page references: 5, 4, 3, 3, 4, 1, 2, 2, 1, 2, 1, 1, 5, 4, 3, 5; identify the distinct pages referenced within each working set window and finally, find out the minimum number of elements in a working set on execution of the above sequence. **[CO6][03 Marks]**

Q8. Consider a typical disk that rotates at 15000 rotations per minute and has a transfer rate of 50×10^6 bytes/sec. if the average seek time of the disk is twice the average rotational delay and the controller's transfer time is ten times the disk transfer time, the average time (in millisec) to read or write a 512 byte sector of the disk is? **[CO6][03Marks]**

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