1. How shared memory are accessed if we have two processors?

2. What must be stored in memory before the computer can manipulate data?

3. What is a binary semaphore? What is its use?

4. What are the requirements for virtual memory architecture?

5. How does the distinction between kernel mode and user mode function as a rudimentary form of protection (security) system?

6. What is the main difficulty that a programmer must overcome in writing an operating system for a real-time environment?

7. What resources are used when a thread created? How do they differ from those when a process is created?

8. What is the state of the processor, when a process is waiting for some event to occur?

9. What is the important aspect of a real-time system or Mission Critical Systems?

10. What is the difference between Hard and Soft real-time systems?

11. What is the cause of thrashing? How does the system detect thrashing? Once it detects thrashing, what can the system do to eliminate this problem?

12. What is multi tasking, multi programming, multi threading?

13. What is a Safe State and what is its use in deadlock avoidance?

14. What are the main advantages of the microkernel approach to system design?

15. Why do some systems store the operating system in firmware, and others on disk?

16. How could a system be designed to allow a choice of operating systems to boot from? What would the bootstrap program need to do?

17. What is the purpose of the command interpreter? Why is it usually separate from the kernel?

18. What system calls have to be executed by a command interpreter or shell in order to start a new process?

19. What are the purposes of system calls?

20. Using system-calls like create, open, and read, develop a program to make a copy of an existing file.
21. In a thread-based operating system, if the primary thread of a process exits, is it possible for the other threads of this primary thread to continue running?

22. The following table gives the arrival times and CPU times of five processes. If the process scheduler is round robin, compute the average turnaround time of the processes.

<table>
<thead>
<tr>
<th>Process</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrival time</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CPU time</td>
<td>8</td>
<td>10</td>
<td>6</td>
<td>9</td>
<td>12</td>
</tr>
</tbody>
</table>

23. With respect to average turnaround time, if processes do not have any I/O needs, it is not clear whether single-programming or multiprogramming performs better.
   a. Provide an example that shows single-programming performs better.
   b. Now, provide another example that shows multi-programming performs better.

24. The head of a one-surface hard disk is on track 250 and its moving direction is upward (i.e., towards higher number tracks). The scheduler is Shortest Seek Time First (SSTF). If going from one track to its adjacent track takes two microseconds, what is the total seek time to access all tracks of the following track-trace?
   231  256  245  133  283

25. When a process creates a new process using the fork() operation, which of the following state is shared between the parent process and the child process?
   a. Stack
   b. Heap
   c. Shared memory segments

26. What are the three major activities of an operating system in regard to secondary-storage management?

27. What is the purpose of the command interpreter? Why is it usually separate from the kernel?

28. What system calls have to be executed by a command interpreter or shell in order to start a new process?

29. What is the purpose of system programs?

30. What is the main advantage of the layered approach to system design? What are the disadvantages of using the layered approach?

31. List five services provided by an operating system. Explain how each provides convenience to the users. Explain also in which cases it would be impossible for user-level programs to provide these services.

32. What are two differences between user-level threads and kernel-level threads? Under what circumstances is one type better than the other?

33. Describe the actions taken by a kernel to context switch between kernel level threads.
34. What resources are used when a thread is created? How do they differ from those used when a process is created?

35. Given page reference string:
   - 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6
   - Compare the number of page faults for LRU, FIFO and Optimal page replacement algorithm.

36. How Buffering can improve the performance of a Computer system?

37. What are the primary differences between Network Operating System and Distributed Operating System?

38. What are the differences between paging and segmentation?

39. What is Virtual Memory? How is it implemented?

40. What is Belady’s Anomaly?

41. On a system using demand-paged memory, it takes 120 nanoseconds to satisfy a memory request if the page is in memory. If the page is not in memory, the request (on average) takes 5 milliseconds.
   What would the page fault rate need to be to achieve an effective access time of 1 microsecond? Assume that the system is only running a single process and the CPU is idle during page swaps.

42. In a page replacement policy using reference byte, 8 bits are used and there are four pages.
   Before the first tick, pages accessed are 0, 2 and 3.
   Therefore, the values in reference bytes before the first tick are as follows:
<table>
<thead>
<tr>
<th>Page#</th>
<th>Reference Byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10000000</td>
</tr>
<tr>
<td>2</td>
<td>00000000</td>
</tr>
<tr>
<td>3</td>
<td>10000000</td>
</tr>
<tr>
<td>4</td>
<td>10000000</td>
</tr>
</tbody>
</table>
   Subsequently, following is the sequence of page accesses
   Between 1st tick and 2nd tick Page 2 and Page 3
   Between 2nd tick and 3rd tick Page 0 and Page 3
   Between 3rd tick and 4th tick Page 1 and Page 2
   Show the content of the reference byte immediately after 3rd tick.

43. Discuss the any three disk scheduling algorithms.
   Following are the tracks for which I/O requests have arrived, according to their order of arrival:
   17, 30, 24, 37, 15, 27, 11, 75, 20, 5
   The disk has 80 tracks and the read write head is currently placed at track 28 and it was moving in the direction of the lower numbered tracks.
   Mention the sequence of tracks visited in each algorithm.

44. What is the need for hierarchical paging system?

45. What is re-entrant code? What kind of paging is used for re-entrant code?

46. What are the fields of a Segmentation Table?

47. Explain with diagram the address translation scheme in pure segmentation.
48. If a Segment is too large to have contiguous memory allocation, then which scheme can be introduced into Segmentation? What will be the structure of the logical address?

49. Consider a system with fixed partitions with equal sizes. On a system with 2 24 bytes of memory and fixed partitions, all of size 65,536 bytes, what is the minimum number of bits needed in an entry in the process table to record the partition to which a process has been allocated?

50. A system has 4 processes with CPU burst 7ms, 9ms, 2ms and 5ms. All the processes arrive at T=0; Calculate the average waiting time, average turn around time and average response time of the system if shortest remaining time first algorithm is used.