BACHELOR OF COMPUTER SCEINCE & ENGG. EXAMINATION, 2010

(3rd Year, 2nd Semester,)

OPERATING SYSTEMS

Time: 3 hours

Full Marks: 100

Answer Question No. 1 and ANY FOUR (4) from the rest

1.

a. What are the contents of Process Control Block (PCB)?
b. Why the *wait* and *signal* operations on a semaphore have to be atomic?
c. "The implementation difficulty with the Shortest Job First (SJF) scheduling algorithm and the Optimal Page Replacement algorithm is the same." Justify
d. What are the difficulties with segmentation? How can these be overcome?

4 X 5

2.

a. Define the following: response time, dispatcher
  b. A set of processes are going to execute on a single CPU. Arrival times and corresponding execution times of these processes are shown as below:

Process	Arrival time	Expected CPU time
1	0	11
2	3	12
3	5	7
4	7	4
5	19	7

Calculate waiting time and turnaround time of each process for Round Robin scheduling with time quantum = 4 units. Show the Gantt chart.
c. What are the advantages of Multilevel Feedback Queue scheduling algorithm?
d. Intended for modest desktop computers running at about 10 million instructions per second (10 MIPS), a scheduler is designed that is based on a single-queue round-robin scheme with a quantum of 1 microsecond (1/1,000,000 of a second). Discuss the performance of this scheduler, especially with respect to efficiency and response time.

2X2+10+3+3

3.

a. In what respects are threads considered to be advantageous than processes?
b. For each of the following issues, specify which type of thread will be advantageous:
  (i) Creating a threads within the same process, (ii) Executing multithreaded process on a multiprocessor
c. Consider a file system on a disk that has both logical and physical block sizes of 512 bytes. Assume that the information about each file is already cached in memory. For each of the following file allocation strategies (Linked and Indexed), answer the following question: If we are currently at logical block 10 (i.e., the last block accessed was block 10) and want to access logical block 4, how many physical blocks must be read from the disk?
d. Consider the following code of Process P$_i$ and justify whether the proposed code is a two-process solution to the problem of critical section (Prove any two properties):

  while true {

  flag[i] = true; turn = j; while (flag[i] & turn = j) do no-op;

  < critical section >

```
flag[i] = false;
}
```

e. Under each of the following process coordination scenarios, specify the **number of semaphores** needed and the **initial count** of each. Justify your answer.
    i. A producer-consumer problem with two producers producing values that are stored in a buffer of size *n* with a single consumer consuming them.
    ii. A pipe-like mechanism between two processes where the pipe is a buffer of 4K bytes.

                                                  3+2+4+6+5

4.

a. Given the following free memory partitions of 100K, 500K, 200K, 300K, and 600K respectively at addresses 20, 370, 1060, 1300, 1900 (in order), how would each of the following algorithms place processes of 212K, 417K, 112K (in order)? (Show the modified memory map after each insertion):   i) First-fit   and   ii) Best-fit
b. For the page reference string 5, 1, 1, 1, 2, 5, 2, 0, 1, 3, 2 compare the page faults experienced by First In First Out (FIFO) and Least Recently Used (LRU) page replacement techniques, for a memory with 3 frames. Show clearly when each page fault would occur.

                                                  6+14

5.

a. What are the major components of disk access time?
b. What are the overheads with SCAN disk scheduling?
c. What are the advantages of First-Come First-Served (FCFS) disk scheduling?
d. Consider the following sequence of requests for disk tracks: 137, 29, 10, 86, 174, 64, 43, 150 for track range 1 - 200. The disk head is currently at track 120 and moving towards 200. Calculate the average seek length using i) Circular SCAN and ii) SCAN disk scheduling policy. Compare and comment on the result.

                                               4+3+3+10

6.

a. Discuss the advantages and disadvantages of Indexed file allocation over Linked file allocation.
b. What are the different file access methods?
c. Explain the Bit Vector and Grouping disk space management techniques with their respective advantages and disadvantages.
d. If you are asked to design an operating system, will you keep swap-space management as one of the tasks of your operating system? Why or why not?
e. What is RAID?

                                              6+2+6+4+2

7.

a. What is the task of the *bootstrap* program?
b. What is inode? What information does an in-core inode contain?
c. Explain the file system layout of Unix.
d. What is buffer cache?
e. How does a user authenticate itself to the system?

                                             3+(2+4)+6+3+2

8.

a. Explain the Access control mechanism and its various implementations.
b. What are the problems with deadlock prevention mechanism with preemption allowed?
c. What are the preconditions of detecting safe/unsafe system state? "All unsafe system states may not lead to deadlock" – discuss.

                                             10+4+(3+3)