8 Operating System

Practice Questions

Q.1 A circular queue is the most appropriate data structure for
(A) FCFS scheduling
(B) Round Robin scheduling
(C) SJF scheduling
(D) None of these.

Q.2 Which of the following is not possible?
(A) Run→Ready
(B) Blocked→Run
(C) New→Ready
(D) Run→Terminated

Q.3 Which of the following does not interrupt a running process?
(A) A device
(B) Timer
(C) Scheduler process
(D) Power failure

Q.4 Consider the given statements
S1 : If a user-level thread is blocked for I/O operation, then other thread of same process can be scheduled by operating system.
S2 : Multiprogramming is used to improve CPU utilization.
S3 : Multitasking is implemented to improve CPU responsiveness.
Which of the given is/are true?
(A) S1 and S2
(B) S2 and S3
(C) S1 and S3
(D) S1, S2 and S3

Q.5 Which of the following will not be included in the Process Control Block of a Process ?
(A) Process State
(B) Program Counter
(C) Priority
(D) None of these

Q.6 Which one of the following is NOT shared by the threads of the same process?
(A) Stack
(B) Address Space
(C) File Descriptor Table
(D) Message Queue

Q.7 How many process will be created when we run this program

```
main( )
{
  printf("Hello")
  fork ( );
  fork ( );
  fork ( );
}
```

(A) 2 (B) 8
(C) 4 (D) 7

Q.8 On receiving an interrupt from an I/O device, the CPU

(A) Halts for a predetermined time

(B) Hands over control of address bus and data bus to the interrupting device

(C) Branches of the interrupt service routine immediately

(D) Branches off the interrupt service routine after completion of the current instruction.

Q.9 Concurrent processes are

(A) Do not overlap in time

(B) Overlap in time

(C) Are executed by a processor at the same time

(D) None of the above

Q.10 Consider the following set of process with their arrival time and burst times **[MSQ]**

Process	(msec) Arrival time	(msec) Burst time
P1	0	7
P2	2	4
P3	3	5
P4	1	2

The average turnaround time and average waiting time are, if you are using shortest remaining time first (SRTF).

(A) Average TAT = 8.5 msec

(B) Average WT = 4 msec

(C) Average TAT = 8.25 msec

(D) Average WT = 4.25 msec

Q.11 Consider the following set of processes in process information table.

Process Id	Arrival Time (msec)	Burst time (msec)
P1	0	4
P2	3	2
P3	5	1
P4	1	3
P5	7	5

The absolute difference in average TAT of FCFS and SJF is _______ msec (upto 2 decimal places).

Q.12 In a lottery scheduler with 40 tickets, distributed among 4 processes as 10%, 5%, 60%, and 25% tickets respectively. Executing each ticket code it needs 1 msec. Processes P_0, P_1, P_2, P_3 having Input output operation of 5 msec, 8 msec, 3 msec and 2 msec respectively. After executing code, the operating system uses a shortest remaining compute time first scheduling algorithm and schedules a new process either when the running process gets blocked on Input output or when running process finishes its compute burst. Assume that all Input output operations can be overlapped as much as possible for what percentage of time does the CPU remains idle?

[All process arrives at 0 msec, context switch time = 1 msec]

(upto two decimal places]

Q.13 Consider 800 Kbytes memory is managed using variable partitions, there is no compaction used. If current two process of size 210 Kbytes and 140 Kbytes are allocated into memory. The smallest size of allocation request in Kbytes that can be denied is equal to

(A) 450 (B) 151

(C) 400 (D) 451

Q.14 Consider a system with specifications :

Virtual address space = 4 GB

Physical address space = 4 GB

Page size = 1 kB

The TLB (Translation Look aside Buffer) used in the system which has 128 entries. The number of virtual addresses translated by the TLB is ______.

Q.15 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 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.16 Let S be the binary semaphore variable S=1 initially. Assume that no blocked processes exit in the system. If the following operations performed how many blocked processes are present in the system at the end?

5 P, 7 V, 10 P, 12 V, 18 P, 24 V

(A) 0 (B) 13

(C) 14 (D) 11

Q.17 Consider the page references 1, 3, 5, 6, 3, 1, 3, 5

Assume that main memory can accommodate 3 pages and the main memory already has the page 1 and 3 with page. 1 having been brought earlier than page 3. If LRU algorithm is used, then number of page faults that occur would be ________.

Q.18 Consider the following process table:

	Arrival time	Burst time
P_1	1	4
P_2	2	8
P_3	3	5
P_4	4	6

If found robin scheduling (with time slice = 2 units) is used to schedule above processes, then the number of context switches (don't consider start and end context switches) is_____

Q.19 Consider a system with five processes and a single resource of multiple instances.

	Allocation	Maximum needed
P_1	2	4
P_2	2	3
P_3	4	10
P_4	3	8
P_5	1	6

Then minimum number of resources need to be available, for the system to be in safe state is ____________.

Q.20 Consider a counting semaphore value as 25, if 33 down operations are performed followed by 50 up operations, then resultant value of semaphore is ________.

Q.21 What could be a possible output of following program:

```
main ( )
    {
fork ( );
printf ("X");
fork ( );
printf("Y");
fork( );
printf("Z");
```

}

(A) XYYZZZ

(B) XXYYYZZZZZ

(C) XXYYYYZZZZ

(D) XXYYYYYZZZZZZZZ

Q.22 Consider the following program segment, we want to synchronize process P and Q using semaphore X = 1, Y = 0

```
void Process P1          void process P2
{                        {
while (1)                while (1)
{                        {
P(X);                    P(X);
printf ("1")             printf("0")
P(Y);                    V(X)
}                        V(Y)
}                        }
                         }
```

(While P and V are the usual semaphore operation) what will be the output of the following program segment?

(A) It will print 010101

(B) It will print 001001

(C) It will print 101010

(D) None of the above

Q.23 Which of the following system call is generally paired with fork ( ) in the implementation of UNIX shell

[MSQ]

(A) exec() (B) pipe( )

(C) ioctl() (D) wait()

Q.24 Consider the following two arguments:

S1: FIFO scheduling results in the shortest possible average response time if the jobs happen to arrive in the ready queue with the shortest completion times first (or as a special case, if all jobs have the same completion time).

S2: Round robin scheduling behaves identically to FIFO if all the job lengths are longer than the length of the time slice.

Which of the above arguments is correct?

(A) Only S1

(B) Only S2

(C) Both (A) and (B)

(D) None of these

Q.25 Consider a paged virtual memory system with 32-bit virtual addresses and 1 KB page size. Each page table entry requires 32 bits. It is desired to limit the page table size to one page. Assume multi-level paging is used to implement the above requirement then how many level are required?

(A) 5 (B) 2

(C) 4 (D) 3

Q.26 Consider the following set of processes with their Arrival Times and Burst Times

Process	Arrival Time	Burst Time
P1	0	10
P2	1	7
P3	2	6
P4	3	5

The average Turnaround time and average waiting times are, if we are using the Highest Response Ratio Next Scheduling algorithm is used. (Assume there is no pre-emption)

(A) 11.18 (B) 18.11

(C) 10.17 (D) 17.10

Q.27 Consider an operating system that uses 48-bit virtual addresses and 16KB pages. The system uses a hierarchical page table design to store all the page table entries of a process, and each page table entry is 4 bytes in size. What is the total number of pages that are required to store the page table entries of a process, across all levels of the hierarchical page table?

(A) $2^{22}+1$ (B) $2^{10}+1$

(C) $2^{22}+2^{10}+1$ (D) 2^{22}

Q.28

P1: repeat	P2: repeat
Obtain an empty buffer Fill it Return a full buffer forever	Obtain a full buffer empty it Return an empty buffer forever

style = “font-weight : 400;”> increasing the number of buffers is likely to do which of the following?

I. Increase the rate at which requests are satisfied (throughput)

II. Decrease the likelihood of deadlock

III. Increase the ease of achieving a correct implementation

(A) III only

(B) II only

(C) I only

(D) II and III only

Q.29 Consider a job scheduling problem with 4 jobs J_1, J_2, J_3, J_4 and with corresponding deadlines: $(d_1, d_2, d_3, d_4) = (4, 2, 4, 2)$. Which of the following is not a feasible schedule without violating any job schedule?

(A) J_2, J_4, J_1, J_3 (B) J_4, J_1, J_2, J_3

(C) J_4, J_2, J_1, J_3 (D) J_4, J_2, J_3, J_1

Q.30 Virtual memory is

(A) Part of Main memory only used for swapping

(B) A technique to allow a program, of size more than the size of main memory, to run

(C) Part of secondary storage used in program execution

(D) None of these

Q.31 The 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) Number of processes in memory

(D) Physical memory size

Q.32 A particular parallel program computation requires 100 sec when executed on a single processor. If 40 % of this computation is inherently sequential (i.e. will not benefit from additional processors), then theoretically best possible elapsed times of this program running with 2 and 4 processors, respectively, are

(A) 20 sec and 10 sec

(B) 30 sec and 15 sec

(C) 50 sec and 25 sec

(D) 70 sec and 55 sec

Q.33 The Operating System of a computer may periodically collect all the free memory space to form contiguous block of free space. This is called:

(A) Concatenation

(B) Garbage collection

(C) Collision

(D) Dynamic Memory Allocation

Q.34 Disk requests come to a disk driver for cylinders in the order 10, 22, 20, 2, 40, 6 and 38 at a time when the disk drive is reading from cylinder 20. The seek time is 6 ms/cylinder. The total seek time if the disk arm scheduling algorithms is first-come-first-served is 360 ms

(A) 360 ms
(B) 850 ms
(C) 900 ms
(D) None of the above

Q.35 Four jobs to be executed on a single processor system arrive at time 0 in the order A, B, C, D. Their burst CPU time requirements are 4,1,8,1 time units respectively. The completion time of A under round robin scheduling with time slice of one time unit is

(A) 10 (B) 4
(C) 8 (D) 9

Q.36 What is the output of the following program?

```
main ( )
{
    int a = 10:
    if ((fork ( ) = = 0))
    a++;
    printf("%d\n",a);
}
```

(A) 10 and 11 (B) 10
(C) 11 (D) 11 and 11

Q.37 At a particular time, the value of a counting semaphore is 10, it will become 7 after:

(A) 3 V operations
(B) 3 P operations
(C) 5 V operations and 2 P operations
(D) 2 V operations and 5 P operations

Which of the following option is correct?

(A) Only (b) (B) Only (d)
(C) Both (b) and (d) (D) None of these

Q.38 Consider a set of 5 processes whose arrival time, CPU time needed and the priority are given below:

Process	Arrival Time (in ms)	CPU Time Needed	Priority
P1	0	10	5
P2	0	5	2
P3	2	3	1
P4	5	20	4
P5	10	2	3

(smaller the number, higher the priority)
If the CPU scheduling policy is priority scheduling without preemption, the average waiting time will be

(A) 12.8 ms (B) 11.8 ms
(C) 10.8 ms (D) 9.8 ms

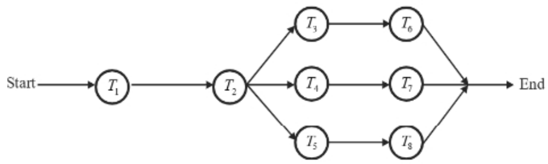
Q.39 At a particular time of computation the value of a counting semaphore is 7. Then 20 P operations and xV operations were completed on this semaphore. If the new value of semaphore is 5, x will be

(A) 18 (B) 22
(C) 15 (D) 13

Q.40 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 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.41 Below is the precedence graph for a set of tasks to be executed on a parallel processing system S.



What is the efficiency of this precedence graph on S if each of the tasks T1, T2, T3… T8 takes the same time and the system S has five processors?

(A) 25 %
(B) 40 %
(C) 50 %
(D) 90 %

Q.42 Consider a set of 5 processes whose arrival time, CPU time needed and the priority are given below:

Process Priority	Arrival Time (in ms)	CPU Time Needed (in ms)	Priority
P_1	0	10	5
P_2	0	5	2
P_3	2	3	1
P_4	5	20	4
P_5	10	2	3

Note: Smaller the number higher the priority

If the CPU scheduling Policy is SJF, the average waiting time (without pre-emption) will be

(A) 12.8 ms
(B) 6.8 ms
(C) 17 ms
(D) None of the above

Q.43 Suppose a system contains n processes and system uses the round robin algorithm for CPU scheduling then which data structure is best suited ready queue of the processes.

(A) Stack
(B) Queue
(C) Circular queue
(D) Tree

Q.44 Semaphores are used to solve the problem of

1. Race condition
2. Process synchronization
3. Mutual exclusion

(A) 1 and 2
(B) 2 and 3
(C) All of the above
(D) None of the above

Q.45 An operating system implements a policy that requires a process to release all resources before making a request for another resource.

(A) Both starvation and deadlock can occur
(B) Starvation can occur but deadlock cannot occur
(C) Starvation cannot occur but deadlock can occur
(D) Neither starvation nor deadlock can occur

Q.46 Suppose that a certain computer will paged virtual memory has 4 KB pages, a 32 bit byte addressable virtual address space and, 30 bit byte-addressable physical address space. The system manages an inverted page table. Where each entry includes the page number plus 12 overhead bits. How big is the basic inverted page table including page number and overhead bits?

(A) 2^{10} B
(B) 2^{20} B
(C) 2^{30} B
(D) 2^{32} B

Common Data for Questions 47 & 48

Consider a paging system with 16 MB of physical memory, 256 pages of logical address space and page size of 1 KB.

Q.47 How many bits are in logical address space

(A) 8 bits (B) 12 bits

(C) 18 bits (D) 16 bits

Q.48 Suppose that the head of a moving head disk with 192 tracks, numbered 0 to 191, is currently serving a request at track 80 and has just finished at track 62. The queue of the request is kept in the FIFO order: 119, 58, 114, 28, 111, 55, 103, 30, 75. What is the total number of tracks traversed by head movements needed to satisfy these request for the Elevator disk-scheduling algorithms?

(A) 143 (B) 130

(C) 177 (D) 547

Q.49 The correct matching for the following pairs is

A	Disk scheduling	1	Round robin
B	Batch processing	2	SCAN
C	Time sharing	3	LIFO
D	Interrupt processing	4	FIFO

(A) a-3, b-4, c-2, d-1

(B) a-4, b-3, c-2, d-1

(C) a-2, b-4, c-1, d-3

(D) a-3, b-4, c-3, d-2

Q.50 Consider the following heap in which blank regions are not in use and hatched regions are in use.

25	75	150	175	300

The sequence of requests for blocks of size, 150, 12.5, 62.5, 25 can be satisfied if we use,

(A) First fit but not best fit policy

(B) Best fit but not first fit policy

(C) Either first fit or best fit policy

(D) None of the above

Q.51 Consider system with specifications

TLB hit rate $= 85\%$

TLB access time $= 5$ msec

Memory access time $= 150$ msec

______ percentage memory access is slow down due to two level paging? (rounded upto two decimal places).

Q.52 Consider a single level paging scheme. The logical address space is 8 MB and page size is 4 kB. The maximum page table entry size possible such that the entire page table fits well in one page is _____ bytes

Q.53 Consider a single level paging scheme. The virtual address space is 8 GB and page table entry size is 4 bytes. The minimum page size possible such that entire page table fits well into single page is _____ kB. (integer value only)

Q.54 Consider a system using multilevel paging scheme. The page size is 1 MB. The memory is byte addressable and virtual address is 64 bits long. The page table entry size is 4 bytes, The number of bits required to search an entry in outer page table is _____

Q.55 Consider a system with Logical address space = physical address space $= 2^{16}$ Bytes. System uses segmented paging, pager apply on segment pages are power of 2 in size and page table entry size is 4 B. The page size of segment is _____, so that page table of segment exactly fit into one page. Let consider LAS is divided into 8 equal size segment. (integer value only)

Q.56 A CPU has two modes - privileged and non-privileged. In order to change the mode from privileged to non-privileged

(A) A hardware interrupt is needed.

(B) A software interrupt is needed.

(C) A privileged instruction (which does not generate an interrupt) is needed.

(D) A non- privileged instruction (which does not generate an interrupt) is needed.

Q.57 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 kernel level threads can be scheduled on different processors in a multi- processor system.

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

Q.58 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.59 For the processes listed in the following table, which of the following scheduling schemes will give the lowest turnaround time?

Process	Arrival time	Processing time
A	0	3
B	1	7
C	4	4
D	6	2

(A) First Come First Serve

(B) Non- preemptive Shortest Job First

(C) Shortest Remaining Time

(D) Round Robin with Quantum value two

Q.60 Consider three concurrent processes P1, P2 and P3 as shown below, which access a shared variable D that has been initialized to 100

P1	P2	P3
:	:	:
:	:	:
D = D + 20	D = D – 50	D = D + 10
:	:	:
:	:	:

The processes are executed on a uniprocessor system running a time – shared operating system .If the minimum and maximum possible values of D after the three process have completed are X of Y respectively, then the value of Y-X is _________.

Q.61 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 apriori.

Q.62 A system has 6 identical resources and N processes competing for them. Each process can request at most 2 resources. Which one of the following values of N could lead to a deadlock?

(A) 1 (B) 2

(C) 3 (D) 6

Q.63 A system shares 9 tape drives. The current allocation and maximum requirement of tape drives for that processes are shown below:

Process	Current Allocation	Maximum Requirement
P1	3	7
P2	1	6
P3	3	5

Which of the following best describes current state of the system?

(A) Safe, Deadlocked

(B) Safe, Not Deadlocked

(C) Not Safe, Deadlocked

(D) Not Safe, Not Deadlocked

Q.64 Indicate all the false statements from the statements given below: **[MSQ]**

(A) The amount of virtual memory available is limited by the availability of secondary storage.

(B) Any implementation of a critical section requires the use of an indivisible machine – instruction such as test-and-set.

(C) The use of monitors ensures that no deadlocks will be caused.

(D) The LRU Page- replacement policy may cause thrashing for some type of programs.

Q.65 The capacity of memory units is defined by the number of words multiplied by the number of bits/work. How many separate address and data lines are needed for a memory of 4K $\times$ 16?

(A) 10 address, 16 data lines

(B) 11 address, 8 data lines

(C) 12 address, 16 data lines

(D) 13 address, 12 data lines

Q.66 Consider a machine with 64 MB physical memory and a 32- bit virtual address space. If the page size is 4KB, what is the approximate size of the page table?

(A) 16 M (B) 8MB

(C) 2MB (D) 24MB

Q.67 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.68 Assume that there are 3 page frames which are initially empty. If the page reference string is 1, 2, 3, 4, 2, 1, 5, 3, 2, 4, 6, the number of page faults using the optimal replacement policy is ____.

Q.69 Consider a computer system with 40-bit virtual addressing and page size of sixteen kilobytes. If the computer system has a one- level page table per process and each page table entry requires 48 bits, then the size of the per-process page table is______ megabytes.

Q.70 Recall that Belady's anomaly is that the page-fault rate may increase as the number of allocated frames increases. Now, consider the following statements:

S1 : Random page replacement algorithm (where a page chosen at random is replaced)

Suffers from Belady's anomaly

S2 : LRU page replacement algorithm suffers from Belady's anomaly

Which of the following is CORRECT?

(A) S1 is true, S2 is true

(B) S1 is true, S2 is false

(C) S1 is false, S2 is true

(D) S1 is false, S2 is false

Q.71 Disk requests come to disk driver for cylinders 10, 22, 20, 2, 40, 55 and 36, in that order at a time when the disk drive is reading from cylinder 20. The seek time is 6 msec per cylinder. Compute the total seek time if the disk arm scheduling algorithm is

(A) First come first served

(B) Closest cylinder next

Q.72 Which of the following is true?

(A) When interrupt is enabled, a CPU will be able to process the interrupt.

(B) Loop instructions cannot be interrupted till they complete.

(C) A processor checks for interrupts before executing a new instruction.

(D) Only level triggered interrupts are possible on microprocessors.

Q.73 Consider a disk system with 100 cylinders. The requests to access the cylinders occur in following sequence:

4, 35, 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.74 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 5000 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) 1.00 s

(C) 1.6 s (D) 1.50 s

Q.75 A FAT (File allocation table) based file system is being used and the total overhead of each entry in the FAT is 4 bytes in size. Given a 100×10^6 bytes disk on which the file system is stored and data block size is 10^3 bytes, the maximum size of a file that can be stored on this disk in units of 10^6 bytes is___.

Answers Operating System

1.	B	2.	B	3.	C	4.	B	5.	D
6.	A	7.	B	8.	D	9.	B	10.	A,D
11.	0.6	12.	14.89	13.	B	14.	131072	15.	B
16.	D	17.	3	18.	11	19.	1	20.	42
21.	D	22.	D	23.	A,D	24.	A	25.	D
26.	D	27.	D	28.	C	29.	B	30	B
31.	A	32.	D	33.	B	34.	D	35.	D
36.	A	37.	C	38.	C	39.	A	40	B
41.	B	42.	B	43.	C	44.	B	45.	D
46.	B	47.	C	48.	D	49.	C	50.	A
51.	33.33	52.	2	53.	181	54.	8	55.	181
56.	D	57.	D	58.	B	59.	C	60.	80
61.	A	62.	D	63.	B	64.	B,D	65.	C
66.	C	67.	C	68.	7	69.	384	70.	B
71.	*	72.	C	73.	B	74.	C	75.	99.6

Explanations Operating System

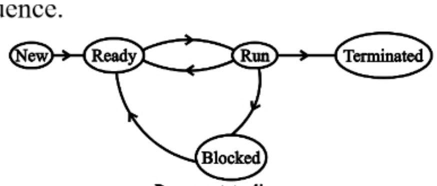
1. (B)

Round Robin scheduling uses circular queue for its implementation.

Hence, the correct option is (B).

2. (B)

Blocked to ready then to run is possible sequence.



Process state diagram

Hence, the correct option is (B).

3. (C)

Scheduler cannot interrupt a running process, but Device, timer and power failure can interrupt a running process

Hence, the correct option is (C).

4. (B)

Operating system does not have information about user level threads, it consider all threads of a process as a single process itself.

If one thread of user level is doing I/O it block entire user level process.

When many processes are present in main memory, if one process is busy on input/output

then other process can be scheduled on CPU from main memory. Hence, multiprogramming improve CPU utilization.
When CPU is time shared among multiple task is known as multitasking. It is done to increase responsiveness.
Hence, the correct option is (B).

5. **(D)**

Process Control Block (PCB) holds the information about a process.

Process ID
State
Pointer
Priority
Program counter
CPU registers
I/O information
Accounting information
Etc.

PCB diagram

Hence, the correct option is (D).

6. **(A)**

Stack and register are not shared by the threads of the same process while address space, message queue etc. are shared.
Hence, the correct option is (A).

7. **(B)**

The number of processes created =

$2^{\text{number of times the fork called}}$

$2^3 = 8$

But the number of child processes $= 2^3 - 1 = 7$

8. **(D)**

Branches off the interrupt service routine after finishing current execution.

9. **(B)**

Concurrent processes overlap in time.

10. **A,D**

CT $\rightarrow$ Completion time

TAT $\rightarrow$ Turn Around time

WT $\rightarrow$ Waiting Time

PID	AT	BT	CT	TAT	WT
P1	0	6	18	18	12
P2	2	4	7	5	1
P3	3	5	12	9	4
P4	1	2	3	2	0

GANTT Chart

P1	P4	P4	P2	P3	P1

0 1 2 3 7 12 18

$\text{TAT} = \text{CT} - \text{AT}$

$\text{WT} = \text{TAT} - \text{BT}$

$$\text{Avg. TAT} = \frac{18+5+9+2}{4} = 8.5$$

$$\text{Avg. WT} = \frac{12+1+4+0}{4} = 4.25$$

Hence, the correct options are (A, D).

11. **0.6**

In FCFS

P1	P4	P2	P3	P5

0 4 7 9 10 15

AT	CT	TAT
0	4	4
3	9	6
5	10	5
1	7	6
7	15	8

$$\text{Average TAT} = \frac{4+6+5+6+8}{5} = 5.8$$

In SJF

P1	P2	P3	P4	P5

0 4 6 7 10 15

AT	CT	TAT
0	4	4
3	6	3
5	7	2
1	10	9
7	15	8

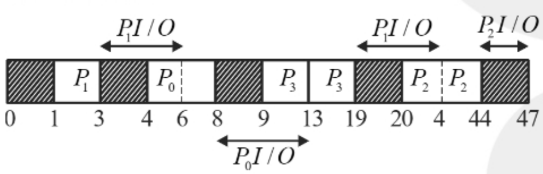
$$\text{Average TAT} = \frac{4+3+2+9+8}{5} = \frac{26}{5} = 5.2$$

Hence, absolute difference $= |5.8 - 5.2| = 0.6$

12. 14.89

Process	CPU Tine (msec)	Input/Output time (msec)
P_0	4	5
P_1	2	8
P_2	24	3
P_3	10	2

Gantt Chart

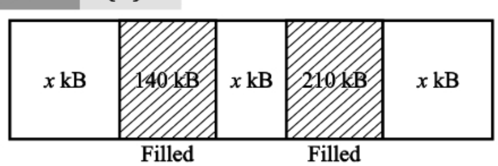


$$\text{CPU remains idle} = \frac{07}{47} \times 100$$

$$= 14.89\%$$

Hence, the correct answer is 14.89

13. (B)



Consider memory is allocated in above manner.

$$x + 140 + x + 210 + x = 800$$

$$3x + 350 = 800$$

$$3x = 450$$

$$x = \frac{450}{3}$$

$$x = 150 \text{ kB}$$

Hence, smallest memory request that cannot be fulfilled = 151 kB.

14. 131072

Logical address space $= 2^{32}$ B

LA = 32 bit

Page size $= 2^{10}$ B

Each byte is an address and each page consist of 1024 addresses

Total addresses mapped by TLB = number of TLB entries × number of address per page

$$= 128 \times 1024$$

$$= 131072$$

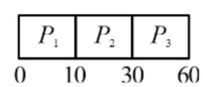
15. (B)

Given :

Let three processes are P_1, P_2 and P_3

Process	Arrival time	Burst time
P_1	0	10
P_2	2	20
P_3	6	30

The Gantt chart for SRTF scheduling algorithm is



So, there is only two context switches at time unit 10 context switches P_1 and P_2 and at time unit 30 context switch from P_2 to P_3.

Hence, the correct option is (B).

16. (D)

Initially $S = 1$

P = Down operation (–)

V = Up operation (+)

So,

$$1 - 5P = -4$$

Now $-4 + 7V = 3$

$$3-10=-7$$
$$-7+12=5$$
$$5-18=-13$$
$$-13+24=11$$

Hence, the correct option is (D).

17. **3**

1, 3, 5, 6, 3, 1, 3, 5

$\cancel{1}\ \cancel{6}\ 5$
3
$\cancel{5}\ 1$

= 3 page faults

Hence, the correct answer is 3.

18. **11**

P_1	P_2	P_3	P_1	P_4	P_2	P_3	P_4	P_2	P_3	P_4	P_2

Ready Queue:

$$P_1, P_2, P_3, P_1, P_4, P_2, P_3, P_4, P_2, P_3, P_4, P_2$$

Hence, the correct answer is 11.

19. **1**

Need matrix:

Process	Need
P_1	2
P_2	1
P_3	6
P_4	5
P_5	5

Resources required to be available is 1.

20. **42**

Given:

Counting semaphore value = 25

33 down operations results semaphore value to be $25-33=-8$ and 50 UP operations result semaphore value to be $-8+50=42$

21. **(D)**

The order of execution of processes are not unique, that is they can execute in any manner. But, there should be 2-X's and 4-Y's and 8-Z's in the result.

22. **(D)**

Value of the semaphore X = 1 and Y = 0

If Process P_1 execute first then after executing the P(X), X value become 0 and it will print 1. P(Y) is executed, value of semaphore Y is 0 so Process P_1 is blocked and if Process P_2, started executing, after executing P(X). X value is 0 so Process P_2, is also block this is a deadlock condition.

P_2 can run forever and in that case output will be 00000….

So option (D) is correct.

23. **A,D**

exec () will execute the given command and wait () will allow the parent to wait till child completes.

So, exec () and wait ( ) system call is generally paired with fork ( ) in the implementation of UNIX shell

24. **(A)**

FIFO scheduling results in the shortest possible average response time if the jobs happen to arrive in the ready queue with the shortest completion times first (or. as a special case, if all jobs have the same completion time).

Round robin scheduling behaves identically to FIFO if the job lengths are No longer than the length of the time slice. So. SI is true. S2 is false.

25. **(D)**

Page table size of 1^{st} level $=\dfrac{2^{32}B}{2^{10}B}\times 4B$

$$=2^{24}B > 1\text{KB}$$

Page table size of 2^{nd} level $= \frac{2^{24}B}{2^{10}B} \times 4\text{B}$

$= 2^{16}B > 1\text{KB}$

Page table size of 3^{rd} level $= \frac{2^{16}B}{2^{10}B} \times 4B$

$= 2^{8}B < 1\text{ KB}$

So 3 level of page table required.

26. (D)

Gantt Chart

Processes	P1	P4	P3	P2
CT	10	15	21	28

Ready Queue

AT	0	1	2	3
Processes	P1	P2	P3	P4

Response ratio of

$P2 = (\text{WT}+\text{BT})/\text{BT} = (9+7)/7 = 2.285$

Response ratio of

$P3 = (\text{WT}+\text{BT})/\text{BT} = (8+6)/6 = 2.333$

Response ratio of

$P4 = (\text{WT}+\text{BT})/\text{BT} = (7+5)/5 = 2.4$

Turnaround time of $P1 = 10$

Turnaround time of $P2 = 28 - 1 = 27$

Turnaround time of $P3 = 21 - 2 = 19$

Turnaround time of $P4 = 15 - 3 = 12$

Average Turnaround Time

$= (10+27+19+12)/4 = 17$

Waiting time of P1 = 0

Waiting time of P2 = 21-1 = 20

Waiting time of P3 = 15 – 2 = 13

Waiting time of P4 = 10 – 3 = 7

Average Waiting Time

= (0 + 20 + 13 + 7)/4 = 10

27. (D)

Page size $= 2^{14}$ bytes.

So, the number of page table entries $= \frac{2^{48}}{2^{14}} = 2^{34}$

Each page can store $= \frac{16\,KB}{4} = 2^{12}$ page table entries.

So, the number of innermost pages $= \frac{2^{34}}{2^{12}} = 2^{22}$

Now, pointers to all these innermost pages must be stored in the next level of the page table,

So, the next level of the page table has $\frac{2^{22}}{2^{12}} = 2^{10}$ pages

Finally, a single page can store all the 2^{10} page, table entries, so the outermost level has one page. So, the total number of pages that store page table entries are $2^{22} + 2^{10} + 1$.

28. (C)

It only satisfied statement I, because increasing the memory size increases the rate at which requests are satisfied but can not alter the possibility of deadlock and neither does it play any role in implementation.

Hence, the correct option is (C).

29. (B)

Feasible schedule is completing all the jobs within deadline.

From the dead line, we can deduce that Job J_2 & J_4 will complete by time "2" whereas remaining two requires time "4".

So the order of completion of Jobs are Either J_2 or J_4 and followed by either J_1 or J_3.

From the given option, option A, C & D gives the solution because after completion of jobs J_2 & J_4 then only jobs J_1 & J_3 is going to complete.

But in option B, order of completing jobs is J_4, J_1, J_2, J_3 which is not possible and it is not feasible schedule

Hence, the correct option is (B).

30. **(B)**

A computer can address more memory than the amount physically installed on the system. This extra memory is actually called virtual memory and it is a section of a hard disk that's set up to emulate the computer's RAM. The main visible advantage of this scheme is that programs can be larger than physical memory. Virtual memory serves two purposes. First, it allows us to extend the use of physical memory by using disk. Second, it allows us to have memory protection, because each virtual address is translated to a physical address.

Hence, the correct option is (B).

31. **(A)**

There are two important tasks in virtual memory management: a page-replacement strategy and a frame allocation strategy. Frame allocation strategy says gives the idea of minimum number of frames which should be allocated. The absolute minimum number of frames that a process must be allocated is dependent on system architecture, and corresponds to the number of pages that could be touched by a single (machine) instruction. So, it is instruction set architecture.

Hence, the correct option is (A).

32. **(D)**

The computation requires 100 seconds on a single processor implies that 40% of the computation takes 40 seconds on any number of processors and the remaining 60 % takes 60 seconds on parallel computation which becomes 30 seconds on two processors and 15 seconds on four.

Hence, in total, the computation takes 40+30=70 seconds on two processors and 40+15=55 seconds on four processors.

Hence, the correct option is (D).

33. **(B)**

The Operating System of a computer may periodically collect all the free memory space to form a contiguous block of free space. This is called garbage collection.

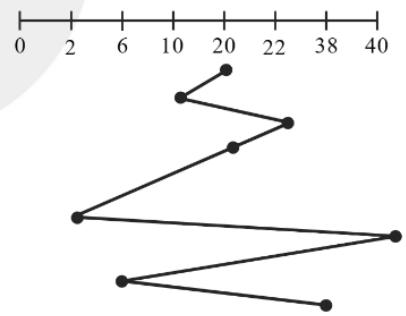
We can also use compaction to minimize the probability of external fragmentation.

In compaction, all the free partitions are made contiguous and all the loaded partitions are brought together.

Hence, the correct option is (B).

34. **(D)**

FCFS Total seek time in FCFS Scheduling when the disk drive is reading from cylinder 20 for cylinders in the order 10, 22, 20, 2, 40, 6 and 38.



$$=(146)\times 6 = 876 \text{ ms}$$

Hence, the correct option is (D).

35. **(D)**

1. All processes are arrived at time 0.
2. Algorithm used for scheduling is round robin with time quantum of one unit time.
3. The order of execution of the processes A, B, C, D, A, C, A, C, A, C, C, C, C, C
4. After 8 context switches, process A completes it execution so the completion time is 9.

Hence, the correct option is (D).

36. (A)

The purpose of the fork system call is to create a child process.

The parent process fork call will return process ID which will make if condition false then parent process will print 10

The child process will execute the next instruction is a++ because in the child process if the condition is not tested. Execution starts from next instruction and it will print 11

Hence, the correct option is (D).

37. (C)

P: Wait operation decrements the value of the counting semaphore by 1.

V: Signal operation increments the value of counting semaphore by 1.

Current value of the counting semaphore = 10

(b) after 3 P operations, value of semaphore = 10–3 = 7

(d) after 2 V operations, and 5 P operations value of semaphore = 10+ 2 – 5 = 7

Hence, the correct option is (C).

38. (C)

Following is the Gantt diagram :

P_1	P_3	P_4	P_5	P_1

0 5 8 28 30 40

Process	Arrival Time (in ms)	CPU Time Needed	Priority	Waiting Time
P1	0	10	5	30–0=30
P2	0	5	2	0
P3	2	3	1	5–2=3
P4	5	20	4	8–5=3
P5	10	2	3	28–10=18

Average Waiting Time $= \frac{(30+3+3+18)}{5} = 10.8$

Hence, the correct option is (C).

39. (A)

Here, 20 P operations means 20 wait operations. It decrement value by 1 every time. xV operations means x increments operations. It increment value by 1 every time. - New value of semaphore is 5 after performing xV operations

$$= -13 + xV$$
$$= 5$$
$$xV = 5 + 13 = 18$$

After applying 20 P operations in semaphore value is = 7–20 = –13

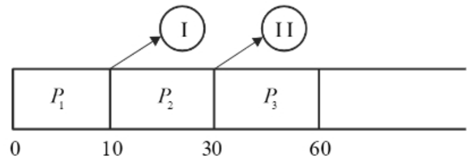
Hence, the correct option is (A).

40. (B)

Shortest Remaining Time. SRT is a preemptive scheduling. In SRT. The process with smallest runtime to complete (i.e remaining time) is scheduled to run next, including new arrivals

In SRT, a running process may be preempted by new process with shorter estimated run time.

Process	AT	BT
P_1	0	10
P_2	2	20
P_3	6	30



Total no. of context switches is 2.

Hence, the correct option is (B).

41. (B)

From the precedence graph, we say that the following tasks executed sequentially

I. Tl, T2

II. T3 and T6

III. T4 and T7

IV. T5 and T8

(T3, T6), (T4, T7) and (T5, T8) will execute parallely. So total number of processes that can be executed in 4 units time using 5 available processors = $5 \times 4 = 20$

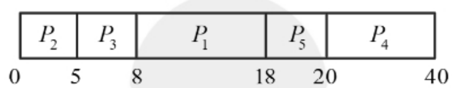
Maximum number of tasks are 8

$$\text{Efficiency} = \frac{8}{20 \times 100} = 40\%$$

Hence, the correct option (B).

42. (B)

Process ID	Priority	Arrival Time	CPU Time	Completion time	T.A.T. (C.T. – A.T.)
P_1	5	0	10	18	18
P_2	2	0	5	5	5
P_3	1	2	3	8	6
P_4	4	5	20	40	35
P_5	3	10	2	20	10



Average waiting time

$$= \frac{(18-10)+(5-5)+(6-3)+(35-20)+(10-2)}{5} = \frac{8+10+3+15+8}{5} = \frac{34}{5} = 6.8\,\text{m.s}$$

43. (C)

In round robin policy each process has allotted fix time quantum, after its time quantum is over it goes to tail of the ready queue if not completed. Hence it act as a circular queue implementation.

44. (B)

Semaphores are used in deadlock avoidance by using them during interprocess communication. It is used to solve the problem of synchronization among processes.

45. (D)

The given operating system follows DEAD LOCK prevention policy which also ensures neither starvation nor deadlock can occur.

46. (B)

Vitual address space $= 2^{32}$ Bytes

Physical address spaces $= 2^{30}$ Bytes

Page size = 4 KB $= 2^{12}$ Bytes

Number of frames in physical memory

$$= \frac{2^{30}}{2^{12}} = 2^{18}$$

Number of Bits in each page table entry

Page Number	Overhead (offset)
20 bits	12 bits

Page table size = No. of frames $\times (20+12)$ bits

$$= 2^{18} \times 32 \text{ bits}$$

$$= 2^{18} \times \frac{32}{8} \text{ bytes}$$

$$= 2^{18} \times 2^{2} \text{ bytes} = 2^{20} \text{Bytes}$$

47. (C)

Physical memory size = $16\,\text{MB} = 2^{24}$Bytes

Page size $= 1\,\text{KB} = 2^{10}$Bytes

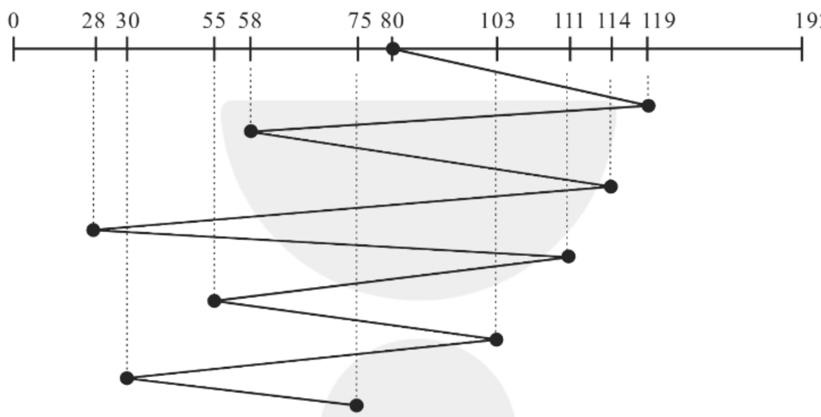
Virtual address space = 256 Pages

$$= 256 \times 1\,\text{KB}$$

$$= 2^{18} \text{ Bytes}$$

Number of bits to identify each address in logical address space of 2^{18} Bytes = 18 bits.

48. (D)



Total number of tracks traversed

$\Rightarrow$ (119 – 80) + (119 – 58) + (114 – 58) + (114 – 28) + (111 – 28) + (111 – 55) + (103 – 55) + (103 – 30) + (75 – 30)

$\Rightarrow$ 39 + 61 + 56 + 86 + 83 + 56 + 48 + 73 + 45

$\Rightarrow$ 547 tracks

49. (C)

1. Scan method is used in Disk scheduling
2. FIFO method is used in Batch processing
3. Round Robin method is used in Time sharing operations
4. LIFO method is used in Interrupt processing.

50. (A)

I. Allocation using First fit policy :

	12.5	62.5		150	25	
25		75	150	175		300

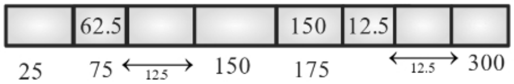
$P_1 = 150$

$P_2 = 12.5$

$P_3 = 62.5$

$P_4 = 25$

II. Allocation using Best fit policy :



$$P_1 = 150$$

$$P_2 = 12.5$$

$$P_3 = 62.5$$

As it gives non contiguous blocks, this policy is not possible

51. **33.33**

TLB hit rate $(T_h) = 0.85$

TLB miss rate $(1 - T_h) = 0.15$

Average memory access time

$$= 0.85(5+150) + 0.15(5+3\times150)$$

$$= 131.75 + 68.25$$

$$= 200 \text{ msec}$$

% slow down

$$= \left(\frac{200-150}{150}\right)\times 100$$

$$= \frac{50}{150}\times 100 = 33.33\%$$

52. **2**

Given:

Logical Address space $= 8 \text{ MB} = 2^{23}$ B

Page size $= 4 \text{ kB} = 2^{12}$ B

Number of pages $= \frac{\text{LAS}}{\text{PS}} = \frac{2^{23}\text{ B}}{2^{12}\text{ B}} = 2^{23-12} = 2^{11}$

Page Table size $=$ 1 Page size $= 4$ kB

Page Table size $=$ entry size $\times$ number of pages

Entry size $= \frac{\text{Page Table size}}{\text{number of pages}}$

$$e = \frac{2^{12}\text{ B}}{2^{11}} = 2^{12-11}\text{ B} = 2^1 \text{ Byte}$$

53. **181**

Given:

Logical address space $= 8 \text{ GB} = 2^{33}$ B

$$e = 4\text{ B} = 2^2\text{ B}$$

Page Table size $=$ Page size

Let page size $= 2^k$ Bytes

Number of pages $= \frac{\text{LAS}}{\text{PS}} = \frac{2^{33}\text{ B}}{2^k\text{ B}} = 2^{33-k}$

Page Table size $=$ entry size $\times$ number of pages

Page size $=$ $e \times$ number of pages

$$2^k = 2^2\text{ B} \times 2^{33-k}$$

$$2^k = 2^{35-k}\text{ B}$$

$$\log_2(2^k) = \log_2(2^{35-k})\text{B}$$

$$k = 35 - k \text{ . B}$$

$$2k = 35 \text{ . B}$$

$$k = 17.5 \text{ B}$$

Page size $= 2^{17.5}\text{ B} = 2^{10}\cdot 2^{7.5}\text{ B} = 2^{7.5}$ kB

$$= 181.019 \text{ kB}$$

54. **8**

Given:

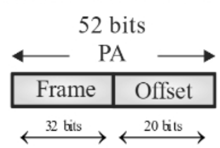
Logical address space $= 2^{64}$ B

Page size $=$ 1 MB $= 2^{20}$ B

$$e = 4\text{ B} = 2^2\text{ B}$$

Entry size represents the frame bits,

So, number of frame bits $= 32$ bits



Number of pages

$$= \frac{\text{LAS}}{\text{PS}} = \frac{2^{64}\text{ B}}{2^{20}\text{ B}} = 2^{64-20} = 2^{44} \text{ Pages}$$

Inner Page Table size $= 2^{44} \times e$

$$= 2^{44} \times 2^2\text{ B}$$

$$= 2^{46}\text{ B} > \text{Page size}$$

Number of pages of inner page Table

$$= \frac{2^{46}\text{ B}}{2^{20}\text{ B}} = 2^{26} \text{ Pages}$$

Layer-2 Page Table size $= 2^{26}$ pages $\times 2^2$ B

$= 2^{28}\text{ B} > \text{Page size}$

Number of pages of Layer-2 PT

$$= \frac{2^{28}\text{ pages}}{2^{20}\text{ B}} = 2^8 \text{ pages}$$

Outer Page Table size $= 2^8 \times 2^2$ B

$= 2^{10}$ B

Number of searches $=$ number of pages in outer Page Table

$= 2^8$

$\Rightarrow$ 8 bits

55. 181

LAS $= 2^{16}$ B, PAS $= 2^{16}$ B

Let page size $= 2^k$ B

Number of segments $= 8$

(Page Table of segment) size $= 1$ page size

$$\text{One segment size } = \frac{\text{LAS}}{8} = \frac{2^{16}\text{ B}}{2^3} = 2^{13}\text{ B}$$

$$\text{Number of pages/segment } = \frac{2^{13}\text{ B}}{2^k\text{ B}} = 2^{13-k}$$

(Page table of segment) size $=$ number of pages $\times e$

$$= 2^{13-k} \times 4\text{ B}$$
$$2^k = 2^{15-k}\text{ B}$$
$$2^k = 2^{15-k}$$
$$\log_2 2^k = \log_2 2^{15-k}$$
$$k = 15 - k$$
$$2k = 15$$
$$k = 7.5$$

Page size $2^k\text{ B} = 2^{7.5}\text{ B} = 181$ Byte

56. (D)

A CPU has two modes-privileged and non-privileged. In order to change the mode from privileged to non-privileged, the next instruction to be executed should be non-privileged instruction.

Hence, the correct option is (D).

57. (D)

Given statements are as follows :

(A) Context switch time is longer for Kernel level threads than for user level threads
It is True, user level threads are managed by users and Kernel level thread managed by OS. There are many overheads involved in Kernel level thread management, which are not present in user level thread, so context switch time is longer for Kernel than for user level threads.

(B) User level threads do not need any hardware support, It is true, As we know user level threads are managed by users, there is no need for hardware support.

(C) Related Kernel level threads can be scheduled on different processors in a multi-processor system.
It is true

(D) Blocking one Kernel level threads blocks all related threads. It is false Kernel level threads are managed by os, If one thread block, it does not cause other threads.

Hence, the correct option is (D).

58. (B)

Given :

Process	Execution time	Arrival time
P_1	20	0
P_2	25	15
P_3	10	30
P_4	15	45

The Gantt chart for SRT scheduling algorithm is

P_1	P_2	P_3	P_2	P_4

0 20 30 40 55 70

So the waiting time for

$$P_2 = (20-15) + (40-30) = 5 + 10 = 15$$

Hence, the correct option is (B).

59. **(C)**

Given :

Process	Arrival time	Processing time
A	0	3
B	1	7
C	4	4
D	6	2

(1) FCFS :

A	B	C	D

0 3 10 14 16

$$\text{Avg TAT} = \frac{3+9+10+10}{4} = \frac{32}{4} = 8$$

(2) Non preemptive SJF :

A	B	D	C

0 3 10 12 16

$$\text{Avg TAT} = \frac{3+9+6+12}{4} = \frac{30}{4} = 7.5$$

(3) SRTF :

A	B	C	D	B

0 3 4 8 10 16

$$\text{Avg TAT} = \frac{3+15+4+4}{4} = \frac{26}{4} = 6.5$$

(4) RR :

A	B	A	C	B	D	C	B	B

0 2 4 5 7 9 11 13 15 16

$$\text{Avg TAT} = \frac{5+15+9+5}{4} = \frac{34}{4} = 8.5$$

SRTF has lowest turn around time.
Hence, the correct option is (C).

60. **80**

Given :

P1	P2	P3
:	:	:
:	:	:
D = D + 20	D = D – 50	D = D + 10
:	:	:
:	:	:

Initial value of $D = 100$

Minimum value occurs when P_1, P_2, P_3 read and P_1, P_3 update the value

P_3 Update $D = 110$

P_1 Update $D = 120$

And last P_2 will update the $D = 100 - 50 = 50 = X$ maximum value will occur when P_2 and P_3 read the initial value of D and update, first own P_2 and update $D = 50$, P_3 will run and update

$D = 100 + 10 = 110$

Now P_1 will read the value of $D = 110$ and update:

$D = D + 20 = 110 + 20$

$D = 130 = Y$

$Y - X = 130 - 50 = 80$

Hence, the correct option is 80.

61. **(A)**

In deadlock prevention, the request for n resource may not be granted even if the resulting state is safe.
Deadlock prevention scheme handles deadlock by making sure that one of the four necessary conditions don't occur. So, it may be the case that a resource request might be rejected even if the resulting state is safe.
Hence, the correct option is (A).

62. **(D)**

Let's assume that each process requests 2 resources each. Now there are total 6 identical resources available. Give 1 resources to every process then there will be deadlock because now each process will wait for another resource which is not available. Since there are total 6 resources so for deadlock to be possible there should be 6 process available. Hence, the value of N is 6.
Hence, the correct option is (D).

63.	(B)

Given :

Process	Current Allocation	Maximum Requirement	Need
P_1	3	7	4
P_2	1	6	5
P_3	3	5	2

Number of resources = 9

Therefore, Available = 9 – 7 = 2

From current available need of process P_3 can be satisfied, releasing 3 additional resources. After execution of P_3 number of available resources = 5.

Now, form current available need of any of the two processes P_1 or P_2 can be satisfied.

Safe sequence $\Rightarrow P_3 \rightarrow P_1 \rightarrow P_2$

Safe and not deadlock.

Hence, the correct option is (B).

64.	B,D

(B) Without indivisible machine instruction critical section can be implemented like using monitors.

(D) Best fit also suffers from fragmental

Hence, the correct option is (B) and (D).

65.	(C)

Given :

ROM memory size $= 2m \times n$

number of address lines $= m$

number of data lines $= n$

$$4k \times 16 = 2^2 \times 2^{10} \times 16$$

$$4k \times 16 = 2^{12} \times 16$$

Address lines $= 12$

Data lines $= 16$

Hence, the correct option is (C).

66.	(C)

Given :

Physical memory $= 64MB = 2^{26} B$

Size of frame $= 4KB = 2^{12} B$

$$\text{Number of frames} = \frac{\text{physical memory}}{\text{size of frame}}$$

$$= \frac{2^{26} B}{2^{12} B} = 2^{14}$$

Frame number =14 bits

Virtual memory $= 32\,\text{bits} = 2^{32} B$

Size of page = size of frame $= 4KB = 2^{12} B$

$$\text{Number of pages} = \frac{\text{virtual memory}}{\text{size of page}}$$

$$= \frac{2^{32} B}{2^{12} B} = 2^{20}$$

Size of page table

= Number of pages $\times$ Size of each entry size of page table

= Number of pages $\times$ Page table entry

Size of page table

= Number of pages $\times$ Frame number

Assume Frame number = 16bits

Size of page table $= 2^{20} \times 16\,\text{bits} \approx 2MB$

Hence, the correct option is (C).

67.	(C)

Incrementing the number of page frames doesn't always decrease the page faults (Belady's Anomaly).

Hence, the correct option is (C).

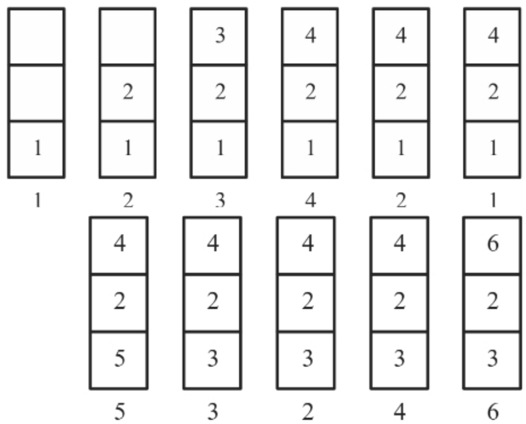
68.	7

Given :

Number of page frame = 3

Reference string 1, 2, 3, 4, 2, 1, 5, 3, 2, 4, 6

Optimal page replacement policy.



∴ 7 page faults.

Hence, the correct answer is 7.

69. **384**

Given :

Page table entry size = 48 bits

Page table size = Number of entries in page table × page table entry size

$$= \left(\frac{2^{40}}{2^{14}}\right) \times 48 \text{ bits } = 2^{26} \times 6 \text{ bytes}$$

$$= 64\,\text{M} \times 6\,\text{B} = 384\,\text{MB}$$

Hence, the correct answer is 384.

70. **(B)**

Given :

Following statements:

S1 : Random page replacement algorithm (where a page chosen at random is replaced) Suffers from Belady's anomaly

S2 : LRU page replacement algorithm suffers from Belady's anomaly

Considering each statement

Random page replacement algorithm can behave like only algorithm probably FCFS too, hence it can suffer from Belay's anomaly.

LRU page replacement algorithm doesn't suffer from Belady's anomaly.

Hence, the correct option is (B).

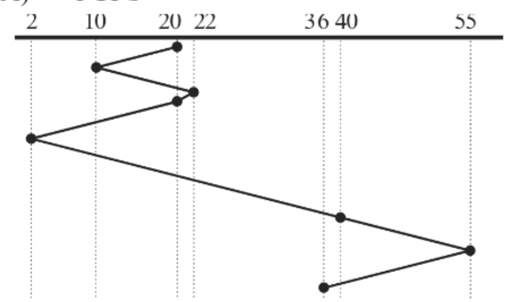
71. **(*)**

Given :

Disk requests : 10, 22, 20, 2, 40, 55, 36

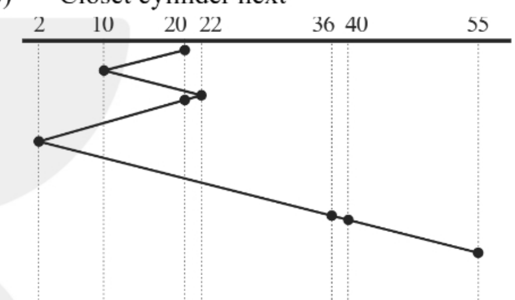
seek time = 6 msec per cylinder

(A) FCFS



$$6 \times (10+12+2+18+38+15+19) = 684$$

(B) Closet cylinder next



$$6 \times (2+12+18+34+4+19) = 534$$

Hence, the correct answer is (684, 534).

72. **(C)**

(C) CPU checks for interrupts before executing a new instruction.

Hence, the correct option is (C).

73. **(B)**

Given :

Number of cylinders = 100

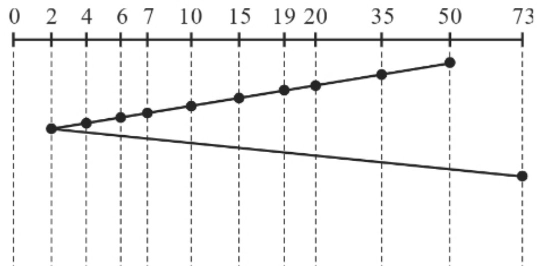
Cylinder access request :

4, 35, 10, 7, 19, 73, 2, 15, 6, 20

Initial position of head = 50

Seek time = 1 ms

Head is currently at cylinder 50



$50-35=15$ $\quad$ $35-20=15$

$20-19=1,$ $\quad$ $19-15=4$

$15-10=5,$ $\quad$ $10-7=3$

$7-6=1,$ $\quad$ $6-4=2$

$4-2=2,$ $\quad$ $2-73=71$

Total move

$$=15+15+1+4+5+3+1+2+2+71$$

$$=119$$

Hence, the correct option is (B).

74.	(C)

Given :

Seek time = 10 ms

Rotational speed = 5000 rpm

$$60\ s \rightarrow 5000 \text{ rotations}$$

$$1 \text{ rotation} \rightarrow \frac{60}{5000}\ s$$

$$\text{Rotational latency} = \frac{1}{2} \times \frac{60}{5000}\ s = 6 \text{ ms}$$

Total time to transfer one library

Number of entries in FAT

$$= \frac{100\times10^6}{1004} = 0.099601$$

Maximum size of a file

$$= 0.099601\times10^3 \text{ bytes}$$

$$= 99.601\times10^6 \text{ bytes}.$$

Hence, the correct answer is 99.6.

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