Operating Systems
(Unit- 3 & 5)

Questions & Answers:

1. **Define Critical Section (or) Critical Region.**
   Consider a system consisting of n processes of $\{P_0,P_1,P_2,\ldots P_{n-1}\}$, Each process has a segment of code called Critical section, in which the process may be changing common variables, updating a table, writing a file and so on.

2. **What is Race condition?**
   Several processes access and manipulate the same data concurrently and the outcome of execution depends on the particular order in which the access takes place is called Race condition.

3. **What are the three requirements of solutions to solve Critical section?**
   The requirements are 1. Mutual Exclusion 2. Progress 3. Bounded Waiting

4. **Describe two approached to handle Critical Sections in OS**
   1. Preemptive Kernel: Allows a process to be preempted while it is running in kernel mode
   2. Non Preemptive Kernel: Doesn't allow a process running in Kernel mode.

5. **What is Mutex lock?**
   The OS designers build software tools to solve the Critical section problem. The simplest of these tools is the Mutex lock (short of Mutual Exclusion) also called spin lock. Mutex lock protects critical region and race condition. It is a Boolean variable to indicate lock is available or not.

6. **What is Semaphore?**
   A Semaphore S is an integer variable that apart from initialization, is accessed only through two standard atomic operations, wait(), and signal().

7. **Explain different types of Semaphores?**
   There are two types of Semaphores. 1. Counting Semaphore 2. Binary Semaphore
   Counting Semaphore: Counting semaphore can be used to control access to a given resource consisting of a finite number of instances.
   Binary Semaphore: Binary semaphore behave similar to mutex locks. If the system does not provide mutex locks, binary semaphore can be used.

8. **What is Deadlock?**
   When two or more processes are waiting indefinitely for an event that can be caused only by one of the waiting process. These process are said to be deadlocked.

9. **What is Starvation or indefinite blocking?**
   Starvation is a situation in which processes wait indefinitely with in the semaphore. It may occur if we remove processes from the list associated with a semaphore have in FIFO.

10. Describe possible remedies for Dining Philosopher's Problem.

1. Allow at most four philosophers to be sitting simultaneously at the table.
2. Allow a philosopher to pick up only if both chopsticks are available.
3. Use an asymmetric solution that is
   Odd number philosopher picks up first left & right chopsticks
   Even number philosopher picks up right & left chopsticks

11. What are the resource sequence for a process?

1. Request 2. Use 3. Release

12. What are the four conditions a dead lock situation can arise in a system?

1. Mutual Exclusion 2. Hold & Wait 3. No Preemption 4. Circular wait

13. Define Resource Allocation Graph (RAG).

Dead locks can be described more precisely in terms of directed graph called a system Resource Allocation Graph (RAG).

Directed Edge: $P_i \longrightarrow R_j$ Assignment Edge: $R_j \longrightarrow P_i$ Calm Edge: $P_i \longrightarrow R_j$

Process request resource in the future is claim edge

14. Dead lock prevention

Provides a set of methods to ensure that at least one of the necessary conditions

15. What is Safe state or Safe Sequence?

A state is safe if the system can allocate resources to each process in same order and still avoid a deadlock

16. **What is meant by Multiprogramming?**

Several users simultaneously compete for system resources (i.e) the job currently waiting for I/O will yield the CPU to another job which is ready to do calculations, if another job is waiting. Thus it increases CPU utilization and system throughput.

17. What requirement is to be satisfied for a solution of a critical section problem?

A solution to the critical section problem must satisfy the following 3 requirements.

- Mutual exclusion: If process P1 is executing in its critical section, then no other processes can be executing in their critical sections.
- Progress: If no process is executing in its critical section and some processes wish to enter their critical sections, then only those processes that are not executing in their remainder section can participate in the decision on which will enter its critical section next, and this selection cannot be postponed indefinitely.
- Bounded waiting: There exists a bound on the number of times that other processes are allowed to enter their critical section after a process has made a request to enter its critical section and before that request is granted.

18. Define semaphores.

Semaphore is a synchronization toll. A semaphore S is an integer variable that apart from initialization is accessed only through 2 standard atomic operations.

- Wait ()
- Signal ()

19. Define Starvation in deadlock?

A problem related to deadlock is indefinite blocking or starvation, a situation where processes wait indefinitely within a semaphore. Indefinite blocking may occur if we add and remove processes from the list associated with a semaphore in LIFO order.

20. Name dome classic problem of synchronization?

- The Bounded – Buffer Problem
- The Reader – Writer Problem
- The Dining –Philosophers Problem

21. Define deadlock?

A process request resources; if the resource are not available at that time, the process enters a wait state. Waiting processes may never change state, because the resources they are requested are held by other waiting processes. This situation is called deadlock.

22. What is the sequence of operation by which a process utilizes a resource?

Under the normal mode of operation, a process may utilize a resource in only the following sequence:

- Request: If the request cannot be granted immediately, then the requesting process must wait until it can acquire the response.
- Use: The process can operate on the resource.
- Release: The process releases the resource

23. Give the condition necessary for a deadlock situation to arise?

A deadlock situation can arise if the following 4 condition hold simultaneously in a system.

- Mutual Exclusion
- Hold and Wait
- No preemption
- Circular Wait

24. Define 'Safe State"?

A state is safe if the system allocates resources to each process in some order and still avoid deadlock

25. What is a File?

A file is a named collection of related information that is recorded on secondary storage. A file contains either programs or data. A file has certain “structure” based on its type.
File attributes: Name, identifier, type, size, location, protection, time, date File operations: creation, reading, writing, repositioning, deleting, truncating,appending, renaming File types: executable, object, library, source code etc

26. List the various File Attributes.

A file has certain other attributes, which vary from one operating system to another, but typically consist of these: Name, identifier, type, location, size, protection, time, date and user identification.

27. What are the various File Operations?

The basic file operations are, Creating a file Writing a file Reading a file Repositioning within a file Deleting a file Truncating a file

28. What is the information associated with an Open File?

Several pieces of information are associated with an open file which may be: File pointer File open count Disk location of the file

29. What are the different Accessing Methods of a File?

The different types of accessing a file are: Sequential access: Information in the file is accessed sequentially Direct access: Information in the file can be accessed without any particular order. Other access methods: Creating index for the file, indexed sequential access methods

30. What is Directory?

The device directory or simply known as directory records information- such as name, location, size, and type for all files on that particular partition. The directory can be viewed as a symbol table that translates file names into their directory entries.

31. What are the operations that can be performed on a Directory?

The operations that can be performed on a directory are, Search for a file Create a file Delete a file Rename a file List directory Traverse the file system

32. What are the advantages of Contiguous Allocation?

The advantages are, Supports direct access Supports sequential access Number of disk seeks is minimal.

33. What are the drawbacks of Contiguous Allocation of Disk Space?

The disadvantages are, Suffers from external fragmentation Suffers from internal fragmentation Difficulty in finding space for a new file File cannot be extended Size of the file is to be declared

1. What is Readers-Writers problem? Give a solution to Readers-Writers problem using Monitors.
2. What is a Critical Section problem? Give the conditions that a solution to the critical section problem must satisfy.
3. What is a Virtual Memory? Discuss the benefits of virtual memory technique
4. What is a deadlock? Consider the deadlock situation that could occur in the dining philosopher's problem when the philosophers obtain the chopsticks one at a time.
5. Discuss how the four necessary conditions for deadlock indeed hold in this setting. What are the
   solutions to this problem?
6. Explain Deadlock Detection scheme for Several Instances of a Resource Type.
7. Explain the three allocation methods in file system implementation. Illustrate with a proper diagram.
8. What are the objectives of file management systems? Explain the file system architecture.
9. Explain different structures and page tables with strengths and weaknesses.
10. Define semaphore and mention the operations on semaphore.
11. Demonstrate when a system is said to be in safe state.
12. Discuss what a critical section is and what requirements must a solution to the critical solution problem satisfied.
13. Describe what is meant by 'starvation' in operating system
14. Define monitor. What does it consists of ?
15. Show that mutual exclusion will be violated if the signal and wait operations are not executed atomically.
16. Conclude your answer is it possible to prevent the occurrence of deadlock Under what conditions
17. Convince the statement "If there is a cycle in the resource allocation graph, it may or may not be in deadlock state .
18. Define race condition
19. Evaluate the following snapshot of the system

	Allocation	Max	Available
	A B C D	A B C D	A B C D
Po	0 0 1 2	0 0 1 2	1 5 2 0
P1	1 0 0 0	1 7 5 0	
P2	1 3 5 4	2 3 5 6	
P3	0 6 3 2	0 6 5 2	
P4	0 0 1 4	0 6 5 6	

Answer the follow based on banker's algorithm.

(i)Define safety algorithm

(ii)What is the content of need matrix?

(iii)Is the system in a safe state?

(ii)Is a request from process P1arrives for(0,4,2,0) can the request be granted immediately?

20. Examine the criteria for evaluating the performance of scheduling Algorithms? Demonstrate with an example about critical section
21. Define semaphore. Explain the use of semaphore in synchronization problem with an example
22. Describe Mutex and Locks in detail with an example.
23. Infer the necessary condition for deadlock and methods for handling the deadlock.
24. Differentiate between page and segment
25. Name two difference between logical and physical address
26. Define page fault
27. Define virtual memory. Mention its advantages.
28. Evaluate by Consider the follow page reference string assuming four frames. Remember all frames are initially empty. i) LRU replacement ii) FIFO replacement iii) Optimal replacement
29. What are the advantages and disadvantages of contiguous and non-contiguous memory allocation?
30. Describe how logical address is translated into physical address us Paging mechanism with a neat diagram
31. illustrate contiguous memory allocation schemes, give examples.
32. Summarize inverted page tables and their use in paging and segmentation
33. Discuss demand paging. Describe the process of demand paging in OS
34. Discuss in detail about various allocation methods
35. Compare Which algorithms make the most efficient use of memory .Given memory partitions of 500 KB, 100 KB, 300 KB, 200 KB and 600 KB in order, how would each of the first-fit, best-fit, and worst-fit algorithms place processes of size 418 KB, 202 KB, 506 KB,11 2 KB, and 95 KB (in order)?
36. Describe the various techniques for structuring the page table in a page memory management scheme
37. Distinguish between Internal fragmentation And External Fragmentation
38. Explain in detail about Logical versus Physical address