Registration No. :

Total number of printed pages – 4

B. Tech.

BCSE 3305 (O)

Sixth Semester Examination – 2011

OPERATING SYSTEM

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any five from the rest.

The figures in the right-hand margin indicate marks.

1. Answer the following questions :   2 ×10

    (a) State the three ways to implement basic mutual exclusion in an operating system.

    (b) What is external fragmentation in a system with contiguous files ?

    (c) What is a race condition ? Give an example.

    (d) What is a process ? Define the role of PCB in process management.

    (e) Define deadlock. Give an example of a deadlock involving only a single process.

    (f) Draw a diagram of possible state transitions for a process (possible states are RUNNING, READY-TO-RUN, BLOCKED, and TERMINATED/ ZOMBIE).

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(g) What must the *banker's algorithm* know a priori in order to prevent deadlock ?

(h) Define the wait-(postpone) operation, wait(S). and the wakeup operation signal(S).

(i) Why is it generally correct to favour I/O bound processes over CPU-bound processes ?

(j) What are three requirements of any solution to the critical sections problem ? Why are the requirements needed?

2. (a) Show that, if the wait and signal operations are not executed atomically, then mutual exclusion may be violated. 5

(b) What are the differences between user-level threads and kernel-supported threads ? Under what circumstances is one type "better" than the other ? 5

3. (a) What is the meaning of the term busy waiting ? What other kinds of waiting are there ? Can busy waiting be avoided altogether ? Explain your answer. 5

(b) Consider a system consisting of four resources of the same type that are shared by three processes, each of which needs at most two resources. Show that the system is deadlock-free. 5

4. (a) Describe page-based *virtual memory*. You should consider *pages, frames, page tables*, and *Memory Management Units* in your answer. 5

(b) What is the maximum file size supported by a file system with 16 direct blocks, single, double, and triple indirection ? The block size is 512 bytes. Disk block numbers can be stored in 4 bytes.   5

5. (a) What two advantages do threads have over multiple processes? What major disadvantage do they have ? Suggest one application that would benefit from the use of threads, and one that would not.   5

(b) What is a semaphore ? What are the differences between binary and general semaphores ?   5

6. (a) Suppose we want to execute the statements S1, S2, and S3 in sequence, but that S2 has to be executed exclusively for one process at a time. Write the code needed using semaphores.   5

6. (b) The processes are assumed to have arrived in the order P1, P2, P3, P4, P5 all at time 0. The following table shows the respective length of the CPU-burst time given in millisecond for above processes.   5

Process	Burst times	Priority
P1	9	2
P2	7	1
P3	2	4
P4	8	3
P5	4	1

What is the waiting time for each process using FCFS and SJF scheduling?

7. (a) What is a RAM disk ? Compare and contrast RAM disk with conventional moving-head magnetic disk storage.   5

7. (b) What is the difference between preemptible and non-preemptible scheduling ? What would be the waiting time for a high-priority process which arrives at time 214ms if the system in (a) uses preemptible scheduler ? What if the scheduler is non-preemptible ? (for this problem assume that the context switch requires 0.01 ms.)   5

8. Answer the following questions :   2.5×4

   (a) What is the purpose of system calls ? Why are they necessary ?

   (b) What is the "degree of multiprogramming" ?

   (c) What is the purpose of valid/invalid bit in the demand paging ?

   (d) Define and differentiate between swapping and spawning ?