[Total No. of Questions - 9] [Total No. of Printed Pages - 4] (2125)

15161

B. Tech 5th Semester Examination

Principles of Operating System (OS)

CS-5001

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all selecting one from each of the Sections A, B, C & D. Section E is compulsory.

SECTION - A

1. (a) How do clustered systems differ from multiprocessor systems? What is required for two machines belonging to a cluster to cooperate to provide a highly available service? (10)

   (b) List five services provided by an operating system that are designed to make it more convenient for users to use the computer system. In what cases it would be impossible for user-level programs to provide these services? Explain. (10)

2. (a) Assume you have the following jobs to execute with one processor, with the jobs arriving in the order listed here:

i	0	1	2	3	4
T(pi)	80	20	10	20	50

   (i) Suppose a system uses FCFS scheduling. Create a Gantt chart illustrating the execution of these processes?

   (ii) What is the turnaround time for process p3?

   (iii) What is the average wait time for the processes? (10)

[P.T.O.]

   (b) Discuss, with examples, how the problem of maintaining coherence of cached data manifests itself in the following processing environments:

   (i) Single-processor systems. (ii) Multiprocessor systems.

   (iii) Distributed systems. (10)

SECTION - B

3. (a) Explain different necessary condition for deadlock. Consider a system consisting of m resources of the same type, being shared by n processes. Resources can be requested and released by processes only one at a time. Show that the system is deadlock free if the following two conditions hold:

   (i) The maximum need of each process is between 1 and m resources.

   (ii) The sum of all maximum needs is less than m+n. (10)

   (b) Explain why logging metadata updates ensures recovery of a file system after a file system crash. (10)

4. (a) Discuss the trade-off between fairness and throughput of operations in the readers-writers problem. Propose a method for solving the reader's writer's problem without causing starvation. (10)

   (b) Consider the deadlock situation that could occur in the dining-philosophers Problem when the philosophers obtain the chopsticks one at a time. Discuss how the four necessary conditions for deadlock indeed hold in this setting. Discuss how deadlocks could be avoided by eliminating any one of the four conditions. (10)

SECTION - C

5. (a) Most systems allow programs to allocate more memory to its address space during execution. Data allocated in the heap segments of programs is an example of such allocated memory. What is required to support dynamic memory allocation in the following schemes:

   (i) Contiguous-memory allocation

   (ii) Pure segmentation (iii) Pure paging. (10)

(b) Explain paging and segmentation. Compare paging with segmentation with respect to the amount of memory required by the address translation structures in order to convert virtual addresses to physical addresses. (10)

6. (a) On a system with paging, a process cannot access memory that it does not own; why? How could the operating system allow access to other memory? Why should it or should it not? (10)

(b) Explain the concept of virtual memory. Consider a logical address space of 8 pages of 1024 words mapped into memory of 32 frames.

(i) How many bits are there in the logical address?

(ii) How many bits are there in physical address? (10)

SECTION - D

7. (a) Show how to implement the wait() and signal() semaphore operations in multiprocessor environments using the TestAndSet() instruction. The solution should exhibit minimal busy waiting. (10)

(b) Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is

86, 1470, 913. 1774. 948, 1509. 1022, 1750, 130

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk-scheduling algorithms?

(i) FCFS (ii) SSTF (iii) SCAN (10)

8. (a) Demonstrate that monitors and semaphores are equivalent insofar as they can be used to implement the same types of synchronization problems. (10)

(b) None of the disk-scheduling disciplines, except FCFS, is truly fair (starvation may occur).

(i) Explain why this assertion is true.

(ii) Describe a way to modify algorithms such as SCAN to ensure fairness.

(iii) Explain why fairness is an important goal in a time-sharing system.

(iv) Give three or more examples of circumstances in which it is important that the operating system be unfair in serving I/O requests. (10)

SECTION - E

9. (a) What is external fragmentation?

(b) What are the factors that need to be considered to determine the degree of Multi-programming in a system?

(c) State three advantages of placing functionality in a device controller, rather than in the kernel.

(d) List two examples of deadlocks that are not related to a computer system environment.

(e) What is disadvantage of pipes?

(f) Give an example of an application that could benefit from operating system support for random access to indexed files.

(g) What are the disadvantages of supporting memory mapped I/O to device control registers?

(h) What hardware features are needed for efficient capability manipulation? Can these be used for memory protection?

(i) What are the various kinds of performance overheads associated with servicing an interrupt?

(j) Explain header of information storage organization on disks. (10×2=20)