Sample Question Format

KIIT Deemed to be University

Online Mid Semester Examination(Spring Semester-2021)

Subject Name & Code: CS2002 & Operating Systems **Applicable to Courses: B.Tech**

Full Marks=20 **Time:1 Hour**

SECTION-A(Answer All Questions. All questions carry 2 Marks)

Time:20 Minutes **(5×2=10 Marks)**

Question No	Question Type(MCQ/SAT)	Question	Answer Key(if MCQ)	CO Mapping
1(a)	MCQ	Select the incorrect option regarding Process synchronization: (A) Busy waiting cycles reduces the productivity of the processor (B) Binary semaphore behave similar to the mutex lock (C) Semaphores can also be used for resources handling (D) Application of semaphore can never result in timing error	D	CO-2
	MCQ	Select the correct option regarding Process synchronization: (A) Busy waiting cycles increases the productivity of the processor (B) Binary semaphore behave similar to the mutex lock (C) Application of semaphore can never result in timing error (D) Semaphores can not be used for resources handling	B	CO-2
	MCQ	Select the correct option regarding Process synchronization: (A). Monitor construct ensures that only one process at a time is active within the monitor (B) Spinlock has a disadvantages of having too much context switching during a process must wait on a lock (C) Spinlocks are useful when locks are expected to be held for long times (D) The representation of Monitor type can be used directly by various processes	A	CO-2
	MCQ	Select the incorrect option regarding Process synchronization: (A) The representation of Monitor type can not be used directly by various processes (B) Spinlock has a disadvantages of having too much context switching during a process must wait on a lock (C) Monitor construct ensures that only one process at a time is active within the monitor (D) Spinlocks are useful when locks are expected to be held for short times	B	CO-2
1(b)	MCQ	The arrival and burst times of three processes P0, P1, and P2, are given in the following table. Process Arrival time(ms) Burst Time(ms) P0 0 9 P1 1 4 P2 4 7 The algorithm employed is the pre-emptive shortest job first scheduling.	E	CO-3

		Scheduling is performed only at the arrival of the processes. What is the average waiting time for the three processes? A. 5.33 ms B. 4.66 ms C. 4.33 ms D. 6.33 ms E. None of the above		
	MCQ	Consider four processes, which require 10, 5, 8 and 6 time units and arrive at times 0, 4, 6 and 10, respectively. If the operating system uses a shortest remaining time first scheduling technique, how many context changes are required? Do not count the context switches at time zero and at the end. **(A)** 2 **(B)** 3 **(C)** 4 **(D)** 6 **(E)** None of the above	C	CO-3
	MCQ	An operating system uses shortest remaining time first scheduling algorithm for pre-emptive scheduling of processes. Consider the following set of processes with their arrival times and CPU burst times (in milliseconds). The average waiting time (in milliseconds) of the processes is ________. Process Arrival time(ms) Burst Time(ms) P0 0 12 P1 2 4 P2 3 6 A. 5.33 ms B. 4.66 ms C. 4.33ms D. 6.33 ms E. None of the above	C	CO-3
	MCQ	Assume that each process requires 2 seconds of service time in a single-processor system. If new processes are arriving at the rate of 40 processes per two minutes, then calculate the CPU idle rate? **(A)** 50% **(B)** 30% **(C)** 33.33% **(D)** 66.66% **(E)** None of the above	C	CO-3
1(c)	**MCQ**	For long term scheduler which of the following stands true I. The long-term scheduler, or job scheduler, selects processes from this pool and loads them into memory for execution. II. The long-term scheduler, or CPU scheduler, selects from among the processes that are ready to execute and allocates the CPU to one of them. III. The long-term scheduler must select a new process for the CPU frequently. IV. The long-term scheduler executes much less frequently and it controls the degree of multi programming. V. The long-term scheduler may need to be invoked only when a process leaves the system.	C	CO-2

		VI. The long term scheduler only selects CPU bound processes. A. I, IV and VI only B. II,III,VI only C. I,IV,V only D. All of the above		
	MCQ	For short term scheduler which of the following stands true I. The short-term scheduler, or job scheduler, selects processes from this pool and loads them into memory for execution. II. The short-term scheduler, or CPU scheduler, selects from among the processes that are ready to execute and allocates the CPU to one of them. III. The short-term scheduler must select a new process for the CPU frequently. IV. The short-term scheduler controls the degree of multiprogramming. V. The short-term scheduler can afford to take more time to decide which process should be selected for execution. VI. Time-sharing systems such as UNIX and Microsoft Windows systems often have no long-term scheduler but simply put every new process in memory for the short-term scheduler. A. II,III,VI only B. I,IV,V only C. IV,V,VI only D. All of the above	A	CO-2
	MCQ	Which of the followings are false about the schedulers? I. The long-term scheduler selects a good process mix of I/O-bound and CPU-bound processes. II. The medium-term scheduler, or job scheduler, selects from among the processes that are ready to execute and allocates the CPU to one of them. III. If all processes are CPU bound, the ready queue will almost always be empty, and the short-term scheduler will have little to do. IV. The key idea behind a medium-term scheduler is that sometimes it can be advantageous to remove processes from memory (and from active contention for the CPU) and thus reduce the degree of multiprogramrning.	B	CO-2

		V. The short term scheduler controls the degree of multiprogramming. A. I,IV,V only B. II,III,V only C. I,II,V only D. All of the above		
	MCQ	Which of the followings are true about scheduler? I. In a batch os, processes are spooled to a mass-storage device, job scheduler or long term scheduler select processes from this pool and loads them into memory for execution. II. The short term scheduler controls the degree of multi programming. III. The long-term scheduler selects a good process mix of I/O-bound and CPU-bound processes. IV. If all processes are I/O bound, the ready queue will almost always be empty, and the short-term scheduler will have little to do A. I ,II and III only B. I,III and IV only C. II,III and IV only D. All of the above	B	CO-2
1(d)	**MCQ**	The following pair of processes share a common variable X and use a binary semaphore S. Process A: int Y Y=X*3 X=Y signal(S) Process B: int Z wait(S) Z=X+2 X=Z Let the semaphore S is initialized to 0 and the shared variable X is initialized to 4 before execution of both the processes. How many different values of X are possible after finishing execution of both the processes? A) one B) Two C) Three D) Four E) None of these	A	CO-5
	MCQ	The following pair of processes share a common variable X and use a binary semaphore S. Process A: int Y Y=X*3	B	CO-5

		X=Y signal(S) Process B: int Z wait(S) Z=X+2 X=Z Let the semaphore S is initialized to 0 and the shared variable X is initialized to 4 before execution of both the processes. What will be the value of X after finishing execution of both the processes? A) 11 B) 14 C) 17 D) 18 E) None of these		
	MCQ	The following pair of processes share a common variable X and use a binary semaphore S. Process A: int Y Y=X*3 X=Y signal(S) Process B: int Z wait(S) Z=X+2 X=Z Let the semaphore S is initialized to 1 and the shared variable X is initialized to 4 before execution of both the processes. How many different values of X are possible after both processes finish their execution? A) one B) Two C) Three D) Four E) None of these	D	CO-5
	MCQ	The following pair of processes share a common variable X and use a binary semaphore S. Process A: int Y wait(S) Y=X*3 X=Y Process B: int Z Z=X+2 X=Z signal(S) Let the semaphore S is initialized to 0 and the shared variable X is	D	CO-5

		initialized to 5 before execution of both the processes. What will be the value of X after finishing execution of both the processes? A) 11 B) 14 C) 17 D) 21 E) None of these		
1(e)	**MCQ**	To ensure the hold and wait condition in deadlock prevention, a process must A) Hold at least one resource and waiting to acquire additional resources which are being held by other processes. B) Not hold any resources but waiting for more number of resources. C) Hold at least one resource and not waiting for any more additional resources. D) All of the cases	A	CO-1
	MCQ	To ensure the no preemption condition in deadlock prevention, if a process hold some resources and request some more additional resources that could not be granted immediately, then A) Process must wait for the resource to be granted B) All the resources that are currently being held are preempted C) Process restart its execution by allocating all its resources D) None of the cases	B	CO-1
	MCQ	In deadlock prevention, to ensure the circular wait condition that never hold A) Imposes the partial ordering of all resource types and each process requests resources non-increasing order of enumeration. B) Imposes the partial ordering of all resource types and each process requests resources increasing order of enumeration. C) Imposes the total ordering of all resource types and each process requests resources increasing order of enumeration. D) Imposes the total ordering of all resource types and each process requests resources non-increasing order of enumeration.	C	CO-1
	MCQ	In deadlock prevention, the drawback of protocol that request and allocate all its resources before execution begins A) High CPU utilization B) High resource utilization C) Low CPU utilization D) Low resource allocation	D	CO-1

SECTION-B(Answer Any One Question. Each Question carries 10 Marks)

Time: 30 Minutes **(1×10=10 Marks)**

Question No	**Question**	**CO Mapping**
Q.No:2	a. Three processes are running on a system that uses Shortest Job First non-preemptive scheduling Algorithm. Draw the Gantt chart and find out the average response time for the following processes: <table><tr><td>Process Name</td><td>Arrival Time (in ms)</td><td>CPU Burst Time (in ms)</td></tr></table>	CO-4

P1	0	6
P2	AA	4
P3	3	8

(Assume AA = Your Roll number MODULOS 10 + 2, for example AA = 6 if your roll number is 20205124) [5]

Solution: **Let AA be 7**

Process Name	AT	BT	Response Time	CPU Time
P1	0	6	0	0+6+8
P2	7	4	7	
P3	3	8	4	

Average Response Time = 10/3 = 3.33ms

Gantt Chart:

P1	**P3**	**P2**
0	6	14 18

b. Consider four processes A, B, C, and D scheduled on a CPU as per Round Robin algorithm with a time quantum of N units. The process A arrives at t=0, remaining processes arrive in the order B, C, D at time t = 3. There is exactly one context switch from D to B, exactly one context switch from C to B, and exactly two context switches from B to C. There is no context switch from D to A. Switching to a ready process after the termination of another process is also considered a context switch. Find out the expected range (minimum and maximum) of the CPU burst time (in time units) of the processes A, B, C and D. (Assume N=Your Roll No. MODULOS 10 + 3)
[5]

Let N be 6
Gantt Chart:

A	B	C	D	B	C	B

Name of the process	Number of times dispatched to CPU	Range (units)
A	1	1 to 6
B	3	>=13
C	2	7 to 12
D	1	1 to 6

Generalized Solution for N
Gantt Chart:

A	**B**	**C**	**D**	**B**	**C**	**B**

Name of the process	Number of times dispatched to CPU	Range (units)
A	1	1 to N if N>=3 1 to 3 if N<3
B	3	>=2N + 1
C	2	N + 1 to 2N
D	1	1 to N

<u>**Q.No:3**</u> CO-4

a. Three processes are running on a system that uses Shortest Job First non-preemptive scheduling Algorithm. Draw the Gantt chart and find out the average response time for the following processes:

Process Name	Arrival Time (in ms)	CPU Burst Time (in ms)
P1	0	8
P2	AA	6
P3	3	4

(Assume AA = Your Roll number MODULOS 10 + 2, for example AA = 6 if your roll number is 20205124) [5]

	b. Consider four processes A, B, C, and D scheduled on a CPU as per Round Robin algorithm with a time quantum of N units. The process A arrives at t=0, remaining processes arrive in the order B, C, D at time t = 3. There is exactly one context switch from D to B, exactly one context switch from C to B, and exactly two context switches from B to C. There is no context switch from D to A. Switching to a ready process after the termination of another process is also considered a context switch. Find out the expected range (minimum and maximum) of the CPU burst time (in time units) of the processes A, B, C and D. (Assume N=Your Roll No. MODULOS 5 + 4) [5]	
Q.No:4	a. Three processes are running on a system that uses Shortest Job First non-preemptive scheduling Algorithm. Draw the Gantt chart and find out the average response time for the following processes:	CO-4

Process Name	Arrival Time (in ms)	CPU Burst Time (in ms)
P1	0	4
P2	AA	6
P3	4	8

(Assume AA = Your Roll number MODULOS 10 + 2, for example AA = 6 if your roll number is 20205124) [5]

b. Consider four processes A, B, C, and D scheduled on a CPU as per Round Robin algorithm with a time quantum of N units. The process A arrives at t=0, remaining processes arrive in the order B, C, D at time t = 3. There is exactly one context switch from D to B, exactly one context switch from C to B, and exactly two context switches from B to C. There is no context switch from D to A. Switching to a ready process after the termination of another process is also considered a context switch. Find out the expected range (minimum and maximum) of the CPU burst time (in time units) of the processes A, B, C and D. (Assume N=Your Roll No. MODULOS 5 + 3) [5]

Q.No:5	In a railway ticket booking office, maximum 10 persons, either male, female, or both are allowed to go inside. There are three ticket counters in the booking office. Among these 10 persons, a maximum of 3 persons are allowed to book the ticket at a time with a restriction that all these 3 persons can neither be male nor be female. It means that maximum of 2 males with 1 female or maximum of 2 females with 1 male is allowed to book the ticket. Write a solution using semaphore to synchronize among the males and females to	CO-5

	book their ticket.	
	Semaphore person_cnt=10, female_cnt=2, male_cnt=2, counter=3; Male: p(person_cnt) p(male_cnt) p(counter) book_ticket() v(counter) v(male_cnt) v(person_cnt) Female: p(person_cnt) p(female_cnt) p(counter) book_ticket() v(counter) v(female_cnt) v(person_cnt)	
Q.No:6	In a railway station, there are 3 rest rooms. In each rest room, only one passenger is allowed to take rest at a time. Write a solution using semaphore to synchronize among the passenger to avoid the race condition for accessing the rooms.	CO-5

```
Semaphore person_cnt=10, female_cnt=2, male_cnt=2, counter=3;
            Male                                   Female
   p(person_cnt)                          p(person_cnt)
       p(male_cnt)                            p(female_cnt)
           p(counter)                             p(counter)
               book_ticket()                          book_ticket()
           v(counter)                             v(counter)
       v(male_cnt)                            v(female_cnt)
   v(person_cnt)                          v(person_cnt)
```

```
enum {empty,pack};
        int room_state[3] = {empty};
   Semaphore passenger[n] = {0}, mutex=1;
        int room_occupied[n] = {-1};

   passenger_work(i)
   {
       while(1)
       {
           occupy_room(i);
           take_rest();
           vacant_room(i);
       }
   }

   occupy_room(i)
   {
       p(mutex)
           check_room_status(i);
       v(mutex)
       p( passenger[i])
   }

   check_room_status(i)
   {
       int rm_no=-1;
       if(room_state[0] == empty)
       {
            rm_no=0;
       }
       else if(room_state[1] == empty)
       {
            rm_no=1;
       }
       else if(room_state[2] == empty)
```

	`` { rm_no=2; } if(rm_no != -1) { room_occupied[i] = rm_no; room_state[rm_no] = pack; v(passenger[i]) } } vacant_room(i) { p(mutex) room_state[room_occupied[i]] = empty; room_occupied[i] = -1; check_room_status(for waited process); v(mutex) } ```	
Q. No:7	In a civilized society, a gentle man lives with his spouse and his elderly parents. Due to old age, his parents cannot be left alone in the house. So, at least any one of the spouse must be available in the house. Write a synchronize solution using semaphore for this problem.	CO-5
	`` enum {in,out,desire_out}; int spouse_state[2] = {out}; Semaphore spouse[2] = {0}, mutex=1; spouse_work(i) { while(1) { enter_house(i); takecare_parent(); leave_house(i); } } enter_house(i) { p(mutex) spouse_state[i]=in; check_spouse_status((i+1)%2); v(mutex) } check_spouse_status(i) { if(spouse_state[(i+1)%2] == in && spouse_state[i] == desire_out) { spouse_state[i] = out; v(spouse[i]) } } ```	

<table>
<tr><td></td><td><pre>leave_house(i)
{
       p(mutex)
              spouse_state[i] == desire_out;
               check_spouse_status(i);
       v(mutex)
       p(spouse[i])
}</pre></td><td></td></tr>
</table>