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Assignment - 03

Operating System.

Ques1-

Ans:- A race condition occurs when two or more entities try to change a shared resource simultaneously, leading to unpredictable results.

Eg:- (real world): Two people editing the same document at once - one saves changes while the other overwrite them.

Ans 2.

Aspect	Peterson's Sol^n	Semaphores.
Implementation	Software based algorithm for two process	Abstract data types implemented in OS
complexity	Simpler logic but limited to 2 process.	More flexible, supports multiple processes.
Hardware dependancy	works purely in Software.	Depends on hardware supported atomic operations.

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Ans 3.

Advantage: Monitors provide automatic synchronization through mutual exclusion within the monitor. In multi core systems, they are easier to implement and maintain as synchronization is handled at a higher level, reducing the chance of programing errors.

Ans 4.

Starvation:- Occurs when writers keep waiting indefinitely because continuous readers hold access to shared data.

Prevention:- Use write priority - once a writer is waiting, block new readers until the writer finishes.

Ans 5.

Drawback:- Processes must request all resources at once before execution begins, leading to resources underutilization and reduced concurrency since some resources remain idle for long periods.

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Ans 6.

Given :-

Total instances: A = 10, B = 5, C = 7

Allocation & Max Table:

Process	Allocation (A, B, C)	Max (A, B, C)
P0	0, 1, 0	7, 5, 3
P1	2, 0, 0	3, 2, 2
P2	3, 0, 2	9, 0, 2
P3	2, 1, 1	4, 2, 2
P4	0, 0, 2	5, 3, 3

(a) Need Matrix = Max - Allocation

Process	Need (A, B, C)
P0	(7-0, 5-1, 3-0)
P1	(3-2, 2-0, 2-0)
P2	(9-3, 0-0, 2-0)
P3	(4-2, 2-1, 2-1)
P4	(5-0, 3-0, 3-2)

(b) Available = Total - ΣAllocation

(10, 5, 7) - (7, 2, 5) = (3, 3, 2)

Now check safe sequence using Banker's algorithm

Safe sequency = P1 → P3 → P4 → P0 → P2

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ⓒ If P1 requests (1, 0, 2):

New Need for P1 = (1, 2, 2) - (1, 0, 2) = (0, 2, 0)
Available = (3, 3, 2) - (1, 0, 2) = (2, 3, 0)
check if safe → sequence still possible → Yes.

Ans 7. Dining Philosophers Problem using semaphores:

- Each philospher has once chopstick
- To each philospher need both left and right chopstick.

Deadlock scenario :- All philosophers pick up their left chopstick and wait for the right one.

Sol^n :- • Use one semaphore mutex to limit maximum philosphers eating to 4 (n-1) rule.

Ans 8. I/O system Analysis.

Given:-

- Interrupt handling time = 5 μs.
- Data transfer rate = 500 KB/s
  = 500,000 bytes/s.

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- Data block per interrupt = 100 bytes.

(a) CPU time spent handling interrupt:
interrupts per second = 500,000 / 100 = 5,000
CPU time = 5000 × 5 μs = 25000 μs = 0.025 s

(2.5% of CPU time per second).

(b) <u>Improvement</u>:-

Increase data block size per interrupt (eg. 1KB intead of 100 bytes).

<u>Ans 9.</u> Case Study - Air traffic control system

(a) <u>Critical sections</u>:
- Radar data acquistion
- Flight path calculation
- Commonication channel updates

IPC mechanism: Use message queue for real time data synchronization and minimal latency.

(b) Deadlock handling:-
If a deadlock occurs b/w data acquistion and path calculations.