Midterm Exam 2 Online

Due Apr 6, 2022 at 1pm **Points** 100 **Questions** 8
Available Apr 6, 2022 at 11am - Apr 6, 2022 at 11:59pm 12 hours and 59 minutes
Time Limit 60 Minutes

Instructions

COMP 3500

Introduction to Operating Systems

Midterm Exam 2

Maximum Points: 100

Exam Duration: 50 Minutes

Spring 2022

Instructions:

Write neatly and clearly. If we can't read it, you will NOT get credit even if it is correct.
Do not spend too much time on any one question – move on, and come back to it later if you have time.
If explanations are asked for, these should be brief but precise.
Some questions have multiple parts. Answer all parts of the question.

This quiz is no longer available as the course has been concluded.

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	60 minutes	90 out of 100

Correct answers are hidden.

Score for this quiz: **90** out of 100

Submitted Apr 6, 2022 at 12:07pm

This attempt took 60 minutes.

Question 1

12 / 12 pts

Question 1 (4*3 = 12 Points): Consider the following solution to the **Producer–Consumer synchronization problem**. The shared buffer size is **N**. Three semaphores are initialized as follows: **(1) ToEmpty: 0; (2) ToFull: N; and (3) Mutex: 1**.

Semaphore **ToEmpty** denotes the number of available slots in the buffer for the consumer to read from. Semaphore **ToFull** denotes the number of available slots in the buffer for the producer to write to. Semaphore **Mutex** is used to provide exclusive access to the shared buffer.

```
Producer:
do{
        Wait(P);
        Wait(Mutex);
        // Add item to Buffer
        Signal(Mutex);
        Signal(Q);
}while(1);
```

```
Consumer:
do{
        Wait(R);
        Wait(Mutex);
        // Consume item from Buff
er
        Signal(Mutex);
        Signal(S);
}while(1);
```

The placeholder variables, denoted by P, Q, R and S, in the code above can be assigned either ToEmpty or ToFull. The valid semaphore operations are: Wait() and Signal().

Which semaphore assignments to P, Q, R and S will yield the correct solution?

P: __________ **Q:** __________ **R:** __________ **S:** __________

Your Answer:

P: ToFull

Q: ToEmpty

R: ToEmpty

S: ToFull

Question 2

6 / 6 pts

Question 2: (6 Points): A counting semaphore was initialized to 10. Then 6 P (wait) operations and 4 V (signal) operations were completed on this semaphore. The resulting value of the semaphore is __________. (**Note**: Show work to receive full credit.)

Your Answer:

Initial value is 10

After the 6 P (wait) operations = 10-6 = 4

After the 4 V (signal) operations = 4+4 = 8

Final value of counting semaphore is 8

Question 3

10 / 20 pts

Question 3: (20 Points) Assume that a log analytics application comprises four processes, A, B, C, and D. Process A scans the log file to identify failed user attempts to log into the system. Process B scans the log file to identify successful user attempts to log into the system. Process C scans the log file to identify the users logged out from the system. Processes A, B, and C update the Log_Tracker database table with the number of successful login / failed login / logout instances observed for each user. Finally, Process D reads the entries in database table Log_tracker to generate the summary report comprising total number of successful login attempts, failed login attempts, number of logged out users, and number of users currently active in the system. Note: Assume that there are only four processes A, B, C, D running in the system.

What is/are the shared resources? What comprises critical section? Write pseudocode with the specific sequence of resource acquisition/release, and usage of semaphores/mutex locks per process.

Your Answer:

The shared resources are A and C

C comprises the critical section because it is scanning the log file

Not enough time to write pseudocode :/ :(

Question 4

10 / 10 pts

Question 4: (10 Points): A system has 6 identical resources and N processes competing for them. Each process may request 2 resources. What is the minimum value of N that could lead to a deadlock?

Your Answer:

The minimum value of N is 6

Question 5

16 / 16 pts

Question 5: (4*4=16 Points): Assume a system comprises one resource having a single instance, and N processes. Argue that the system cannot enter a deadlock state. (**Note**: For a system to be in deadlock state, four deadlock conditions must satisfy. Show that the four conditions cannot occur in the given system.)

Your Answer:

Since there is only one resource which have only one instance, deadlock is not possible. For the system to enter deadlock all 4 conditions have to be satisfied. But the 4th condition of cyclic wait and also hold and wait condition can't arise. Since there is only one resource, only one process can hold the resource and it cannot wait for any other resource. Also, other processes can only wait at that time and cannot hold any resources. Therefore the condition of deadlock is not possible.

Question 6

6 / 6 pts

Question 6: (6 Points): Briefly describe a deadlock recovery approach, and its limitations.

Your Answer:

One deadlock recovery approach is Resource Preemption. This is when the resources are preempted from the process that has been involved in the deadlock. These resources that are preempted are allocated to other processes so there is a possibility that the system can be recovered from the deadlock. However, when this case is executed the system will go into starvation.

Question 7

10 / 10 pts

Question 7 (5+5=10 Points):

Does the following approach ensure mutual exclusion? Provide reasoning.
Does the following approach prevent deadlock? Provide reasoning.

Note: Assume wantS1 and wantS2 are shared variables initialized to false.

```
while (true) {
wantS1 = true;
while (wantS2 == true);
          // CS1 Tasks….
wantS1 = false;
          // Remainder section
}
```

```
While (true) {
wantS2 = true;
while (wantS1 == true);
          // CS2 Tasks….
wantS2 = false;
          // Remainder section
}
```

Your Answer:

The following approach ensures mutual exclusion because only the task in the critical section is being executed

The following approaches do not however prevent deadlock because it doesn't avoid any starvation

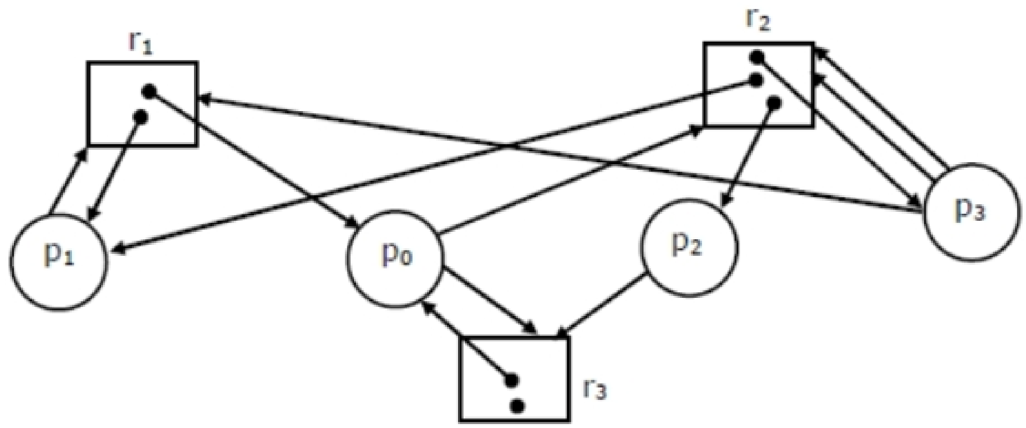
Question 8

20 / 20 pts

Question 8: (10+10=20 Points): Shown below is the resource allocation graph of a system.

(a) Identify the allocation matrix, request matrix, and available vector.

(b) Is the system in a deadlock state? If yes, identify the processes involved in the deadlock. If no, identify the safe execution sequence of processes.



Process	Allocation Matrix			Request Matrix		
	R1	R2	R3	R1	R2	R3
P0						
P1						
P2						
P3						

Your Answer:

(a)

Allocation Matrix:

	R1	R2	R3

P0	1	0	1
P1	1	1	0
P2	0	1	0
P3	0	1	0

Request Matrix:

	R1	R2	R3
P0	0	1	1
P1	1	0	0
P2	0	0	1
P3	1	2	0

Available Vector:

R1	R2	R3
0	0	1

(b)

NOT IN DEADLOCK

Sequence => <P2, P0, P1, P3>

Quiz Score: **90** out of 100