B3.4-R4: OPERATING SYSTEM

NOTE:

1. **Answer question 1 and any FOUR from questions 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

Time: 3 Hours **Total Marks: 100**

1.

a) What are the three main purposes of an operating system?
b) Why do some systems store the operating system in firmware, while others store it on disk?
c) Describe the actions taken by a kernel to context-switch between kernel level threads.
d) Name two differences between logical and physical addresses.
e) Why is rotational latency usually not considered in disk scheduling?
f) Systems that support sequential files always have an operation to rewind files. Do systems that support random access files need this too?
g) Explain Process Control Block.

(7x4)

2.

a) What resources are used when a thread is created? How do they differ from those used when a process is created?
b) What is the meaning of the term busy waiting? What other kinds of waiting are there in an operating system? Can busy waiting be avoided altogether?

(9+9)

3.

a) Suppose that the following processes arrive for execution at the times indicated. Each process will run for the amount of time listed. In answering the questions, use non-preemptive scheduling, and base all decisions on the information you have at the time the decision must be made.

Process	Arrival Time	Burst Time
P1	0.0	8
P2	0.4	4
P3	1.0	1

   i) What is the average turnaround time for these processes with the FCFS scheduling algorithm?
   ii) What is the average turnaround time for these processes with the SJF scheduling algorithm?
   iii) The SJF algorithm is supposed to improve performance, but notice that we chose to run process P1 at time 0 because we did not know that two shorter processes would arrive soon. Compute what the average turnaround time will be if the CPU is left idle for the first 1 unit and then SJF scheduling is used.

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

(12+6)

4.

a) Consider a paging system with the page table stored in memory. If a memory reference takes 200 nanoseconds, how long does a paged memory reference take? If we add a TLB and 75 percent of all page-table references are TLB hits, what is the effective memory reference time?
b) Could a RAID level 1 organization achieve better performance for read requests than a RAID level 0 organization? If so, how?

(9+9)

5.

a) Consider a system that supports 5,000 users. Suppose that you want to allow 4,990 of these users to be able to access one file.
   i) How would you specify this protection scheme in UNIX?
   ii) Can you suggest another protection scheme that can be used more effectively for this purpose than the scheme provided by UNIX?

b) Explain architecture of UNIX Environment.

(9+9)

6.

a) Consider the following segment table:

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

What are the physical addresses for the following logical addresses?
   i) 0, 430
   ii) 1, 10
   iii) 2, 500
   iv) 3, 400

b) Suppose that a disk has 1,500 cylinders numbered 0 to 1499. The disk head is currently at cylinder 143 and previous request was at 120. The queue of pending requests in FIFO order is:
   470, 913, 777, 1248, 1409, 130, 500
   Calculate and show total head movements for the following disk scheduling algorithms:
   i) FCFS
   ii) SSTF
   iii) SCAN

(9+9)

7.

a) Consider a system that supports the strategies of contiguous, linked, and indexed allocation. What criteria should be used in deciding which strategy is best utilized for a particular file?

b) Why is deadlock detection much more expensive in a distributed environment than in a centralized environment?

(9+9)