

CS3009: OS Mid Sem Autumn 2021-22

Instructions

1. 30 Marks, 120 minutes.
2. The MCQs may have multiple correct answers. You need to select all the correct answers to fetch the mark.
3. System will not auto submit your answers at the end of the examination. You are required to explicitly submit/turn-in your answers at the end of examination.
4. No one can submit after the submission window closes and will be assigned 0 mark.
5. Upload the scanned copy (.pdf) of your rough work in the File section of the Team by 11:15am. Write your roll no. on each page. The file should be named as per your roll no.

...

Hi, SUSHREE. When you submit this form, the owner will see your name and email address.

1. The _____ scheduler temporarily suspends the process from execution and places it in secondary memory.

(0.5 Points)

- ☐ Short term scheduler
- ☐ Long term scheduler
- ☐ CPU scheduler
- ☐ Medium-term scheduler

2. An operating system uses the Longest Remaining Time First (LRTF) process scheduling algorithm. Consider the set of Processes [P1, P2, P3, P4]; Arrival Times [1, 2, 3, 4]; Burst Times [5, 1, 3, 1]. For tie breaking OS first focuses on context switch overhead then on the order of appearance in the ready queue. The waiting time of P1 is ____ and the CPU utilization is \approx ____ % ?

(1 Point)

- ☐ 2, 91
- ☐ 5, 91
- ☐ 2, 100
- ☐ 5, 100

3. Consider the following algorithm for mutual exclusion between two concurrent processes i and j. The program executed by the process i is shown below where flag[i] and flag[j] are initialized to false and turn is initialized to i or j randomly.

```
Repeat
    flag[i]=true;
    turn=j;
    while (P) ;
        Critical section
    flag[i]=false;
    Reminder section.
until false;
```

For the program to guarantee mutual exclusion, the predicate P in the while loop should be_____.

(1 Point)

- ☐ flag[i]==true
- ☐ flag[j]==true and turn==i
- ☐ flag[j]==true and turn==j
- ☐ flag[j]==true

4. In indirect communication between processes P and Q _____

(0.5 Points)

- ☐ there is a mailbox to help communication between P and Q
- ☐ there is another user process R to handle and pass on the messages between P and Q
- ☐ there is another machine between the two processes to help communication

☐ none of the mentioned

5. Consider n processes: P_1, P_2, \dots, P_n added to the ready queue, in order, at $t=0$. A scheduling algorithm assigns priority proportional to the waiting time of a process. Every process starts with priority 1 (the lowest priority). The scheduler re-evaluates the process priorities every T time units and decides the next process to schedule. If there is a tie between process P_i and P_j then the process with lower index is selected. Which of the following is/are TRUE if the processes have no I/O operations?

(1 Point)

- ☐ This algorithm is equivalent to the shortest job first algorithm.
- ☐ This algorithm is equivalent to the first come first serve algorithm.
- ☐ This algorithm is equivalent to the round robin algorithm with time quanta T
- ☐ This algorithm will never lead to starvation

6. Which of the following statements is/are not true? Choose all that apply.
(0.5 Points)

- ☐ Shortest remaining time first scheduling may cause starvation but shortest job next scheduling does not
- ☐ FCFS scheduling may cause starvation
- ☐ Shortest remaining time first scheduling may result in more number of context switches compared to the shortest job next scheduling
- ☐ FCFS is better than Round robin in terms of average response time

7. Given n processes to be scheduled on one processor, how many possible different schedules are there?
(0.5 Points)

- ☐ 2^n
- ☐ $n!$
- ☐ $C(n, r)$
- ☐ $P(n, r)$

8. Consider n tasks with known burst times b_1, b_2, \dots, b_n to be executed on a uniprocessor system. Which of the following scheduling algorithms is the best if throughput is the only criteria?

(0.5 Points)

- ☐ First come first serve
- ☐ Round robin
- ☐ Shortest job first
- ☐ High response ratio next

9. Which of the following is/are true regarding the SJF scheduling algorithm? Choose all that apply.
(0.5 Points)

- ☐ SJF minimizes the process flow time
- ☐ SJF improves the average waiting time
- ☐ SJF is a special case of the general priority scheduling algorithm
- ☐ SJF improves the turnaround time of the shorter process

10. Which is/are true about the non-preemptive scheduling algorithm?
(1 Point)

- ☐ First come first serve is a non-preemptive algorithm and provides minimum average turnaround time.
- ☐ The non-preemptive priority-based scheduling algorithm may suffer starvation and does not provide a minimum average waiting time compared to other non-preemptive algorithms.
- ☐ Round robin is a non-preemptive algorithm and provides minimum average response time.
- ☐ The shortest job next is a non-preemptive algorithm and provides a minimum average waiting time than other non-preemptive algorithms.

11. Which of the following OS guarantees the parallel execution of multiple processes?

(0.5 Points)

- ☐ Multi-programming OS
- ☐ Multi-threading OS
- ☐ Multi-processing OS
- ☐ Time Sharing OS

12. If the time quantum of a round-robin algorithm is very large then which is/are true?

(0.5 Points)

- ☐ It works like the shortest job first and provides poor response time.
- ☐ It works like first come first serve and provides poor response time.
- ☐ It works like first come first serve and improves response time
- ☐ It works like the shortest remaining time first and provides poor response time.

13. Which is/are true for lack of process synchronization in a system?

(0.5 Points)

- ☐ May lead to blocking of processes from progressing
- ☐ May affect throughput
- ☐ May degrades system performance
- ☐ May lead to data inconsistency

14. Consider the following proposed solution for the critical section problem. There are n processes: P0 ...Pn-1. In the code, function MAX returns the maximum value of its arguments. For all i, no[i] is initialized to zero and c[i] is initialized to false. Following is the code for Pi.

```
do{
  c[ i ]=true;
  no[ i ]= MAX(no[ 0 ], ... , no[ n-1 ]);
  no[ i ]= no[ i ] + 1;
  c [ i ]=false;
  for every j ≠ i in {0, ..., n-1}
  {
    while (c[ j ]);
    while (no[ j ] != 0 && no[ j ] >= no[ i ]);
  }
}
```

Critical Section

no[i]=0;

Remainder Section;

}while(true);

Which one of the following is not TRUE about the above solution?

(1 Point)

- ☐ The bounded wait condition is satisfied
- ☐ The progress condition is satisfied
- ☐ It cannot cause starvation
- ☐ At most one process can be in the critical section at any time

15. What is the degree of multiprogramming?

(0.5 Points)

- ☐ The number of processes in the ready queue
- ☐ The number of processes loaded by LTS and are not yet terminated
- ☐ The number of processes in the I/O queue

☐ The number of processes executed per unit time

16. Which process affects some other process executing in the system?
(0.5 Points)

☐ Cooperating process

☐ Parent process

☐ Child process

☐ Independent process

17. Process synchronization can be done on _____
(0.5 Points)

☐ software level

☐ I/O device level

☐ memory level

☐ hardware level

18. Which of the following operations are provided by the IPC facility?
(0.5 Points)

☐ receive & send message

☐ write & delete message

☐ send & delete message

☐ delete & receive message

19. Which is/are not true about Long- Term scheduler (LTS) and Short-Term Schedulers (STS).
(0.5 Points)

☐ LTS regulates the programs which are selected to the system for processing but STS ensures which program is suitable or important for processing at which time.

☐ The frequency of invocation of STS is often high as compared to LTS.

☐ STS changes process state from new to ready and LTS changes process state from ready to run.

☐ LTS is also known as CPU scheduler and STS is also known as a job scheduler.

20. Consider a time quantum of 2 units with Round Robin Scheduling policy and the set of 3 processes [A, B, C] with arrival times [0, 1, 2] and burst times [3, 6, 5]. The context switch overhead time is 1 unit. The expiry of time quantum is considered before the arrival of a new process if both occur at the same time. The waiting time for processes B, A, and C are _____.
(1 Point)

☐ 2, 6, 7

☐ 6, 2, 7

☐ 4, 12, 13

☐ 7, 12, 13

21. Consider the following algorithm for mutual exclusion between two concurrent processes i and j. The program executed by the process i is shown below where flag[i] and flag[j] are initialized to false and turn is initialized to i or j randomly.

```
Repeat
    flag[i]=true;
    turn=j;
    while (P) ;
        Critical section
    flag[i]=false;
    Reminder section.
until false;
```

For the program to guarantee progress property, the predicate P in the while loop should be _____.
(1 Point)

☐ flag[i]==true

☐ flag[j]==true and turn==i

☐ `flag[j]==true and turn==j`

☐ `flag[j]==true`

22. **Interprocess communication can be done through _____.**
(0.5 Points)

☐ Messages

☐ Shared memory

☐ Traps

☐ System Calls

23. **Multiprogramming may increase _____.**
(0.5 Points)

☐ Burst time of processes

☐ I/O device total usage time

☐ Throughput

☐ Percentage of CPU utilization

24. **Consider three CPU-intensive processes, which require 10, 20 and 30 time units and arrive at times 0, 2 and 6, respectively. How many context switches are needed if the operating system implements a shortest job next scheduling algorithm? Count only the switches where a previously executing process is preempted (forcibly taken) by another process.**
(1 Point)

☐ 5

☐ 0

☐ 2

☐ 4

25. **When several processes access the same data concurrently and the outcome of the execution depends on the particular order in which the access takes place is called _____**
(0.5 Points)

☐ Critical condition

☐ Deadlock Condition

☐ Race condition

☐ Atomic condition

26. **Consider the set of processes [P1, P2, P3, P4] with arrival times [0, 1, 2, 3] and burst times [4, 5, 1, 7] and the system uses the shortest remaining time first (SRTF) scheduling algorithm. The waiting time of process P2 and P1 are _____.**

(1 Point)

☐ 7, 4

☐ 7, 1

☐ 4, 1

☐ 14, 5

27. Consider two processes A and B wish to execute their critical section and the codes are as given below. The shared Boolean semaphores m1 and m2 are initialized randomly. Which of the options is/are true about the properties achieved?

Code for A

```
-----  
while (m1 == m2) ;  
{ Critical Section }  
m1 = m2;  
-----
```

Code for B

```
-----  
while ( m1 != not(m2) ) ;  
{ Critical Section }  
m2 = not (m1);  
-----
```

(1 Point)

- ☐ Both mutual exclusion and progress
- ☐ Progress but not mutual exclusion
- ☐ Mutual exclusion but not progress
- ☐ Neither mutual exclusion nor progress

28. The time required to create a new thread in an existing process (0.5 Points)

- ☐ is smaller than the time required to create a new process
- ☐ maybe greater or less than the time required to create a new process, depending on the system state
- ☐ is greater than the time required to create a new process
- ☐ is equal to the time required to create a new process

29. Consider a system with FIVE processes [P1, P2, P3, P4, P5] with burst times [3, 4, 1, 5, 2] and arrival times [3, 4, 5, 6, 7]. If the system uses the Highest Response Ratio Next scheduling algorithm then the wait time of process P5 and P2 are _____ and _____ respectively.

(1 Point)

- ☐ 2.4
- ☐ 3
- ☐ 3.6
- ☐ 1.8

30. Which is /are true about the Process Control Block (PCB)? (0.5 Points)

- ☐ PCB must be kept in an area of memory protected from normal process access.
- ☐ The size of the PCB is the same for a CPU-bound process and an I/O-bound process.
- ☐ PCB is a data structure and it is maintained by the OS to store all information about a process.
- ☐ Each process in the system has a single PCB.

31. Which of the techniques is used to overcome starvation in priority scheduling?

(0.5 Points)

- ☐ Schedule the processes from low priority to high priority.
- ☐ Raise the priority of lower priority starved processes
- ☐ Implement Aging policy
- ☐ Have a fixed priority level scheme

32. Consider a system with 'm' CPUs and 'n' processes where $m < n$, then what will be the upper bound and lower bound processes that are present in the running state, ready state, and waiting state respectively?

(0.5 Points)

- ☐ m, m, n and n, n-m, n
- ☐ m, n, n and 0, n-m, 0
- ☐ m, n, n and 0, 0, 0
- ☐ n, m, n and m, 0, 0

33. Assume every process has 2 seconds of burst time in a system with a single processor. If new processes are arriving at the rate of 20 processes per minute, then what is the percentage of time the CPU is idle in the system?

(1 Point)

- ☐ 33.33 %
- ☐ 20 %
- ☐ 50 %
- ☐ 66.66 %

34. Bounded waiting implies that _____.

(0.5 Points)

- ☐ A process that is executing its remainder section should not block another process from entering into the critical section
- ☐ The process executes for a finite time in the critical section
- ☐ The process must be allocated all the required resources before entering into the critical section
- ☐ Other processes may be allowed to enter into their critical section a bounded number of times after a process has requested to access its critical section

35. A process executes the following code snippet where $n > 2$.

```
int i;  
for(i=1; i<100; i++)  
    fork();
```

The total number of child processes created with degree 17 is _____.

(1 Point)

- ☐ 2^{83}
- ☐ 2^{82}
- ☐ $2^{100} - 1$
- ☐ 2^{81}

36. To access the services of an operating system, the interface is provided by the

(0.5 Points)

- ☐ Assembly instructions
- ☐ Library
- ☐ API
- ☐ System call

37. When a process issues a request to print on a printer, and the only printer in the system is busy then _____.

(0.5 Points)

- ☐ It is placed in the ready queue
- ☐ The process transits from ready to waiting state
- ☐ The process transits from running to waiting state
- ☐ It is placed in device queue of the printer

38. Consider the following algorithm for mutual exclusion between two concurrent processes i and j. The program executed by the process i is shown below where flag[i] and flag[j] are initialized to false and turn is initialized to i or j randomly.

```
Repeat
    flag[i]=true;
    turn=j;
    while (P) ;
        Critical section
    flag[i]=false;
    Reminder section.
until false;
```

For the program to guarantee bounded waiting property, the predicate P in the while loop should be _____.

(1 Point)

- ☐ flag[j]==true and turn==j
- ☐ flag[i]==true
- ☐ flag[j]==true
- ☐ flag[j]==true and turn==i

39. What is SPOOL?
- (0.5 Points)

- ☐ Simultaneous Peripheral Operation On Line
- ☐ Simultaneous Process Operation On Line
- ☐ Simultaneous Peripheral Output On Line
- ☐ Simultaneous Process Output On Line

40. Consider the following statements about process state transitions for a system using preemptive scheduling. Which of the above statements is/are true?

(0.5 Points)

- ☐ A blocked process can't move to a running state.

- ☐ A running process can move to a ready state.
- ☐ A blocked process can move to a ready state.
- ☐ A ready process can move to a running state.

41. Pipe is used for inter-process communication. Which statements about PIPE is/are true?

(0.5 Points)

- ☐ The pipe() system call requires an array of two integers as parameter
- ☐ dup2() system call is used to swap the read and write file descriptors of a pipe
- ☐ Pipe is used for unidirectional flow of data
- ☐ We may read and write from a pipe at the same time

42. Consider a system with 3 processes [A, B, C] with arrival times [0.0, 0.4, 1.0] and burst times [8, 4, 1]. All times are in milliseconds. The system uses SJN scheduling with a modification that it forces the CPU to remain idle during the first millisecond. What is the average turnaround time and average waiting time?

(1 Point)

- ☐ 9.53, 5.20
- ☐ 6.86, 7.33
- ☐ 9.53, 7.33
- ☐ 6.86, 5.20

43. Which is/are properties must satisfy any solution to a critical section problem?

(0.5 Points)

- ☐ Deadlock
- ☐ Progress
- ☐ Unbounded waiting

☐ Mutual exclusion

44. **Which of the following is/are true about Interprocess Communication?**

Choose all that apply

(0.5 Points)

- ☐ Shared memory IPC is faster compared to message passing
- ☐ Kernel memory is neither used in message passing nor shared memory IPC
- ☐ Message passing through ports/mailboxes are called direct message passing
- ☐ An asynchronous communication system never leads to deadlock

45. **Which of the following scheduling algorithms may cause starvation?**

(0.5 Points)

- ☐ Highest Response Ratio Next
- ☐ Priority
- ☐ Shortest Job First
- ☐ Round Robin

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