Operating Systems Test 2

Number of Questions: 35 **Section Marks: 30**

Directions for questions 1 to 35: Select the correct alternative from the given choices

1. Suppose we have variable logical records of length 10 bytes, 20 bytes and 30 bytes, while the physical block size in disk is 15 bytes. What is the maximum and minimum fragmentation seen in bytes?
(A) 10 and 5 (B) 10 and 0
(C) 5 and 0 (D) 5 and 5

2. Match the following:

List-A	List-B
1. Contiguous allocation policy	(i) Internal fragmentation
2. Chained list allocation	(ii) External Fragmentation
3. Indexed allocation	

(A) 1–(i), 2–(i), 3–(i) (B) 1–(i), 2–(i), 3–(ii)
(C) 1–(ii), 2–(i), 3–(i) (D) 1–(ii), 2–(ii), 3–(i)

3. Suppose that the scheduling algorithm favors those processes that have used the least processor time in the recent past. Then which of the following is TRUE?
(A) The algorithm favors I/O bound programs.
(B) The algorithm favors CPU bound programs.
(C) Fair treatment to all the programs.
(D) The algorithm favors longer programs.

4. Which of the following is not a necessary condition for deadlock?
(A) Mutual exclusion (B) Hold and wait
(C) Circular wait (D) Reentrancy

5. What will be the state of a process after it encounters an I/O instruction?
(A) Ready (B) Blocked
(C) Idle (D) Running

6. Which of the following is used by a program to request a service from an operating system's kernel that it does not normally have permission to run?
(A) Context switch (B) Threads
(C) System call (D) Service call

7. Which of the following is the reason for having threads within a process?
(i) Threads are lighter in weight than processes.
(ii) Threads have high performance when the processes have both I/O and CPU activity.
(iii) Threads are useful on systems with multiple CPU's.
(A) (i), (ii) (B) (ii), (iii)
(C) (i), (iii) (D) (i), (ii), (iii)

8. Which of the following is TRUE?
(A) No protection required between threads.
(B) Different threads in a process are always independent.
(C) All the threads cannot share open files, child processes.
(D) Each thread will maintain Accounting Information.

9. Which of the following is FALSE with respect to a monitor?
(A) Only one process can be active in a monitor at any instant.
(B) A monitor is a collection of procedures.
(C) Procedures declared outside the monitor can access monitor's internal data structure.
(D) Monitors can be used to provide mutual exclusion.

10. Which of the following is a reason for process scheduling?
(i) When a new process is created.
(ii) When a process exits.
(iii) When a process blocks.
(iv) When an interrupt occurs.
(A) (i), (ii) (B) (i), (iii), (iv)
(C) (ii), (iii) (D) (i), (ii), (iii), (iv)

11. Match the following:

List-A	List-B
1. First Come First Serve	I. High throughput
2. Shortest Process Next	II. Fair treatment of processes
3. Round Robin	III. Non-preemptive

(A) 1-II, 2-III, 3-II (B) 1-III, 2-I, 3-II
(C) 1-I, 2-III, 3-II (D) 1-I, 2-II, 3-III

12. To use process switching in hardware, instead of interrupts, the CPU needs to know about
(A) Process table data structure
(B) System calls
(C) CPU burst time
(D) PC only

13. Which of the following is FALSE?
(A) Throughput is the number of processes that complete their execution per unit time.
(B) Turnaround time is the amount of time required to execute a particular process.
(C) Waiting time is the amount of time, a process has been waiting in the ready queue.
(D) Response time is the amount of time taken to get the output.

14. Which of the following scheduling algorithm is also referred as preemptive version of FCFS?
(A) Shortest Job First
(B) Round Robin
(C) Shortest Remaining Time First
(D) None of these

15. Which of the following malware can result in pop-up ads or can redirect a browser to a commercial site?
(A) Spyware (B) Adware
(C) Zombie (D) Backdoor

16. In 48-bit machine, with 4 GB RAM and 8 KB page size, how many entries will be there in the page table if it is inverted?
(A) 2^{35} (B) 2^{20}
(C) 2^{19} (D) 2^{13}

17. Consider the following process and resource requirement of each process.

Process	Resource 1		Resource 2	
	Used	Max	Used	Max
P1	2	3	2	4
P2	2	4	2	3
P3	3	5	2	5

Assume that there are a total of 8 instances of resource type 1 and 7 instances of resource type 2. What is the state of this system?
(A) Can go to safe or unsafe state based on sequence.
(B) Safe state
(C) Unsafe state
(D) Deadlock state

18. Consider a system that has two CPU's and each CPU has two threads. Suppose three programs *P*1, *P*2 and *P*3 are started with run times 10, 15 and 25 ms respectively. What is the minimum time required to complete the execution of these programs?
(A) 25 ms (B) 35 ms
(C) 45 ms (D) 40 ms

19. A computer system has enough room to hold five programs in its main memory. These programs are blocked on I/O, half the time. What fraction of the CPU time is wasted?
(A) 96.8% (B) 32%
(C) 3.125% (D) 50%

20. A computer has 4 GB of RAM, of which the operating system occupies 256 MB. The processes are all 128 MB and have the same characteristics. If the goal is 95% CPU utilization, what is the maximum I/O wait that can be tolerated?
(A) 90.4% (B) 85.4%
(C) 72% (D) 50%

21. A file system with 4 KB blocks can access 64 GB worth of data through an i-node triple indirect block.
How many bits does the file system use for block pointers?
(A) 8 (B) 16
(C) 32 (D) 64

22. In a File Allocation table, each entry is of size 24-bits. For a 32 GB disk, what is the minimum size of a file allocation in this system?
(A) 1 KB (B) 2 KB
(C) 4 KB (D) 8 KB

23. On a system with 2^{64} bytes of memory and fixed partitions with a partition size of 2^{20} bytes, what is the minimum number of bits needed in an entry in the process table to record the partition to which a process has been allocated?
(A) 20-bits (B) 32-bits
(C) 36-bits (D) 44-bits

24. Which of the following features are required by an ideal CPU scheduling algorithm?
(i) Maximize the CPU utilization
(ii) Maximize the throughput
(iii) Minimize the turnaround time
(iv) Minimize the waiting time
(v) Minimize the response time
(A) (i), (iii), (v) (B) (ii), (iv), (v)
(C) (i), (ii), (iv), (v) (D) (i), (ii), (iii), (iv), (v)

25. Consider the following set of processes:

Process	Burst time	Priority
P1	10	3
P2	1	1
P3	2	3
P4	1	4
P5	5	2

The processes are assumed to have arrived in the order *P*1, *P*2, *P*3, *P*4 and *P*5 all at time 0. What is the average Turnaround time using Shortest Job First scheduling?
(A) 5 (B) 7
(C) 15 (D) 19

26. Consider the given concurrent processes:

```
Process P0:
while (true)
{
    while(turn = = 1);
    critical section
    turn = 1
    remainder section
}
Process P1:
    while (true)
{
        while (turn = = 0);
            critical section
        turn = 0
        remainder section
}
```

'turn' is a global Boolean variable, Which will take either 0 or 1. Which of the following is TRUE for above two processes?
(A) There is mutual exclusion and progress.
(B) There is progress but no mutual exclusion

(C) There is mutual exclusion but no progress.
(D) There is no mutual exclusion and no progress.

27. Consider '*n*' concurrent processes P_1, P_2, ... P_n whose code is shown below:

```
var mutex : semaphore
mutex = 1;
process Pi:
    Repeat
        wait (mutex);
            critical section
        signal (mutex);
            Remainder section
        until false;
```

Then which of the following is TRUE?
(A) There is mutual exclusion.
(B) There is no mutual exclusion in the system.
(C) There is a deadlock in the system
(D) Both (B) and (C)

28. Which of the following correctly specifies the 'wait' operation of a counting semaphore?
(A) semvalue = semvalue – 1;
if semvalue < 0 then
Add this process to Blocked queue.
(B) semvalue = semvalue + 1 ;
if semvalue ≤ 0 then
Block the process;
(C) semvalue = semvalue – 1;
if semvalue ≤ 0 then
Block the process;
(D) semvalue = semvalue – 1;
if semvalue < 1 then Block the process

29. Identify the TRUE statements from the following:
(i) Logical address is generated by the CPU.
(ii) Physical address is the address seen by the memory unit.
(iii) The user program always deals with physical address.
(A) (i), (ii) (B) (i), (iii)
(C) (ii), (iii) (D) (i), (ii), (iii)

30. The correct sequence of steps required for page fault handling from the following is:
(i) Search in the page table.
(ii) Search for the page in the backing store.
(iii) Reset page table
(iv) Bring in missing page
(v) Restart instruction
(vi) The OS takes control on trap.
(A) (i), (ii), (iv), (v), (vi), (iii)
(B) (ii), (i), (v), (iv), (iii), (vi)
(C) (i), (vi), (ii), (iv), (v), (iii)
(D) (i), (vi), (ii), (iv), (iii), (v)

31. If the multiprogramming level increases rapidly then the processor utilization:
(A) always increases (B) always decreases
(C) decreases some times (D) doesn't effected

Common Data for Questions 32 and 33
Consider a swapping system in which memory consists of the following hole sizes in order:11 KB, 5 KB, 21 KB, 19 KB, 8 KB, 10 KB, 13 KB and 16 KB.

32. Which hole is taken for successive segment requests 13 KB, 11 KB and 10 KB for First-fit?
(A) 13 KB, 11 KB, 10 KB (B) 21 KB,11 KB,19 KB
(C) 11 KB, 5 KB, 21 KB (D) 13 KB, 16 KB, 11 KB

33. Which hole is taken for successive segment requests 12 KB, 10 KB, 9 KB for Best-fit?
(A) 21 KB, 19 KB, 11 KB (B) 13 KB, 16 KB, 11 KB
(C) 13 KB, 10 KB, 11 KB (D) 13 KB, 11 KB, 10 KB

Common Data for Questions 34 and 35
A computer has four page frames. The time of loading, time of last access and modify (*M*) bits of each page are shown as below.

Page	Load Time	Last access time	M
0	149	198	1
1	255	280	0
2	85	293	0
3	129	285	1

34. Which page will FIFO algorithm replace next?
(A) page 0 (B) page 1
(C) page 2 (D) page 3

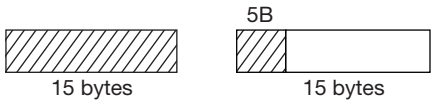
35. Which page will LRU algorithm replace next?
(A) page 0 (B) page 1
(C) page 2 (D) page 3

Answer Keys

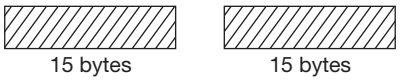
1. B	**2.** C	**3.** A	**4.** D	**5.** B	**6.** C	**7.** D	**8.** A	**9.** C	**10.** D
11. B	**12.** A	**13.** D	**14.** B	**15.** B	**16.** C	**17.** D	**18.** A	**19.** C	**20.** A
21. A	**22.** B	**23.** D	**24.** D	**25.** B	**26.** C	**27.** A	**28.** A	**29.** A	**30.** D
31. C	**32.** B	**33.** C	**34.** C	**35.** A					

Hints and Explanations

1. Record lengths are 10, 20, 30 Bytes
Physical block size = 15 bytes.
Maximum fragmentation occurs with 20 byte records.



∴ Maximum fragmentation = 10 bytes
Minimum fragmentation occurs with 30 byte records.



∴ Minimum fragmentation = 0 Bytes. Choice (B)

2. In Contiguous file Allocation, each file occupies a set of contiguous blocks on the disk. It suffers from external fragmentation. In linked and indexed allocation, there is internal fragmentation. Choice (C)

3. The algorithm favors I/O bound programs because of the relatively short CPU burst request by them.
Choice (A)

4. The necessary and sufficient conditions for deadlock are Mutual exclusion, Hold-and-wait, No-preemption and Circular wait. Choice (D)

5. During I/O instruction execution, a process will be in 'Blocked' state. Choice (B)

6. A system call is used to get services of OS's kernel.
Choice (C)

8. No protection is required between threads. (As it is impossible and not necessary). Threads are dependent on each other. Threads can share open files and child processes. Accounting information is maintained by process. Choice (A)

9. Procedures declared outside the monitor can't access monitor's internal data. Choice (C)

10. All the four are reasons for process scheduling.
Choice (D)

11. FCFS, SPN both are non-preemptive. FCFS's throughput is not that much emphasized. It also penalizes short processes. SPN penalizes long processes. Its throughput is high. Round Robin is preemptive and it treats all processes fairly. Choice (B)

12. To use process switching, the CPU needs to know about process table and state. Choice (A)

13. Response time is the amount of time it takes from, when a request was submitted until the first response is produced. Choice (D)

14. Round Robin is the preemptive version of FCFS.
Choice (B)

15. Advertising that is integrated into software is adware.
Choice (B)

16. In inverted page table, the number of entries is the number of frames in the main memory.
Main memory capacity = 4 GB = 2^{32}B
Page size = frame size = 8 KB = 2^{13}B

∴ Number of entries $= \frac{2^{32}}{2^{13}} = 2^{19}$ Choice (C)

17. Total resources $(R) = \begin{bmatrix} R_1 \\ R_2 \end{bmatrix} = \begin{bmatrix} 8 \\ 7 \end{bmatrix}$

Total used resources $= \begin{bmatrix} 7 \\ 6 \end{bmatrix}$

Available resources$(V) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$

$P1$ requires (1, 2) resources.
$P2$ requires (2, 1) resources.
$P3$ requires (2, 3) resources.
No process can execute with available resources.
So the system is in deadlock. Choice (D)

18. On one CPU, at a time only one program will be executed. At a time two programs will be in running state. If $P1$, $P2$ are executed on CPU1 and $P3$ executed on another CPU, the execution time will be 25 ms.
Choice (A)

19. CPU utilization = $1 - p^n$
where n is the degree of multiprogramming and 'p' is the fraction of time a process spends waiting for I/O.
Here $n = 5$

$p = \frac{1}{2}$

∴ CPU time wasted $= \left(\frac{1}{2}\right)^5 = \frac{1}{32} 0.03125 = 3.125\%$

Choice (C)

20. RAM capacity = 4 GB = 2^{32} B
OS capacity = 256 MB = 2^{28}B
Remaining = $2^{32} - 2^{28} = 4026531840$
Process capacity = 128 MB = 2^{27}B

∴ Number of processes fit in remaining space

$= \frac{4026531840}{2^{27}} = 30$

30 processes can be placed in memory at a time.
Let 'P' is the probability that a process has an I/O.
If all the 30 processes are in I/O, the probability is P^{30}.
CPU idle percentage = 5%
By equating both,
$P^{30} = 0.05 \Rightarrow P = 0.904$
So we can tolerate processes with upto 90.4% I/O.
Choice (A)

21. Data accessed using inode triple indirect block = 64 GB
Block size = 4 KB
(Number of blocks)^3 × block size
= Data accessed using triple indirect blocks
(Number of blocks)^3 × 4 K = 64 G

$\Rightarrow$ (Number of blocks)$^3 = \frac{2^{36}}{2^{12}}$

$\Rightarrow$ Number of blocks = 2^8

$\therefore$ Bits required for block pointer = 8-bits

Choice (A)

22. Disk capacity = 32 GB = 2^{35}B
Each entry size = 24-bits
Using 24-bits, we can access 2^{24} B.

$\therefore$ Minimum size of a file allocation

$= \frac{2^{35}}{2^{24}} = 2^{11}\text{B} = 2\text{ KB}$ Choice (B)

23. Memory = 2^{64}B
Partition size = 2^{20}B

Number of partitions $= \frac{2^{64}}{2^{20}} = 2^{44}$

$\therefore$ 44-bits required for an entry in the process table.

Choice (D)

24. All those features are required by an ideal algorithm.
Choice (D)

25. In SJF the job with smallest CPU burst will execute first. The Gantt chart for given processes is shown below:

P2	P4	P3	P5	P1
0	1	2	4	9	19

Turn Around Time (TAT) of $P1$ = 19 (waiting time + CPU burst)
TAT of $P2$ = 1
TAT of $P3$ = 4
TAT of $P4$ = 2
TAT of $P5$ = 9

Average TAT $= \frac{19+1+4+2+9}{5} = \frac{35}{5} = 7$ units

Choice (B)

26. Initially 'turn = 0' then P_0 only can enter the critical section and if P_1 tries to enter, it is not possible to enter critical section.
Only one process can enter critical section. So there is mutual exclusion. But there is no progress. ($\because$ A process cannot be able to enter into critical section even if no process is in critical section). Choice (C)

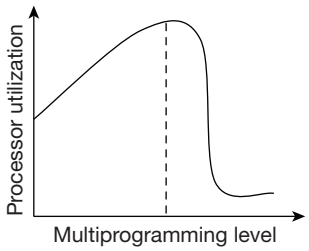
27. Only one process can enter the critical section at a time. So there is mutual exclusion. Choice (A)

28. The wait operation decrements the semaphore value. If it is less than zero, block the process. Choice (A)

29. User program deals with logical address.
Choice (A)

30. Page fault occurs when the page for which CPU is searching is not in memory. Initially we search in the page table. If it is a trap, the OS takes the control. OS searches the backing store for the required page and places it in memory. Updates the page table and restarts the instruction. Choice (D)

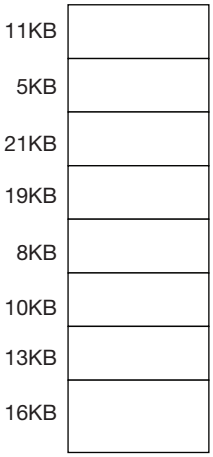
31. If the multiprogramming level increases from a small value, then the processor utilization rises.
But from a point onwards, the number of page faults rises dramatically and processor utilization collapses. The graph is shown below.



Choice (C)

Common Data for Questions 32 and 33

32. Memory system with given hole sizes is shown below:



In first-fit policy, choose the hole from beginning of the memory, using which given request is satisfied.
13 KB placed in 21 KB.
11 KB placed in 11 KB.
10 KB placed in 19 KB. Choice (B)

33. Best-fit policy searches for all holes in the memory and selects the smallest hole using which the memory request will be satisfied.
12 KB placed in 13 KB
10 KB placed in 10 KB
9 KB placed in 11 KB Choice (C)

34. FIFO will replace the page which entered first into the memory.
Load time of page 2 is least

$\therefore$ FIFO replaces page 2. Choice (C)

35. LRU replaces the page whose access time is least.
Access time of page 0 is least. So LRU replaces page 0.
Choice (A)