



Question 1: Choose the correct answer (10 Marks)

1. What is compaction?
 - a) a technique for overcoming internal fragmentation
 - b) a paging technique
 - c) a technique for overcoming external fragmentation
 - d) a technique for overcoming fatal error
2. A solution to the problem of external fragmentation is:
 - a) compaction
 - b) larger memory space
 - c) smaller memory space
 - d) none of the mentioned
3. External fragmentation exists when:
 - a) enough total memory exists to satisfy a request but it is not contiguous
 - b) the total memory is insufficient to satisfy a request
 - c) a request cannot be satisfied even when the total memory is free
 - d) none of the mentioned
4. When the memory allocated to a process is slightly larger than the process, then:
 - a) internal fragmentation occurs
 - b) external fragmentation occurs
 - c) both internal and external fragmentation occurs
 - d) neither internal nor external fragmentation occurs
5. With paging there is no _____ fragmentation.
 - a) internal
 - b) external
 - c) either type of
 - d) none of the mentioned
6. In paged memory systems, if the page size is increased, then the internal fragmentation generally:
 - a) becomes less
 - b) becomes more
 - c) remains constant
 - d) none of the mentioned
7. The interval from the time of submission of a process to the time of completion is termed as
 - a) waiting time
 - b) turnaround time
 - c) response time
 - d) throughput
8. Which scheduling algorithm allocates the CPU first to the process that requests the CPU first?
 - a) first-come, first-served scheduling
 - b) shortest job scheduling
 - c) priority scheduling
 - d) none of the mentioned
9. In priority scheduling algorithm
 - a) CPU is allocated to the process with highest priority
 - b) CPU is allocated to the process with lowest priority
 - c) Equal priority processes can not be scheduled
 - d) None of the mentioned
10. Time quantum is defined in
 - a) shortest job scheduling algorithm
 - b) round robin scheduling algorithm
 - c) priority scheduling algorithm
 - d) multilevel queue scheduling algorithm

Question 2 (10 Marks)

- a) Given five memory partitions of 100 KB, 500 KB, 200 KB, 300 KB, and 600 KB (in order), how would each of the first-fit and best-fit algorithms place processes of 212 KB, 417 KB, 112 KB, and 426 KB (in order)? Which algorithm makes the most efficient use of memory?
- b) Using the following state of memory.
 1. If the partitions are fixed and a new job arrives requiring 52 blocks of main memory, show memory after using each of the following partition selection approaches:
 - i. First fit
 - ii. Best fit
 2. If the partitions are dynamic and a new job arrives requiring 52 blocks of main memory, show memory after using each of the following partition selection approaches:
 - i. First fit
 - ii. Best fit

Operating System
Job 1
Empty: 60 blocks
Job 2
Job 3
Empty: 52 blocks
Empty: 100 blocks

Question 3**(20 Marks)**

- a) A system receives a series of page references in the following order: **a, a, c, e, b, b, f, h, g, f, b, a, e, e, e, a, d, i, g, g**. The system has five page frames. If all of the frames are initially empty
- Using the FIFO page removal algorithm, do a page trace analysis indicating page faults with asterisks (*). Then compute the failure and success ratios.
 - Repeat for the LRU page removal algorithm.
- b) Calculate the cache Hit Ratio assuming that the total number of requests is 2056 and 1209 of those requests are found in the cache.
- c) Assuming a hit ratio of 67 percent, calculate the Average Memory Access Time Average Cache Access Time is 100 nsec and the Average Main Memory Access Time is 600 nsec.
- d) Given that main memory is composed of four page frames for public use, use the following table to answer all parts of this problem:

Page Frame	Time When Loaded	Time When Last Referenced	Referenced Bit	Modified Bit
0	126	279	0	0
1	230	280	1	0
2	120	282	1	1
3	160	290	1	1

- The contents of which page frame would be swapped out by FIFO?
 - The contents of which page frame would be swapped out by LRU?
- e) Given three subroutines of 600, 300, and 500 words each, if segmentation is used then the total memory needed is the sum of the three sizes. Determine the total amount of wasted memory due to internal fragmentation when the three subroutines are loaded into memory using each of the following page sizes:
- 150 words
 - 200 words
 - 500 words

Question 4**(20 Marks)**

Consider the following set of jobs to be scheduled for execution on a single CPU system:

Draw a timeline and calculate the average turnaround time for each of the following scheduling algorithms:

- FCFS (first-come first-serve)
- SJN (shortest job next)
- Preemptive Priority
- Non-preemptive Priority
- SRT (shortest remaining time)
- Round robin (using a time quantum of 6)

Job	Arrival time	Size(msec)	priority
J1	0	10	2 (Silver)
J2	2	8	1 (Gold)
J3	3	3	3 (Bronze)
J4	10	4	2 (Silver)
J5	12	1	3 (Bronze)
J6	15	4	1 (Gold)