

# OS GATE

## Set3

1. Which of the following is NOT a valid deadlock prevention scheme? (GATE CS 2000)

- (A) Release all resources before requesting a new resource
- (B) Number the resources uniquely and never request a lower numbered resource than the last one requested.
- (C) Never request a resource after releasing any resource
- (D) Request that all required resources be allocated before execution

2. Let  $m[0] \dots m[4]$  be mutexes (binary semaphores) and  $P[0] \dots P[4]$  be processes. Suppose each process  $P[i]$  executes the following:

```
wait (m[i]); wait(m[(i+1) mode 4]);  
-----  
release (m[i]); release (m[(i+1)mod 4]);
```

This could cause (GATE CS 2000)

- (A) Thrashing
- (B) Deadlock
- (C) Starvation, but not deadlock
- (D) None of the above

3. A graphics card has an onboard memory of 1 MB. Which of the following modes can the card not support? (GATE CS 2000)

- (A) 1600 x 400 resolution with 256 colors on a 17-inch monitor
- (B) 1600 x 400 resolution with 16 million colors on a 14-inch monitor
- (C) 800 x 400 resolution with 16 million colors on a 17-inch monitor
- (D) 800 x 800 resolution with 256 colors on a 14-inch monitor

4 Consider a virtual memory system with a FIFO page replacement policy. For an arbitrary page access pattern, increasing the number of page frames in the main memory will (GATE CS 2001)

- (A) Always decrease the number of page faults
- (B) Always increase the number of page faults
- (C) Sometimes increase the number of page faults

(D) Never affect the number of page faults

Solution: Correct answer is (C)

Explanation: Incrementing the number of page frames doesn't always decrease page faults ([Belady's Anomaly](#)).

5. Which of the following requires a device driver? (GATE CS 2001)

(A) Register

(B) Cache

(C) Main memory

(D) Disk

Solution: Correct answer is (D).

6. Suppose the time to service a page fault is on average 10 milliseconds, while a memory access takes 1 microsecond. Then a 99.99% hit ratio results in an average memory access time of (GATE CS 2000)

(A) 1.9999 milliseconds

(B) 1 millisecond

(C) 9.999 microseconds

(D) 1.9999 microseconds

Solution: Correct answer is (D)

Explanation: Average memory access time =  $[(\% \text{ of page miss}) * (\text{time to service a page fault}) + (\% \text{ of page hit}) * (\text{memory access time})] / 100$ . So, the average memory access time in microseconds is  $(0.01 * 10 * 1000 + 99.99 * 1) / 100 = (100 + 99.99) / 100 = 199.99 / 100 = 1.9999 \mu s$ .

7. Which of the following need not necessarily be saved on a context switch between processes? (GATE CS 2000)

(A) General purpose registers

(B) Translation look-aside buffer

(C) Program counter

(D) All of the above

8. Where does the swap space reside? (GATE 2001)

(A) RAM

(B) Disk

(C) ROM

(D) On-chip cache

Solution: Correct answer is (B)

Explanation: Swap space is an area on the disk that temporarily holds a process memory image. When physical memory demand is sufficiently low, process memory images are brought back into physical memory from the swap area. Having sufficient swap space enables the system to keep some physical memory free at all times.

9. Which of the following does not interrupt a running process? (GATE CS 2001)

(A) A device

(B) Timer

(C) Scheduler process

(D) Power failure

10. Which of the following scheduling algorithms is non-preemptive? (GATE CS 2002)

(A) Round Robin

(B) First-In First-Out

(C) Multilevel Queue Scheduling

(D) Multilevel Queue Scheduling with Feedback

## Set4

1. Using a larger block size in a fixed block size file system leads to (GATE CS 2003)

- a) better disk throughput but poorer disk space utilization
- b) better disk throughput and better disk space utilization
- c) poorer disk throughput but better disk space utilization
- d) poorer disk throughput and poorer disk space utilization

Answer (a)

If block size is large then seek time is less (fewer blocks to seek) and disk performance is improved, but remember larger block size also causes waste of disk space.

2. Consider the following statements with respect to user-level threads and kernel supported threads

- i. context switch is faster with kernel-supported threads
- ii. for user-level threads, a system call can block the entire process
- iii. Kernel supported threads can be scheduled independently
- iv. User level threads are transparent to the kernel

Which of the above statements are true? (GATE CS 2004)

- a) (ii), (iii) and (iv) only
- b) (ii) and (iii) only

- c) (i) and (iii) only
- d) (i) and (ii) only

3. The minimum number of page frames that must be allocated to a running process in a virtual memory environment is determined by (GATE CS 2004)

- a) the instruction set architecture
- b) page size
- c) physical memory size
- d) number of processes in memory

Answer (a)

Each process needs minimum number of pages based on instruction set architecture. Example IBM 370:

6 pages to handle MVC (storage to storage move) instruction

Instruction is 6 bytes, might span 2 pages.

2 pages to handle from.

2 pages to handle to.

4. In a system with 32 bit virtual addresses and 1 KB page size, use of one-level page tables for virtual to physical address translation is not practical because of (GATE CS 2003)

- a) the large amount of internal fragmentation
- b) the large amount of external fragmentation
- c) the large memory overhead in maintaining page tables
- d) the large computation overhead in the translation process

## Set5

1. A process executes the code

```
fork ();
```

```
fork ();
```

```
fork ();
```

The total number of child processes created is

- (A) 3
- (B) 4
- (C) 7
- (D) 8

2. consider the 3 processes, P1, P2 and P3 shown in the table

| Process | Arrival time | Time unit required |
|---------|--------------|--------------------|
| P1      | 0            | 5                  |
| P2      | 1            | 7                  |
| P3      | 3            | 4                  |

The completion order of the 3 processes under the policies FCFS and RRS (round robin scheduling with CPU quantum of 2 time units) are

- (A) FCFS: P1, P2, P3 RR2: P1, P2, P3
- (B) FCFS: P1, P3, P2 RR2: P1, P3, P2
- (C) FCFS: P1, P2, P3 RR2: P1, P3, P2
- (D) FCFS: P1, P3, P2 RR2: P1, P2, P3

3. Consider the virtual page reference string

1, 2, 3, 2, 4, 1, 3, 2, 4, 1

On a demand paged virtual memory system running on a computer system that main memory size of 3 pages frames which are initially empty. Let LRU, FIFO and OPTIMAL denote the number of page faults under the corresponding page replacements policy. Then

- (A) OPTIMAL < LRU < FIFO
- (B) OPTIMAL < FIFO < LRU
- (C) OPTIMAL = LRU
- (D) OPTIMAL = FIFO

Answer (B) The OPTIMAL will be 5, FIFO 6 and LRU 9.

4. A file system with 300 GByte uses a file descriptor with 8 direct block address. 1 indirect block address and 1 doubly indirect block address. The size of each disk block is 128 Bytes and the size of each disk block address is 8 Bytes. The maximum possible file size in this file system is

- (A) 3 Kbytes
- (B) 35 Kbytes
- (C) 280 Bytes
- (D) Dependent on the size of the disk

## Set6

1) A thread is usually defined as a 'light weight process' because an operating system (OS) maintains smaller data structures for a thread than for a process. In relation to this, which of the followings is TRUE?

- (A) On per-thread basis, the OS maintains only CPU register state
- (B) The OS does not maintain a separate stack for each thread
- (C) On per-thread basis, the OS does not maintain virtual memory state
- (D) On per thread basis, the OS maintains only scheduling and accounting information.

Answer (C)

Threads share address space of Process. Virtually memory is concerned with processes not with Threads.

2) Let the page fault service time be 10ms in a computer with average memory access time being 20ns. If one page fault is generated for every  $10^6$  memory accesses, what is the effective access time for the memory?

- (A) 21ns

- (B) 30ns
- (C) 23ns
- (D) 35ns

3) An application loads 100 libraries at startup. Loading each library requires exactly one disk access. The seek time of the disk to a random location is given as 10ms. Rotational speed of disk is 6000rpm. If all 100 libraries are loaded from random locations on the disk, how long does it take to load all libraries? (The time to transfer data from the disk block once the head has been positioned at the start of the block may be neglected)

- (A) 0.50s
- (B) 1.50s
- (C) 1.25s
- (D) 1.00s

4. Consider the following table of arrival time and burst time for three processes P0, P1 and P2.

| Process | Arrival time | Burst Time |
|---------|--------------|------------|
|---------|--------------|------------|

|    |      |      |
|----|------|------|
| P0 | 0 ms | 9 ms |
|----|------|------|

|    |      |      |
|----|------|------|
| P1 | 1 ms | 4 ms |
|----|------|------|

|    |      |      |
|----|------|------|
| P2 | 2 ms | 9 ms |
|----|------|------|

The pre-emptive shortest job first scheduling algorithm is used. Scheduling is carried out only at arrival or completion of processes. What is the average waiting time for the three processes?

- (A) 5.0 ms
- (B) 4.33 ms
- (C) 6.33 ms
- (D) 7.33 ms

## Set7

1) Let the time taken to switch between user and kernel modes of execution be  $t_1$  while the time taken to switch between two processes be  $t_2$ . Which of the following is TRUE? (GATE CS 2011)

- (A)  $t_1 > t_2$
- (B)  $t_1 = t_2$
- (C)  $t_1 < t_2$
- (D) Nothing can be said about the relation between  $t_1$  and  $t_2$

2) A system uses FIFO policy for page replacement. It has 4 page frames with no pages loaded to begin with. The system first accesses 100 distinct pages in some order and then accesses the same 100 pages but now in the reverse order. How many page faults will occur? (GATE CS 2010)

- (A) 196
- (B) 192
- (C) 197
- (D) 195

3) Which of the following statements are true? (GATE CS 2010)

I. Shortest remaining time first scheduling may cause starvation

II. Preemptive scheduling may cause starvation

III. Round robin is better than FCFS in terms of response time

(A) I only

(B) I and III only

(C) II and III only

(D) I, II and III

4) Consider the methods used by processes P1 and P2 for accessing their critical sections whenever needed, as given below. The initial values of shared boolean variables S1 and S2 are randomly assigned.

Method Used by P1

```
while (S1 == S2) ;
```

Critical Section

```
S1 = S2;
```

Method Used by P2

```
while (S1 != S2) ;
```

Critical Section

```
S2 = not (S1);
```

Which one of the following statements describes the properties achieved? (GATE CS 2010)

(A) Mutual exclusion but not progress

(B) Progress but not mutual exclusion

(C) Neither mutual exclusion nor progress

(D) Both mutual exclusion and progress

## Set8

1) In which one of the following page replacement policies, Belady's anomaly may occur?

(A) FIFO

(B) Optimal

(C) LRU

(D) MRU

2) The essential content(s) in each entry of a page table is / are

(A) Virtual page number

(B) Page frame number

(C) Both virtual page number and page frame number

(D) Access right information

3) Consider a system with 4 types of resources R1 (3 units), R2 (2 units), R3 (3 units), R4 (2 units). A non-preemptive resource allocation policy is used. At any given instance, a request is not entertained if it cannot be completely satisfied. Three processes P1, P2, P3 request the sources as follows if executed independently.

Process P1:

t=0: requests 2 units of R2

t=1: requests 1 unit of R3

t=3: requests 2 units of R1

t=5: releases 1 unit of R2

and 1 unit of R1.

t=7: releases 1 unit of R3

t=8: requests 2 units of R4

t=10: Finishes

Process P2:

t=0: requests 2 units of R3

t=2: requests 1 unit of R4

t=4: requests 1 unit of R1

t=6: releases 1 unit of R3

t=8: Finishes

Process P3:

t=0: requests 1 unit of R4

t=2: requests 2 units of R1

t=5: releases 2 units of R1

t=7: requests 1 unit of R2

t=8: requests 1 unit of R3

t=9: Finishes

Which one of the following statements is TRUE if all three processes run concurrently starting at time t=0?



- (A) All processes will finish without any deadlock
- (B) Only P1 and P2 will be in deadlock.
- (C) Only P1 and P3 will be in a deadlock.
- (D) All three processes will be in deadlock

4) Consider a disk system with 100 cylinders. The requests to access the cylinders occur in following sequence:

4, 34, 10, 7, 19, 73, 2, 15, 6, 20

Assuming that the head is currently at cylinder 50, what is the time taken to satisfy all requests if it takes 1ms to move from one cylinder to adjacent one and shortest seek time first policy is used?

- (A) 95ms
- (B) 119ms
- (C) 233ms
- (D) 276ms