GATE SOLVED PAPER - CS

OPERATING SYSTEM

YEAR 2001

Q. 1 Which of the following statements is false ?

(A) Virtual memory implements the translation of a program's address space into physical memory address space.

(B) Virtual memory allows each program to exceed the size of the primary memory.

(C) Virtual memory increases the degree of multi-programming

(D) Virtual memory reduces the context switching overhead.

Q. 2 Consider a set of n tasks with known runtimes $r_1, r_2, \ldots\ldots r_n$ to be run on a uniprocessor machine. Which of the following processor scheduling algorithms will result in the maximum throughput ?

(A) Round-Robin (B) Shortest-Job-First

(C) Highest-Response-Ratio-Next (D) First-come-First-Served

Q. 3 Where does the swap space reside ?

(A) RAM (B) Disk

(C) ROM (D) On-chip cache

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

(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

Q. 5 Consider a machine with 64 MB physical memory and a 32-bit virtual address space. If the page size is 4 KB, what is the approximate size of the page table ?

(A) 16 MB (B) 8 MB

(C) 2 MB (D) 24 MB

Q. 6 Consider Peterson's algorithm for mutual exclusion between two concurrent processes i and j. The program executed by process is shown below.

```
repeat
      flag[i]=true;
      turn=j;
      while(p)do no-op;
      Enter critical section, perform actions, then
      exit critical section
      Flag[i]=false;
      Perform other non-critical section actions.
```

Until false;

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

(A) flag [j]= true and turn =j
(B) flag [j]=true and turn =j
(C) flag [i]=true and turn=j
(D) flag [i]=true and turn=i

YEAR 2002

Q. 7 Which of the following scheduling algorithms is non-preemptive ?

(A) Round Robin
(B) First-In First-Out
(C) Multilevel Queue Scheduling
(D) Multilevel Queue Scheduling with Feedback

Q. 8 The optimal page replacement algorithm will select the page that

(A) Has not been used for the longest time in the past.
(B) Will not be used for the longest time in the future.
(C) Has been used least number of times.
(D) Has been used most number of times

Q. 9 Which combination of the following features will suffice to characterize an OS as a multi-programmed OS ? More than one program may be loaded into main memory at the same time for execution. (B) If a program waits for certain events such as I/O, another program is immediately scheduled for execution. (C) If the execution of a program terminates, another program is immediately scheduled for execution.

(A) A
(B) A and B
(C) A and C
(D) A, B and C

Q. 10 In the index allocation scheme of blocks to a file, the maximum possible size of the file depends on

(A) The size of the blocks, and the size of the address of the blocks
(B) The number of blocks used for the index, and the size of the blocks.
(C) The size of the blocks, the number of blocks used for the index, and the size of the address of the blocks.
(D) None of the above.

YEAR 2003 ONE MARK

Q. 11 Using a larger block size in a fixed block size file system leads to

(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

Q. 12 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

(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

YEAR 2003 TWO MARKS

Q. 13 A uni-processor computer system only has two processes, both of which alternate 10 *ms* CPU bursts with 90 *ms* I/O bursts. Both the processes were created at nearly the same time. The I/O of both processes can proceed in parallel. Which of the following scheduling strategies will result in the least CPU utilizations (over a long period of time) for this system ?

(A) First come first served scheduling

(B) Shortest remaining time first scheduling

(C) Static priority scheduling with different priorities for the two processes

(D) Round robin scheduling with a time quantum of 5 *ms*.

Common Data For Q. 14 & 15

A processor uses 2-level page table fro virtual to physical address translation. Page table for both levels are stored in the main memory. Virtual and physical addresses are both 32 bits wide. The memory is byte addressable. For virtual to physical address translation, the 10 most significant bits of the virtual address are used as index into the first level page table while the next 10 bits are used as index into the second level page table. The 12 least significant bits of the virtual address are used as offset within the page. Assume that the page table entries in both levels of page tables are 4 a bytes wide. Further, the processor has a translation look aside buffer(TLB), with a hit rate of 96%. The TLB caches recently used virtual page numbers and the corresponding physical page numbers. The processor also has a physically addressed cache with a bit ratio of 90%. Main memory access time is 10 *ns*, cache access time is 1 *ns*, and {LB access time is also 1*ns*.

Q. 14 Assuming that no page faults occur, the average time taken to access a virtual address is approximately (to the nearest 0.5 *ns*)

(A) 1.5 *ns* (B) 2 *ns*

(C) 3 *ns* (D) 4 *ns*

Q. 15 Suppose a process has only the following pages in its virtual address space; two contiguous code pages starting at virtual address 0×0000000, two contiguous data pages starting at virtual address 0×00400000,and a stack page starting at virtual address $0 \times FFFFF000$. The amount of memory required for storing the page tables of this process is

(A) 8 KB (B) 12 KB

(C) 16 KB (D) 20 KB

Common Data For Q. 16 & 17

Suppose we want to synchronize two concurrent processes P and Q using binary semaphores S and T. The code for the processes P and Q is shown below.

```
Process P                    Process Q:
     while(1) {                   while(1) {
W:                           Y:
     print '0';                    print '1'
     print '0';                    print '1'
X:                           Z:
}                            }
```

Synchronization statements can be inserted only at points W,X,Y and Z.

Q. 16 Which of the following will always lead to an output staring with '001100110011'?

(A) P(S) at W, V(S) at X, P(T) at Y, V(T) at Z, S and T inutuakkt 1

(B) P(S) at W, V(T) at X, P(T) at Y, V(S) at Z, S initially 1, and T initially 0

(C) P(S) at W, V(T) at X, P(T) at Y, V(S) at Z, S and T initially 1

(D) P(S) at W, V(T) at X, P(T) at Y, V(S) at Z, S initially 1, and T initially 0

Q. 17 Which of the following will ensure that the output string never contains a substring of the form 0.1" or 10"1 where n is odd?

(A) P(S) at W, V(S) at X, P(T) at Y, V(T) at Z, S and T initially 1

(B) P(S) at W, V(T) at X, P(T) at Y, V(S) at Z, S and T initially 1

(C) P(S) at W, V(S) at X, P(T) at Y, V(S) at Z, S initially 1

(D) (S) at W, V(T) at X, P(T) at Y, P(S) at Z, S and T initially 1

YEAR 2004 **ONE MARK**

Q. 18 Consider the following statements with respect to user-level threads and kernel-supported threads

(i) Context which 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?

(A) (ii),(iii) and (iv) only (B) (ii) and (iii) only

(C) (i) and (iii) only (D) (i) and (ii) only

Q. 19 Consider an operating system capable of loading and executing a single sequential user process at a time. The disk head scheduling algorithm used is First Come First Served (FCFS). If FCFS is replaced by shortest seek Time Fist (SSTF), claimed by the vendor to given 50% better beachmark results, what is the expected improvement in the I/O performance of user programs?

(A) 50% (B) 40%

(C) 25% (D) 0%

Q. 20 The minimum number of page frames that must be allocated to a running process in a virtual memory environment is determined by

(A) the instruction set architecture (B) page size

(C) physical memory size (D) number of processes in memory

Q. 21 Consider the following set of processes, with the arrival times and the CPU-burst times given in milliseconds

Process	Arrival time	Burst time
P1	0	5
P2	1	3
P3	2	3
P4	4	1

What is the average turnaround time for these processes with the preemptive shortest remaining processing time first (SRPT) algorithm?

(A) 5.50 (B) 5.75

(C) 6.00 (D) 6.25

Q. 22 Consider a system with a two-level paging scheme in which a regular memory access takes 150 nanoseconds, and servicing a page fault takes 8 milliseconds. An average instruction takes 100 nanoseconds of CPU time, and two memory accesses. The TLB hit ratio is 99%, and the page fault rate is one in every 10,000 instructions. What is the effective average instruction execution time?

(A) 645 nanoseconds (B) 1050 nanoseconds

(C) 1215 nanoseconds (D) 1230 nanoseconds

Q. 23 Consider two processes P_1 and P_2 accessing the shared variables X and Y protected by two binary semaphores S_x and S_y respectively, both initialized to 1. P and V denote the usual semaphore operators, where P decrements the semaphore value, and V increments the semaphore value. The pseudo-code of P_1 and P_2 is as follows:

```
P1:                                  P2:
     while true                           while true
do{                                  do{
     L1:.....                             L3:.....
     L2:.....                             L4:.....
     X=X+1;                               Y=Y+1;
     Y+Y-1;                               X=Y-1;
     V(Sx);                               V(Sy);
     V(Sy);      }                        V(Sx);      }
```

In order to avoid deadlock, the correct operators at L_1, L_2, L_3 and L_4 are respectively

(A) $P(S_Y), P(S_X); P(S_X), P(S_Y)$ (B) $P(S_X), P(S_Y); P(S_Y), P(S_X)$

(C) $P(S_X), P(S_X); P(S_Y), P(S_Y)$ (D) $P(S_X), P(S_Y); P(S_X), P(S_Y)$

Q. 24 A Unix-style I-node has 10 direct pointers and one single, one double and one triple indirect pointers. Disk block size is 1 Kbyte, disk block address is 32 bits, and 48-bit integers are used. What is the maximum possible file size?

(A) 2^{24} bytes (B) 2^{32} bytes

(C) 2^{34} bytes (D) 2^{48} bytes

Q. 25 Suppose n processes, $P_1,.....P_n$ share m identical resource units, which can be reserved and released one at a time. The maximum resource requirement of process P_i is s_p where $s_i < 0$. Which one of the following is a sufficient condition for ensuring that deadlock does not occur?

(A) $\forall i, s < m$ (B) $\forall i, s, < n$

(C) $\sum_{i=1}^{n} s_i < (m+n)$ (D) $\sum_{i=1}^{n} s_i < (m * n)$

Q. 26 Consider the following code fragment:

if (fork()= = 0

{$a = a + 5$; print f("%d,%/ n"a, and a);}; else {$a - 5$; print f("%d,%d/ n",a,&a);}

let u, vbe the values printed by the parent process, and x,y be the values printed by the child process. Which one of the following is TRUE?

(A) $u = x + 10$ and $v = y$ (B) $u = x + 10$ and $v \neq y$

(C) $u + 10 = x$ and v = y (D) $u + 10 = x$ and v $\neq$ y

Q. 27 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 shortes remaining time first scheduling algorithm? Do not count the context switches at time zero and at the end

(A) 1 (B) 2

(C) 3 (D) 4

Q. 28 The atomic feth-and-set x,y instruction unconditionally sets the memory location x to 1 and fetches the old value of x in y without allowing any intervening access to the memory location x. Consider the following implementation of P and V functions on a binary semaphore S.

```
void p (binary_semaphore*S){
     unsigned y;
unsigned*x =& (S->value);}
          do {
          fetch-and-set x,y;
     } while(y);
}
void V (binary_semphore*S){
     {S_>value = 0;
}
```

Which one of the following is true?

(A) The implementation may not work if context switching is disabled in P

(B) Instead of using fetch-and-set, a pair of normal load/ store can be used

(C) The implementation of V is wrong

(D) The code does not implement a binary semaphore

Q. 29 A CPU generates 32-bit virtual addresses. The page size is 4 KB. The processor has a translation look-aside buffer (TLB) which can hold a total of 128 page table entries and is 4-way set associative.
The minimum size of the TLB tag is
(A) 11 bits (B) 13 bits
(C) 15 bits (D) 20 bits

Q. 30 A computer system supports 32-bit virtual addresses as well as 32-bit physical addresses, Since the virtual address space is of the same size as the physical address space, the operating system designers decide to get rid of the virtual entirely. Which one of the following is true?
(A) Efficient implementation of multi-user support is no longer possible
(B) The processor cache organization can be made more efficient now
(C) Hardware support for memory management is no longer needed
(D) CPU scheduling can be made more efficient now

Q. 31 Consider three processes (process *id* 0,1,2, respectively) with compute time bursts 2,4, and 8 time units. All processes arrive at time zero. Consider the longest remaining time first (LRTF) scheduling algorithm. In LRTF ties are broken by giving priority to the process with the lowest process *id*. The average turn around time is
(A) 13 units (B) 14 units
(C) 15 units (D) 16 units

Q. 32 Consider three processes, all arriving at time zero, with total execution time of 10, 20 and 30 units, respectively. Each process spends the first 20% of execution time doing I/O, the next 70% of time doing computation, and the last 10% of time doing I/O again. The operating system uses a shortest remaining compute time first scheduling algorithm and schedules a new process either when the running process get blocked on I/O or when the running process finishes its compute burst. Assume that all I/O operations can be overlapped as much as possible. For what percentage of time does the CPU remain idle?
(A) 0% (B) 10.6%
(C) 30.0% (D) 89.4%

Q. 33 Consider the following snapshot of a system running n processes. Process i is holding x_i instances of a resource R, for $1 \le i \le n$. Currently, all instances of R are occupied. Further, for all i, process i has placed a request for an additional y, instances while holding the x_i instances it already has, There are exactly two processes p and q such that $y_p = y_q = 0$: Which one of the following can serve as a necessary condition to guarantee that the system is not approaching a deadlock?
(A) $\min(x_p, x_q) < \max_{k \neq p,q} y_k$ (B) $x_p + x_q \le \max_{k \neq p'q} y_k$
(C) $\min(x_p, x_q) < 1$ (D) $\min(x_p, x_q) > 1$

Common Data For Q. 34 & 35

Barrier is a synchronization construct where a set of processes synchronizes globally i.e. each process in the set arrives at the barrier and waits for all others to arrive and then all processes leave the barrier. Let the number of processes in the set be three and S be a binary semaphore with the usual P and V functions.

Consider the following C implementation of a barrier with line numbers shown on the left.

```
Void barrier(void) {
1    :    P(S)
2    :    Process_arrived++;
3    :    V (S) :
4    :    while (process_arrived'=3);
5    :    P(S);
6    :    Precess_left++;
7    :    if(process_left==3)
8    :         process_arrived=0;
9    :         process_left+0;
10   :    }
11   :    V(S);
}
```

The variable process_ arrived and process_ left are shared among all processes and are initialized to zero. In a concurrent program all the three processes call the barrier function when they need to synchronize globally.

Q. 34 The above implementation of barrier is incorrect. Which one of the following is true?

(A) The barrier implementation is wrong due to the use of binary semaphore S

(B) The barrier implementation may lead to a deadlock if two barrier invocations are used in immediate succession

(C) Lines 6 to 10 need not be inside a critical section

(D) The barrier implementation is correct if there are only two processes instead of three

Q. 35 Which one of the following rectifies the problem in the implementation?

(A) lines 6 to 10 are simply replaced by process_ arrived

(B) At the beginning of the barrier the first process to enter the barrier waits until process_ arrived becomes zero before proceeding to execute P(S)

(C) Context switch is disabled at the beginning of the barrier and re-enabled at the end.

(D) The variable process_ left is made private instead of shared

YEAR 2007 **ONE MARK**

Q. 36 Group-1 contains some CPU scheduling algorithms and group-2 contains some applications. Match entries in Group-1 entries in Group-2

Group-1	Group-2
P. Gang Scheduling	1. Guaranteed Scheduling
Q. Rate Monotonic Scheduling	2. Real-time Scheduling
R. Fair Share scheduling	3. Thread Scheduling

(A) P-3;Q-2;R-1

(B) P-1;Q-2;R-3

(C) P-2;Q-3;R-1

(D) P-1;Q-3;R-2

Q. 37 Consider the following statements about user level threads and kernel level threads. Which one of the following statements is FALSE?

(A) Context switch time is longer for kernel level threads than for user level threads

(B) User level threads do not need any hardware support

(C) Related kernal level thread can be scheduled on different processors in a multiprocessor system

(D) Blocking one kernel level thread blocks all related threads

YEAR 2007 TWO MARKS

Q. 38 An operating system uses Shortest Remaining Time first (SRT) process scheduling algorithm. Consider the arrival times and execution times for the following processes

Process	Execution time	Arrival time
P1	20	0
P2	25	15
P3	10	30
P4	15	45

What is the total waiting time for process P2?

(A) 5 (B) 15

(C) 40 (D) 55

Q. 39 A virtual memory system uses first In First Out (FIFO) page replacement policy and allocates a fixed number of frames to a process. Consider the following statements:

P: Increasing the number of page frames allocated to a process sometimes increases the page fault rate.

Q: Some program do not exhibit locality of reference.

Which one of the following is TRUE?

(A) Both P and Q are ture, and Q is the reason for P

(B) Both P and Q are true, but Q is not the reason for P

(C) P is false, but Q is true (D) Both P and Q are false

Q. 40 A single processor system has three resource types X, Y, and Z, which are shared by three processes. There are 5 units of each resource type. Consider the following scenario, where the column alloc denotes the number of units of each resource type allocated to each process, and the column request denotes the number of units of each resource type requested by a process in order to complete execution. Which of these processes will finish LAST?

	alloc	request
	X Y Z	X Y Z
P0	121	103
P1	201	012
P2	221	120

(A) P0 (B) P1

(C) P2

(D) None of the above, since the system is in a deadlock

Q. 41 Two processes, P1 and P2, need to access a critical section of code. Consider the following synchronization construct used by the processes:

```
/* P1 */                          /*P2*/
        while (true) {                    while (true) {
        wants1=true;                      wants2 = true;
                                          while (wants1 ==
while(wants2==true);              true);
        /*      Critical                  /*      Critical
        Section*/                         Section*/
        wants 1 = false;                  wants 2 = false;
}                                 }
/* Remainder section*/            /*Remainder section*/
```

Here, wants 1 and wants 2 are shared variables, Which are initialized to false. Which one of the following statements is TRUE about the above construct?

(A) It does not ensure mutual exclusion.

(B) It does not ensure bounded waiting.

(C) It requires that processes enter the critical section in strict alternation.

(D) It does not prevent deadlocks, but ensures mutual exclusion

Common Data For Q. 42 & 43

A process has been allocated 3 page frames. Assume that none of the pages of the process are available in the memory initially. The process makes the following sequence of page references (reference string): 1,2,1,3,7,4,5,6,3,1.

Q. 42 If optimal page replacement policy is used, how many page faults occur for the above reference string?

(A) 7 (B) 8

(C) 9 (D) 10

Q. 43 Least Recently Used (LRU) page replacement policy is a practical approximation to optimal page replacement. For the above reference string, how many more page faults occur with LRU than with the optimal page replacement policy?

(A) 0 (B) 1

(C) 2 (D) 3

YEAR 2008 **ONE MARK**

Q. 44 Which of the following system calls results in the sending of SYN packets?

(A) socket (B) bind

(C) listen (D) connect

Q. 45 The data block of a very large file in the Unix file system are allocated using

(A) Contiguous allocation (B) Linked allocation

(C) indexed allocation (D) an extension of indexed allocation

Q. 46 The P and V operations on counting semaphores, where s is a counting ewmaphore, are defined as follows:

$P(s)$;$s = s - 1$;

if$s < 0$ then wait;

$V(s)$:$s = s + 1$;

if$s <= 0$ then wakeup a process waiting on s;

Assume that P_b and V_b the wait and signal operations on binary semaphores are provided. Two binary semaphores X_b and Y_b are used to implement the semaphore operations $P(s)$ and $V(s)$ as follows:

```
P(s) : P_b(X_b);
       s=s-1;
       if (s<0){
            V_b(X_b);
            P_b(Y_b);
       }
       else V_b(X_b);
P(s):P_b(X_b);
       s=s+1;
       if (s<=0){
       V_b(Y_b);
       V_b(X_b);
```

The initial values of x_b and y_b are respectively

(A) 0 and 0 (B) 0 and 1

(C) 1 and 0 (D) 1 and 1

Q. 47 Which of the following statements about synchronous and asynchronous I/O is NOT true?

(A) An ISR is invoked on completion of I/O in synchronous I/O but not in asynchronous I/O

(B) In both synchronous and asynchronous I/O an ISR (Interrupt Serive Routine) is invoked after completion of the I/O

(C) A process making a synchronous I/O cal waits until I/O is complete, but a process making an asynchronous I/O call does not wait for completion of the I/O

(D) In the case of synchronous I/O, the process waiting for the completion of I/O is woken up by the ISR that is invoked afterr the completion of I/O

Q. 48 Which of the following is NOT true of deadlock prevention and deadlock avoidance schemes?

(A) In deadlock prevention, the request for resources is always granted if the resulting state is safe

(B) In deadlock avoidance, the request for resources is always granted if the resulting state is safe

(C) Deadlock avoidance is less restrictive than deadlock prevention

(D) Deadlock avoidance requires knowledge of resource requirements a priori

Q. 49 A process executes the following code for($i = 0'\ i < n; i++$)fork();
The total number of child processes created is

(A) n (B) $2^n - 1$

(C) 2^n (D) $2^{n+1} - 1$

Q. 50 A processor uses 36 bit physical addresses and 32 bit virtual addresses, with a page frame size of 4 Kbytes. Each page table entry is of size 4 bytes. A three level page table is used for virtual-to-physical address translation, where the virtual address is used as follows

- bits 30-31 are used to index into the first level page table,
- bits 21-29 are used to index into second level page table
- bits 12-20 are used to index into third level page table
- bits 0-11 are used as offset within the page

The number of bits required for addressing the next level page table (or page frame) in the page table entry of the first, second and third level page table are respectively.

(A) 20,20 and 20 (B) 24,24 and 24

(C) 24,24 and 20 (D) 25,25 and 24

YEAR 2009 ONE MARK

Q. 51 Consider a system with 4 type of resources R1 (3 units), R2 (2 units), R3 (3 units), R4 (4units). A non-preemptive resource allocation policy is used. At any give instance, a request is not entertained if it cannot be completely satisfied. Three processes P1, P2, P3 request the resources as follows if executed independently.

Process P1:	Process P2:	Process P3
t=0; requests 2 units of R2 t=0; request 1 units of R3 t=0; request 2 units of R1 t=5; release 1 unit of R2 and 1 units of R1 t=7; release 1 units of R3 t=8; request 2 units of R4 t=10; Finishes	t=0 : request 2 units of R3 t=2 ; request 1 units of R4 t=4 ; request 1 units of R1 t=6 ; release 1 units of R3 t=8 ; Finishes	t=0 ; request 1 units of R4 t=2 ; request 2 units of R1 t=5 ; release 2 units of R1 t=8 ; request 1 units 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 deadlock

(D) All three processes will be in deadlock

Q. 52 In which of the following page replacement policies, Belady's anomaly may occur

(A) FIFO (B) Optimal

(C) LRU (D) MRU

Q. 53 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

YEAR 2009 TWO MARKS

Q. 54 Consider a disk system with 100 cylinders. The requests to access the cylinders occur in following sequence :

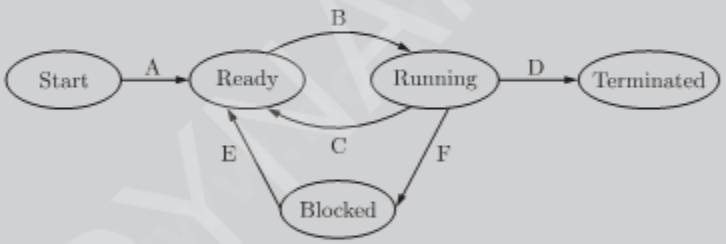
4, 34, 10, 7, 19, 73, 2, 15, 6, 20

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

(A) 95 ms (B) 119 ms

(C) 233 ms (D) 276 ms

Q. 55 In the following process state transition diagram for a uniprocessor system, assume that there are always some processes in the steady state :



Now consider the following statements :

I. If a process makes a transition D, it would result in another process making transition A immediately

II A process P_2 in blocked state can make transition E while another process P_1 is in running state

III The OS uses non-premptive scheduling

IV The OS uses non-premptive scheduling

Which of the above statement are TRUE ?

(A) I and II (B) I and III

(C) II and III (D) II and IV

Q. 56 The enter_ CS ( ) and leave_ CS ( ) functions to implement critical section of a process are realized using test and set instruction as follows :

```
Void enter_cs (X)
{
     while (test-and-set)(X)) :
}
Void leave_CS(X)
```

```
{
      X=0;
}
```

In the above solution, X is a memory location associated with the CS and is initialized to 0. Now consider the following statements

I The above solution to CS problem is deadlock-free

II The solution is starvation free

III The processes enter CS in FIFO order

IV More than one process can enter CS at the same time

Which of the above statements are TRUE

(A) I only (B) I and II

(C) II and III (D) IV only

Q. 57 A multilevel page table is preferred in comparison to a single level page table for translating virtual address to physical address because

(A) It reduces the memory access time to read or write and memory location

(B) It helps to reduce the size of page table needed to implement the virtual address space of a process

(C) If is required by the translation lookaside buffer

(D) If helps to reduce the number of page faults in page replacement algorithms.

YEAR 2010 ONE MARK

Q. 58 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	Method used by P2
While (S1==S2); Critical Section S1=S2;	While (S1!=S2); Critical Section S2=not (S1)

While one of the following statements describes properties achieved ?

(A) Mutual exclusion nut nor progress (B) Progress but not mutual exclusion

(C) Neither mutual exclusion nor progress (D) Both mutual exclusion and progress

Q. 59 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 ?

(A) 196 (B) 192

(C) 197 (D) 195

Q. 60 Which of the following statements are true ?

I Shortest remaining time first scheduling may cause starvation

II Preemptive scheduling may cause starvation

II Round robin in 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

Q. 61 The following program consists of 3 concurrent precesses and 3 binary semaphores. The semaphores are initialized as $S_0 = 1, S_1 = 0, S_2 = 0$

Process P_0	Process P_1	Process P_2

While (true){
wait (S_0);
print '0'
release (S_1);
release (S_2);
}
	wait (S_1);
	release (S_0);
		wait (S_2)
		release (S_0);

How many times will precess P0 print '0' ?

(A) At least twice (B) Exactly twice

(C) Exactly thrice (D) Exactly once

Q. 62 A system has n resources $R_0 \ldots R_{n-1}$, and k processes $P_0 \ldots P_{k-1}$. The implementation of the resource request logic of each process P_i, is as follows:

```
if (i%2==0){
      if(i<n)request Ri;
      if(i+2<n)request Ti+2;
}
else {
      if (i<n)request Rn-1;
      if (i+2<n)request Rn-i-2;
}
```

In which one of the following situations is a deadlock possible ?

(A) $n = 40, k = 26$ (B) $n = 21, k = 12$

(C) $n = 20, k = 10$ (D) $n = 41, k = 19$

Q. 63 Let the time taken to switch between user the 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?

(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

Q. 64 A computer handles several interrupt sources of which the following are relevant for this question.

* Interrupt from CPU temperature sensor (raises interrupt if CPU temperature is too high)
* Interrupt from Mouse (raises interrupt if the mouse is moved or a button is pressed)
* Interrupt from Keyboard (raises interrupt when a key is pressed or released)
* Interrupt from Hard Disk (raises interrupt when a disk read is completed)

Which one of these will be handled at the HIGHEST priority?

(A) Interrupt from Hard Disk

(B) Interrupt from Mouse

(C) Interrupt from Keyboard

(D) Interrupt from CPU temperature sensor

Q. 65 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 following 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

Q. 66 Let the page fault service time be 10 ms in a computer with average memory access time being 20 ns. If one page fault is generated for every 10^6 memory accesses, what is the effective access time for the memory?

(A) 21 ns (B) 30 ns

(C) 23 ns (D) 35 ns

YEAR 2011 TWO MARKS

Q. 67 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

Q. 68 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 10 ms. Rotational speed of disk is 6000 rpm. 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) 0.50 s (B) 1.50 s

(C) 1.25 s (D) 1.00 s

Q. 69 A process executes the code

```
fork();
fork();
fork();
```

The total number of child processes created is

(A) 3 (B) 4

(C) 7 (D) 8

Q. 70 Consider the 3 processes, P1, P2 and P3 shown in the table.

Process	Arrival Time	Time Units Required
P1	0	5
P2	1	7
P3	3	4

The completion order of the 3 processes under the policies FCFS and RR2 (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

Q. 71 Fetch_And_Add(X, i) is an atomic Read-Modify-Write instruction that reads the value of memory location X, increments it by the value i, and returns the old value of X, it is used in the pseudocode shown below to implement a busy-wait lock. L is unsigned integer shared variable initialized to 0. The value of 0 corresponds to lock being available, while any non-zero value corresponds to the lock being not available.

```
AcquireLock (L) {
while (Fetch_And_Add([, 1))
L = i
}
ReleaseLock (L {
        L = 0;
}
```

This implementation

(A) fails as L can overflow

(B) fails as L can take on a non-zero value when the lock is actually available

(C) works correctly but may starve some processes

(D) works correctly without starvation

Q. 72 A file system with 300 GByte disk uses a file descriptor with 8 direct bloc addresses, I 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 KBytes (D) dependent on the size of the disk

Q. 73 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 computer system that has main memory size of 3 page frames which are initially empty. Let LRU, FIFO and OPTIMAL denote the number of page faults under the corresponding page replacement policy. Then

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

****

ANSWER KEY

Operating System									
1	2	3	4	5	6	7	8	9	10
(A)	(B)	(B)	(C)	(B)	(B)	(B)	(B)	(B)	(B)
11	12	13	14	15	16	17	18	19	20
(A)	(C)	(A)	(D)	(C)	(B)	(C)	(B)	(D)	(A)
21	22	23	24	25	26	27	28	29	30
(A)	(D)	(D)	(C)	(C)	(D)	(B)	(A)	(A)	(C)
31	32	33	34	35	36	37	38	39	40
(A)	(B)	(B)	(B)	(B)	(A)	(D)	(B)	(B)	(C)
41	42	43	44	45	46	47	48	49	50
(D)	(A)	(C)	(D)	(D)	(C)	(B)	(C)	(B)	(B)
51	52	53	54	55	56	57	58	59	60
(A)	(B)	(A)	(B)	(C)	(A)	(B)	(A)	(A)	(D)
61	62	63	64	65	66	67	68	69	70
(A)	(B)	(?)	(D)	(C)	(B)	(A)	(D)	(C)	(C)
71	72	73							
(B)	(B)	(B)							