QI.1.1. Choose only ONE answer. *

An I/O-bound program typically has many short ____ and a CPU-bound program might have a few long _____.

- I/O burst, I/O burst.
- I/O burst, CPU burst.
- CPU burst, CPU burst.
- CPU burst, I/O burst.

QI.1.2. Choose only ONE answer. *

A process is at priority 200 at a given point of time. What will be its priority after 10 minutes using an aging system in which the priority is incremented periodically every 5 seconds:

- 190.
- Zero.
- 80.
- None of the given options is correct.

QI.1.3. Choose only ONE answer. *

Which of the following items does NOT belong to the function of a dispatcher?

- Switching to user mode.
- Switching context from one process to another.
- Jumping to the proper location in the user program to resume that program.
- Selecting a process among the available ones in the ready queue.

QI.1.4. Choose only ONE answer. *

Which of the following scheduling algorithms gives the minimum average response time?

- Multilevel queue.
- Shortest Job First.
- Round Robin.
- First-Come, First-Served.

QI.1.5. Choose only ONE answer. *

A significant problem with priority scheduling algorithms is ____.

- Determining the length of the next CPU burst.
- Starvation.
- Complexity.
- Determining the length of the time quantum.

QI.1.5. Choose only ONE answer. *

A significant problem with priority scheduling algorithms is ____.

- Determining the length of the next CPU burst.
- Starvation.
- Complexity.
- Determining the length of the time quantum.
- Other: _____

Q1.1.6. Choose only ONE answer. *

If the time quantum gets too large, Round Robin scheduling degenerates (becomes similar) to _____?

- ◯ Shortest Job First.
- ◯ Multilevel queue.
- ◉ First-Come, First-Served.
- ◯ Shortest-remaining-time-first.

Q1.2.1 *

Consider the following set of processes:

Process#	Arrival Time	Burst Time (ms)	Priority
A	0	5	4
B	6	2	2
C	3	3	1
D	2	5	2
*: Lower number means higher priority			

Suppose the following Gantt charts show the order in which processes are executed according to specific scheduling algorithm. Select the scheduling algorithms used with the provided Gantt chart:

A	A	D	C	C	C	D	B	D	B	D	D	A	A	A
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Note: *When a process finishes at the same time another process arrives, the new process will be submitted to the ready queue first.*

- ◯ (Non-preemptive) Shortest Job First.
- ◯ First-Come-First-Served.
- ◯ Round-Robin with time quantum 1ms.
- ◉ Preemptive priority/ Round-Robin with time quantum 1ms.
- ◯ (Preemptive) Shortest Remaining Time First.
- ◯ Non-preemptive priority.

Q1.2.2. *

Consider the following set of processes:

Process#	Arrival Time	Burst Time (ms)	Priority
A	0	5	4
B	6	2	2
C	3	3	1
D	2	5	2
*: Lower number means higher priority			

Suppose the following Gantt charts show the order in which processes are executed according to specific scheduling algorithm. Select the scheduling algorithms used with the provided Gantt chart:

A	A	A	A	A	D	D	D	D	D	C	C	C	B	B
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Note: *When a process finishes at the same time another process arrives, the new process will be submitted to the ready queue first.*

- ◉ First-Come-First-Served.
- ◯ (Non-preemptive) Shortest Job First.

*: Lower number means higher priority

Suppose the following Gantt charts show the order in which processes are executed according to specific scheduling algorithm. Select the scheduling algorithms used with the provided Gantt chart:

A	A	A	A	A	D	D	D	D	D	C	C	C	B	B
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Note: *When a process finishes at the same time another process arrives, the new process will be submitted to the ready queue first.*

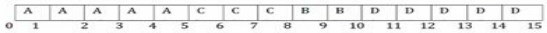
- ◉ First-Come-First-Served.
- ◯ (Non-preemptive) Shortest Job First.
- ◯ (Preemptive) Shortest Remaining Time First.
- ◯ Round-Robin with time quantum 1ms.
- ◯ Preemptive priority/ Round-Robin with time quantum 1ms.
- ◯ Round-Robin with time quantum 3 ms.
- ◯ Non-preemptive priority.

Consider the following set of processes:

Process#	Arrival Time	Burst Time (ms)	Priority
A	0	5	4
B	6	2	2
C	3	3	1
D	2	5	2

**: Lower number means higher priority*

Suppose the following Gantt charts show the order in which processes are executed according to specific scheduling algorithm. Select the scheduling algorithms used with the provided Gantt chart:



Note: *When a process finishes at the same time another process arrives, the new process will be submitted to the ready queue first.*

- ◯ (Preemptive) Shortest Remaining Time First.
- ◯ First-Come-First-Served.
- ◯ Round-Robin with time quantum 3 ms.
- ◯ Non-preemptive priority.
- ◉ (Non-preemptive) Shortest Job First.
- ◯ Round-Robin with time quantum 1ms.
- ◯ Preemptive priority/ Round-Robin with time quantum 1ms.

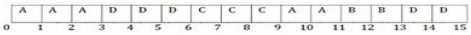
Ql.2.4. *

Consider the following set of processes:

Process#	Arrival Time	Burst Time (ms)	Priority
A	0	5	4
B	6	2	2
C	3	3	1
D	2	5	2

**: Lower number means higher priority*

Suppose the following Gantt charts show the order in which processes are executed according to specific scheduling algorithm. Select the scheduling algorithms used with the provided Gantt chart:



Note: *When a process finishes at the same time another process arrives, the new process will be submitted to the ready queue first.*

- ◉ Round-Robin with time quantum 3 ms.
- ◯ Preemptive priority/ Round-Robin with time quantum 1ms.
- ◯ Non-preemptive priority.
- ◯ First-Come-First-Served.
- ◯ Round-Robin with time quantum 1ms.

- ◯ (Preemptive) Shortest Remaining Time First.
- ◯ (Non-preemptive) Shortest Job First.

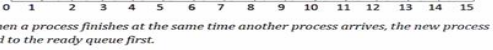
Ql.2.5. *

Consider the following set of processes:

Process#	Arrival Time	Burst Time (ms)	Priority
A	0	5	4
B	6	2	2
C	3	3	1
D	2	5	2

**: Lower number means higher priority*

Suppose the following Gantt charts show the order in which processes are executed according to specific scheduling algorithm. Select the scheduling algorithms used with the provided Gantt chart:



Note: *When a process finishes at the same time another process arrives, the new process will be submitted to the ready queue first.*

- ◯ (Preemptive) Shortest Remaining Time First.
- ◯ (Non-preemptive) Shortest Job First.

- ◉ Non-preemptive priority.
- ◯ Preemptive priority/ Round-Robin with time quantum 1ms.
- ◯ Round-Robin with time quantum 1ms.
- ◯ Round-Robin with time quantum 3 ms.

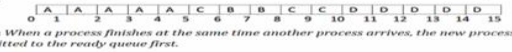
Ql.2.6. *

Consider the following set of processes:

Process#	Arrival Time	Burst Time (ms)	Priority
A	0	5	4
B	6	2	2
C	3	3	1
D	2	5	2

**: Lower number means higher priority*

Suppose the following Gantt charts show the order in which processes are executed according to specific scheduling algorithm. Select the scheduling algorithms used with the provided Gantt chart:



Note: *When a process finishes at the same time another process arrives, the new process will be submitted to the ready queue first.*

- ◯ (Non-preemptive) Shortest Job First.

- ◯ (Non-preemptive) Shortest Job First.
- ◯ Non-preemptive priority.
- ◯ Round-Robin with time quantum 3 ms.
- ◯ Round-Robin with time quantum 1ms.
- ◯ First-Come-First-Served.
- ◯ Preemptive priority/ Round-Robin with time quantum 1ms.
- ◉ (Preemptive) Shortest Remaining Time First.

QII.1.1. Choose only ONE answer. *

The contiguous memory allocation scheme with variable-partition sizes suffers from:

- (•) External Fragmentation.
- ( ) Internal Fragmentation.
- ( ) Decreasing the degree of multiprogramming.

QII.1.2. Choose only ONE answer. *

If the base register is loaded with value 20345 and limit register is loaded with value 1000, which of the following memory address access will not result in a trap to the operating system?

- ( ) 20300
- (•) 21345
- ( ) 21000

QII.1.3. Choose only ONE answer. *

Shuffling memory contents to place all free memory together in one large block is called:

- ( ) Address binding.
- ( ) Swapping.
- (•) Compaction.

QII.1.4. Choose only ONE answer. *

If the starting address location changes, in which of the following cases, the program must be recompiled?

- (•) Execution time binding.
- ( ) Load time binding.
- ( ) Compile time binding.

QII.1.5. Choose only ONE answer. *

An address generated by a CPU is referred to as a _____

- ( ) Physical address.
- ( ) Memory-Management Unit (MMU) generated address.
- (•) Logical address.

QII.1.6. Choose only ONE answer. *

Which of the following is true about dynamic storage allocation?

- ( ) Worst fit provides the best storage utilization.
- ( ) Best fit produces the largest leftover hole.
- (•) First fit requires less time for allocation than worst fit on average.

QII.1.7. Choose only ONE answer. *

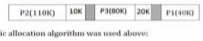
Consider a process with 10 pages. The page size is 256 bytes, and the variable S in this process has the logical address 2200. What is the logical address of S in the representation of (p, d), where p is the page number and d is the page offset? **Note: The first page is Page 0.**

- (•) (8, 152)
- ( ) (8, 59)
- ( ) (10, 152)

QII.1.8. Choose only ONE answer. *

Given memory partitions of 120K, 100K, and 40K (in order) as follows:

Three new processes arrived in order P1, P2, and P3 of sizes 40K, 110K, and 80K respectively, and are allocated the above memory partitions as shown below,



Indicate which dynamic allocation algorithm was used above:

- (•) Best-fit.
- ( ) First-fit.
- ( ) Worst-fit.

QII.2.1 *

Consider a paging memory management scheme with the following characteristics: the logical address consists of 12 bits, the number of frames in the physical memory is 32 frames and the page size is 1 KB.

Complete the following statements using the appropriate numbers from the provided choices:

The size of the logical address space is _____bytes.

- ( ) 3072
- ( ) 2^15
- (•) 2^10
- ( ) 2058
- ( ) 12
- ( ) 2^12

QII.2.2 *

Consider a paging memory management scheme with the following characteristics: the logical address consists of 12 bits, the number of frames in the physical memory is 32 frames and the page size is 1 KB.

Complete the following statements using the appropriate numbers from the provided choices:

The logical address space can contain_____ pages.

- (•) 4
- ( ) 10
- ( ) 2
- ( ) 12
- ( ) 3
- ( ) 15

QII.2.3 *

Consider a paging memory management scheme with the following characteristics: the logical address consists of 12 bits, the number of frames in the physical memory is 32 frames and the page size is 1 KB.

Complete the following statements using the appropriate numbers from the provided choices:

_____ bits are required for the offset.

- ( ) 10
- ( ) 2^5
- ( ) 12
- ( ) 2^12
- (•) 5
- ( ) 2^10

Consider a paging memory management scheme with the following characteristics: the logical address consists of 12 bits, the number of frames in the physical memory is 32 frames and the page size is 1 KB.

Complete the following statements using the appropriate numbers from the provided choices:

_____bits are required for the page number.

- (•) 2
- ( ) 10
- ( ) 12
- ( ) 3
- ( ) 4
- ( ) 15

QII.2.5 *

Consider a paging memory management scheme with the following characteristics: the logical address consists of 12 bits, the number of frames in the physical memory is 32 frames and the page size is 1 KB.

QII.2.5 *

Consider a paging memory management scheme with the following characteristics: the logical address consists of 12 bits, the number of frames in the physical memory is 32 frames and the page size is 1 KB.

Complete the following statements using the appropriate numbers from the provided choices:

The size of the physical address space is _____bytes.

- (•) 2^10
- ( ) 2^12
- ( ) 15
- ( ) 10
- ( ) 2^15
- ( ) 12

QII.2.6 *

Consider a paging memory management scheme with the following characteristics: the logical address consists of 12 bits, the number of frames in the physical memory is 32 frames and the page size is 1 KB.

Complete the following statements using the appropriate numbers from the provided choices:

_____ is the physical address that is corresponding to the following logical address expressed as (page number, offset): (2, 10). Suppose that frame # 3 has been allocated for page # 2 of a given process.

- ( ) 2058
- ( ) 2^15
- ( ) 2^10
- (•) 3082
- ( ) 3072
- ( ) 2^12

QIII.1.1.i *

Consider the following reference string:

0 1 2 0 6 0 2 3 4 2 5 6 4

Identify which page replacement algorithm is being utilized in the following chart:

Reference string	0	1	2	0	6	0	2	3	4	2	5	6	4
Frames	0	0	0		0			3	4		4		
		1	1		6			6	6		6		
			2		2			2	2		5		

- ( ) Least recently used (LRU)
- (•) Optimal (OPT)
- ( ) First-in, first-out (FIFO)

QIII.1.1.ii *

Consider the following reference string:

0 1 2 0 6 0 2 3 4 2 5 6 4

Identify which page replacement algorithm is being utilized in the following chart:

Reference string	0	1	2	0	6	0	2	3	4	2	5	6	4
Frames	0	0	0		0			0	4		4	6	6
		1	1		6			3	3		5	5	5
			2		2			2	2		2	2	4

- (•) Least recently used (LRU)
- ( ) Optimal (OPT)
- ( ) First-in, first-out (FIFO)

QIII.1.2 *

2. Consider a demand paging system in which main memory consists of 4 frames. Suppose pages 0, 1, 2 and 3 are in memory at a given time. The number of times that each of these pages has been referenced is given below:

Page number	Number of times referenced
0	78
1	5
2	263
3	843

If a page needs to be replaced at this time, which page will be selected using the **most frequently used (MFU)** page replacement algorithm?

- (•) Page 3
- ( ) Page 0
- ( ) Page 1
- ( ) Page 2

QIII.1.3 *

For each description in the table below, indicate which of the following page replacement algorithms it pertains to:
a) First-in, first-out (FIFO) b) Optimal (OPT) c) Least recently used (LRU)

	FIFO	OPT	LRU
Suffers from Belady's anomaly	(•)	( )	( )
Guarantees the lowest possible page-fault rate for a fixed number of frames	( )	(•)	( )
Associates with each page the time of that page's last use	( )	( )	(•)
Difficult to implement because requires future knowledge of the reference string	( )	(•)	( )

QIII.2.1. Choose the best answer to fill in the blanks. *

Under _____ (local, global) replacement, the set of pages in memory for a process depends on not only the paging behavior of that process but also on the paging behavior of other processes.

- ( ) local
- (•) global

QIII.2.2. Choose the best answer to fill in the blanks. *

A page fault means that we referenced a page not in _____ (main memory, secondary storage).

- (•) main memory
- ( ) secondary memory

QIII.2.3. Choose the best answer to fill in the blanks. *

According to Belady's anomaly, for some page replacement algorithms, the page fault rate may _____ (increase, decrease, remain the same) as the number of allocated frames increases.

- (•) increase
- ( ) decrease
- ( ) remain the same

QIII.2.4. Choose the best answer to fill in the blanks. *

The _____ (valid-invalid bit, dirty bit, limit register) tells the system whether a page needs to be written to the disk when it is replaced.

- ( ) valid-invalid bit
- (•) dirty bit
- ( ) limit register

QIII.2.5. Choose the best answer to fill in the blanks. *

Suppose that a page is heavily used in the initial phases of a process but then is never used again. The page remains in memory even though it is no longer needed if the _____ (least frequently used (LFU), most frequently used (MFU)) page replacement algorithm is utilized.

- (•) least frequently used (LFU)
- ( ) most frequently used (MFU)

QIII.2.6. Choose the best answer to fill in the blanks. *

In a demand paging system, an average page fault service time is 4ms (4,000,000 ns), with page fault rate equal to 0.0003 and a memory-access time of 100 ns. The effective access time (EAT) is _____ (1300 ns, 99.97 ns, 1299.97 ns).

- ( ) 1300 ns
- (•) 99.97 ns
- ( ) 1299.97 ns

QIII.2.7. Choose the best answer to fill in the blanks. *

Consider a system with 120 free frames where the frame size is 1KB. Suppose these frames need to be split between the following two processes: process P_1 of size 50 KB and a process P_2 of size 200 KB.

P_1 should be allocated ___ (60, 24, 30) frames using the **proportional allocation** algorithm.

- ( ) 60
- (•) 24
- ( ) 30