

WEEKLY TEST – 04

Subject : Operating System

Topic : Process Synchronization / Coordination



Maximum Marks 15

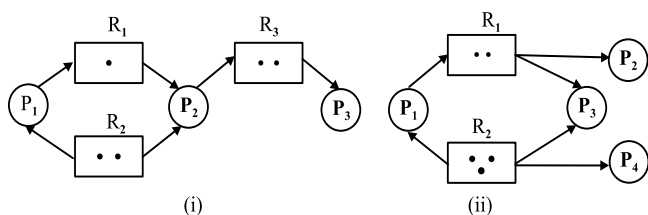
Q.1 to 5 Carry ONE Mark Each

[NAT]

1. Consider a system having 'n' resources of same type. All of these resources are shared by five process P0, P1, P2, P3 and P4 with a peak demand of 7, 8, 9, 10, and 11, respectively. What could be the maximum value of 'n' to ensure that the system is in deadlock.

[MCQ]

2. Consider the following resources allocation graph.



Which of the following is correct about above RAG?

- (a) Both (i) and (ii) has Deadlock
 (b) Only (i) has Deadlock
 (c) Only (ii) has Deadlock
 (d) None of (i) and (ii) has Deadlock.

[NAT]

3. Consider an operating system containing 'n' processes each requiring 5 resources. The maximum number of processes that can be executed without any deadlock if there are 20 resources is _____.

[NAT]

4. Consider three concurrent processes, P1, P2, and P3, as shown below, which access a shared variable X that has been initialized to 100.

P1	P2	P3
:	:	:
:	:	:
$x = x + 20$	$x = x - 50$	$x = x + 10$
:	:	:
:	:	:

Suppose the process are executed on a uniprocessor system running a time-shared operating system. If the minimum and maximum possible values of x after complete execution of x are A and B respectively, then the value of A + B is _____.

[MCQ]

5. Consider the following code:

Process P ₀ code:	Process P ₁ code:
while(true)	while(true)
{	{
non-CS();	non-CS();
while(true!=0);	while(true!=1);
[CS]	[CS]
true = 1;	true = 0;
}	}

Initially CS value was true = 0. Which of the condition this code is not satisfying?

- (a) Mutual Exclusion
 (b) Progress
 (c) Bounded waiting
 (d) All of these.

Q.6 to 10 Carry TWO Mark Each

[MSQ]

6. Consider a system with 3 types of resources R_1 , R_2 and R_3 in quantity 5, 7, 5 respectively. The allocation and max matrices are given as follows:

Allocation

	R_1	R_2	R_3
P_1	2	1	0
P_2	1	2	1
P_3	0	2	2
P_4	1	1	1

Max

R_1	R_2	R_3
2	3	3
2	3	2
3	2	3
3	3	2

Which of the following safe sequences are possible?

- $P_4 P_2 P_1 P_3$
- $P_2 P_4 P_3 P_1$
- $P_2 P_1 P_4 P_3$
- $P_2 P_4 P_1 P_3$

[MCQ]

7. Consider X, Y, Z are shared semaphore on following three concurrent processes:

Process-1	Process-2	Process-3
P(X)	P(Y)	P(Z)
P(Z)	Print "B"	P(X)
Print "A"	Print "E"	Print "C"
Print "D"	V(X)	Print "F"
V(Y)	V(Z)	

If these processes run concurrently and possible outputs are CFBEAD, ADCFBE, ACFDBE. What could be the initial value of X, Y and Z. So that above outputs are possible?

- $X = 2, Y = 0, Z = 1$
- $X = 2, Y = 0, Z = 2$
- $X = 1, Y = 0, Z = 2$
- $X = 2, Y = 0, Z = 1$

[MCQ]

8. Consider the following code:

```
main ()
int a = 0;
int b = 0;
begin
    Parbegin
        thread P();
        thread Q();
    Parend;
end;
```

```
thread P();
begin
    a = 1; /*statement 1*/
    b = b + a; /*statement2*/
end;

threadQ();
begin
    b = 4; /*statement 3*/
    a = a + 5; /*statement 4*/
end;
```

Suppose a process has 2 concurrent threads; one thread executes statement 1 and 2 and other thread executes statement 3 and 4. What are the possible values of variable 'a' and 'b' when the code finishes execution?

- $a = \{1, 5, 6\}$
 $b = \{10, 4, 5\}$
- $a = \{1, 5, 6\}$
 $b = \{1, 4, 5\}$
- $a = \{1, 6\}$
 $b = \{10, 4, 5\}$
- $a = \{1, 6\}$
 $b = \{1, 4, 5\}$

[MCQ]

9. Consider program for P_1 and P_2 :

```
P1()
{
    P(m);
    x++;
    P(n);
    y++;
    V(n);
    V(m);
}

P2()
{
    P(n);
    y++;
    P(m);
    x++;
    V(m);
    V(n);
}
```

If m and n are binary semaphore variable whose values are initially initialized to 1. x and y are shared resources whose values are initialized to 0.

Which of the following holds by above process?

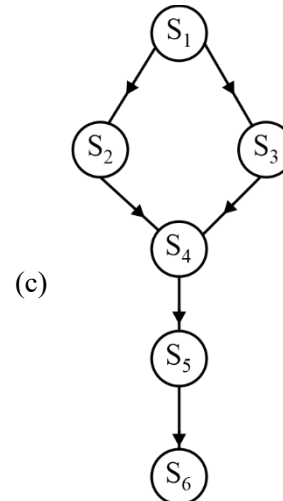
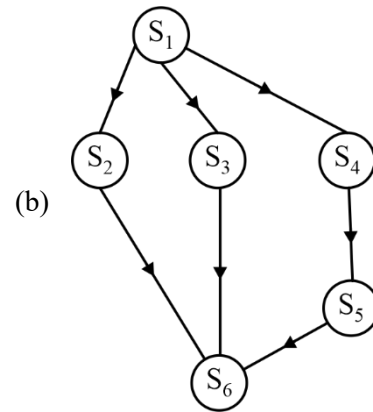
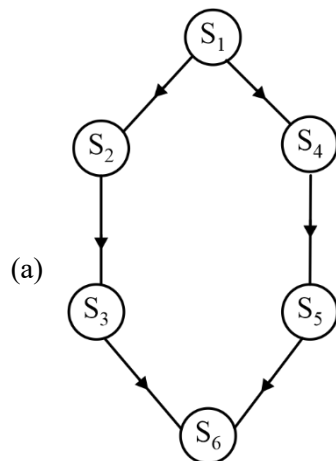
- (a) Deadlock, and No mutual exclusion
- (b) No deadlock, and no race condition.
- (c) Mutual exclusion and no deadlock.
- (d) Deadlock, mutual exclusion.

[MCQ]

10. Consider the following code:

```
begin
  S1;
  Parbegin
    S2;
    S3;
  begin S4; S5; end
  Parend;
  S6;
```

Which of the following is correct precedence graph for the above code?



(d) None of these.



Answer Key

- | | |
|----------|-----------|
| 1. (40) | 6. (b, d) |
| 2. (d) | 7. (b) |
| 3. (4) | 8. (c) |
| 4. (180) | 9. (d) |
| 5. (b) | 10. (b) |



Hints and Solutions

1. (40)

To avoid the deadlock in a system, minimum resources required are:

$$\text{No. of resources} \geq \sum_{i=0}^n (\text{max-need}(i) - 1) + 1$$

To make the system go into deadlock, subtract one extra resource from each process.

$$P_0 \rightarrow 6$$

$$P_1 \rightarrow 7$$

$$P_2 \rightarrow 8$$

$$P_3 \rightarrow 9$$

$$P_4 \rightarrow 10$$

In any process gets one resource, so the system will become deadlock free. So in order to ensure deadlock, there must be $6 + 7 + 8 + 9 + 10 = 40$. Therefore, maximum value of $n = 40$.

2. (d)

There is no deadlock in both RAG.

In (i) Process will be executed in following order

$$P_3 \rightarrow P_2 \rightarrow P_1$$

In (ii) Process will be executed in following order

$$P_2 \rightarrow P_4 \rightarrow P_3 \rightarrow P_1$$

3. (4)

There is no deadlock in both RAG.

In (i) Process will be executed in following order

$$P_3 \rightarrow P_2 \rightarrow P_1$$

In (ii) Process will be executed in following order

$$P_2 \rightarrow P_4 \rightarrow P_3 \rightarrow P_1$$

4. (180)

Total possible execution sequences are

$$P_1, P_2, P_3$$

$$P_1, P_3, P_2$$

$$P_2, P_1, P_3$$

$$P_2, P_3, P_1$$

$$P_3, P_1, P_2$$

$$P_3, P_2, P_1$$

After executing processes in each of these sequences, we will get

$$A = 50 \text{ and } B = 130$$

$$\text{So, } A + B = 180.$$

5. (b)

The above code behaving similar to strict alternation. Thus,

Mutual exclusion and bounded waiting are satisfied. Progress is not satisfied here as we are just focused on the true variable not on the interest of the process to enter the critical section or not.

6. (b, d)

From the given allocation and max matrices, need matrix can be computed as:

	R ₁	R ₂	R ₃
P ₁	0	2	3
P ₂	1	1	1
P ₃	3	0	1
P ₄	2	2	1

$$\text{Availability} = 1, 1, 1$$

Only P₂'s request can be fulfilled.

After P₂ is completed.

$$\text{Available} = 2, 3, 2.$$

Now, only P₄ request can be fulfilled.

After P₄ is completed.

$$\text{Available} = 3, 4, 3$$

Now, any of P₁ and P₃ can be serviced.

So, safe sequences are

$$P_2 P_4 P_1 P_3 \text{ and } P_2 P_4 P_3 P_1$$

\therefore option b, d are correct.

7. (b)

If we take $X = 1, Y = 1$, then after process - 1 or process - 3.

If both are concurrently running, then both of the processes will block and will stuck in deadlock situation.

If we take $X = 2, Z = 1, Y = 0$ or $X = 1, Y = 0, Z = 2$ then only one of the output above mentioned will print.

An $X = 2, Y = 0, Z = 2$ if either process-1 or process-3 starts, it will set value to $X=1, Y=0, Z=1$ and if either process want to interrupt then it will set values to $X=0, Y=0, Z=0$ and then output will be printed.

8. (c)

for variable 'a':

I: $a = 1$

$a = 1 + 5 = 6$

II: $a = 0 + 5 = 5$

$a = 1$

Possible values of 'a' {1, 6}

for variable 'b':

I: $b = 0 + 1$

$b = 4$

II: $b = 4$

$b = 4 + 1 = 5$

$b = 4$

III: $b = 4 + 6 = 10$

Possible values of 'b' {4, 5, 10}

9. (d)

$P_1()$

1. $P(m)$

2. $x++$

→ Preempted

$P_2()$

1. $P(n)$

2. $Y++$

$P(m)$ //waiting for m to become 1

→ Preempted

$P_1()$ //arrived again

3. $P(n)$ //waiting for n to become 1

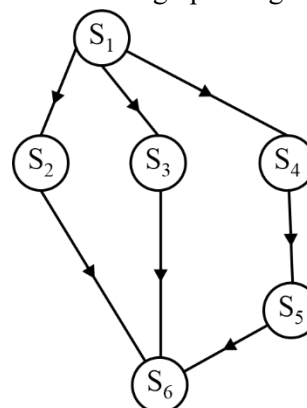
Thus, it creates deadlock.

There is mutual exclusion.

Therefore, option (d) is correct.

10. (b)

Precedence graph for given code is:



therefore, option (b) is correct.



For more questions, kindly visit the library section: Link for web: <https://smart.link/sdfez8ejd80if>



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