Kunal Jha
Course: GATE
Computer Science Engineering(CS)

OPERATING SYSTEM-1: (GATE - 2021) - REPORTS

OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(17) | CORRECT(0) | INCORRECT(0) | SKIPPED(17)

Q. 1 FAQ | Solution Video | Have any Doubt ?

Match the following:

A. Present bit	1. Difference in contents of page in RAM and the disk
B. Dirty bit	2. Moving page from disk to memory
C. Swap out	3. Moving page from memory to disk
D. Swap in	4. Page is present in RAM

	A	B	C	D
(a)	4	3	1	2
(b)	2	1	4	3
(c)	3	4	2	1
(d)	4	1	3	2

A a

B b

C c

D d — Correct Option

Solution :
(d)
- Present bit → Page is present in RAM
- Dirty bit → Differences in contents of page in RAM and the disk
- Swap out → Moving page from memory to disk
- Swap in → Moving page from disk to memory

QUESTION ANALYTICS +

Q. 2 FAQ | Solution Video | Have any Doubt ?

Consider the following memory map using multiprogram with partition model. Shaded region shows memory in use and unshaded region represent free memory.

Request for memory follows the following order:
100 K, 25 K, 125 K, 50 K. Which of the following allocation satisfies the above request?
I. Best Fit II. First Fit III. Worst Fit

A Only 1 and II — Correct Option

Solution :
(a)
Let try to serve every request order for every strategy one by one.
I. Best Fit
- 100 K and 25 K request can be served in 125 K memory span.
- 125 K fits in 175K chunk and remaining 50 K used for 50 K request.

All request served in Best Fit.
II. First Fit
- 100 K fits in 125 K chunks and remaining 25 K chunks for next request i.e. 25 K.
- 125 K fits in 175 K chunks and remaining 50 K used for next request i.e. 50 K.

All request served in First Fit.
III. Worst Fit
- 100 K fits in 175 K. Now 75 K chunks is remaining.
- 25 K fits in 125 K. Now look chunks is remaining.
- 125 K can not be served as there is no face chunks but 50 K request can be served

All request are not being served in Worst Fit.
So, I and II successfully served all the requests.

B Only II and III

C All I, II and III

D None of these

QUESTION ANALYTICS +

Q. 3 FAQ | Solution Video | Have any Doubt ?

The system has 5 process and 3 resources (A, B, C). The maximum count of resources are (10, 5, 7). Consider the following table of resource allocation

	MAX (A B C)			Allocated (A B C)		
P_0	7	5	3	0	1	0
P_1	3	2	2	2	0	0
P_2	9	0	2	3	0	2
P_3	2	2	2	2	1	1
P_4	4	3	3	0	0	2

what will be a safe sequence?

A P_1, P_2, P_3, P_4, P_0

B P_1, P_0, P_3, P_4, P_2

C P_1, P_3, P_4, P_0, P_2 Correct Option

Solution :
(c)

	MAX Allocation A B C			Allocated A B C			Current Need A B C		
P_0	7	5	3	0	1	0	7	4	3
P_1	3	2	2	2	0	0	1	2	2
P_2	9	0	2	3	0	2	6	0	0
P_3	2	2	2	2	1	1	0	1	1
P_4	4	3	3	0	0	2	4	3	1

- After P_1 available resources are (5, 3, 2).
- Now P_3, and P_4 both can be served. After serving both available resources (7, 4, 5).
- Now, similarly P_0 and P_2 an be served.

So possible safe sequence is option (c) which is P_1, P_3, P_4, P_0, P_2.

D Unsafe sequence

QUESTION ANALYTICS +

Q. 4 FAQ Solution Video Have any Doubt ?

Consider the following statements:
S_1 : In linked allocation of disk spaces if a program P_1 reads 20^{th} disk block and now P_1 wants to read 13th disk block then it will again start accessing from the first disk block.
S_2 : Linked allocation can have internal fragmentation.
Which of the above statements is/are correct?

A Only S_1

B Only S_2

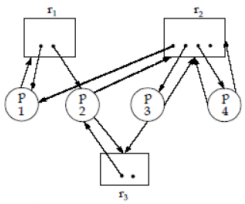
C Both S_1 and S_2 Correct Option

Solution :
(c)
Both statements S_1 and S_2 are correct.

D None of these

QUESTION ANALYTICS +

Q. 5 FAQ Solution Video Have any Doubt ?



Consider a system with the above resources graph. Answer the question based on this graph. The safe sequence of execution for the processes in above figure is:

A P_3, P_1, P_2, P_4

B P_2, P_1, P_4, P_3 Correct Option

Solution :
(b)
Points that can be drawn from above resource allocation graph:

$R_1 \rightarrow 2$
$R_2 \rightarrow 4$ } Total Resources
$R_3 \rightarrow 2$

Available resources:
$R_1 = 0$
$R_2 = 1$
$R_3 = 1$

- P_2 can complete as in RAC (Resource Allocation Graph) it is requesting 1 resource of r_2 and

1 resource of r_3 which can be allocated as it is available.
- After P_2 is completed, P_1 request for r_1 is served.
- Now P_3 or P_4 can be served in any manner.

So sequence of process execution is P_2, P_1, P_4, P_3.

C P_3, P_1, P_4, P_2

D Deadlock occurs

QUESTION ANALYTICS +

Q. 6 ? FAQ ▶ Solution Video Have any Doubt ?

Consider a system using 2-level paging and the virtual address is 38 bits. The most significant 10 bits are used to index the page directory and next 16 bits index the page table. Each entry in both levels is 4 bytes. What is the maximum number of page tables that a process can have?

1025 Correct Option

Solution :
1025
As we know, at first level we always get a page directory and each entry in the page directory points to a page table.
So, given 10 bits for page directory.
Then number of page table = 2^{10} = 1024.
Total number of page table = 1+1024 = 1025

QUESTION ANALYTICS +

Q. 7 ? FAQ ▶ Solution Video Have any Doubt ?

Consider a system has 3 process P_1, P_2 and P_3. Process P_1 needs 11 units of resource R; process P_2 needs 21 units of R and process P_3 needs 16 unit of R. What is the maximum unit of resource R that leads to deadlock?

45 Correct Option

Solution :
45
Maximum number of resources required for deadlock to happen
$= (11 - 1) + (21 - 1) + (16 - 1) = 45$

QUESTION ANALYTICS +

Q. 8 ? FAQ ▶ Solution Video Have any Doubt ?

Which of the following is not a necessary condition to occur the deadlock?

A Mutual exclusions

B No "Hold and wait" Correct Option

C No "preemption"

D Circular wait

YOUR ANSWER - NA | CORRECT ANSWER - b | STATUS - SKIPPED

Solution :
(b)
Necessary conditions to occur the deadlock.
1. Mutual exclusion
2. Hold and wait
3. No preemption
4. Circular wait
∴ No "Hold and wait" is not a necessary condition to occur the deadlock.

QUESTION ANALYTICS +

Q. 9 ? FAQ ▶ Solution Video Have any Doubt ?

Support a system contains n processes and system uses the Round-Robin algorithm for CPU scheduling then which data structure(s) is/are suited ready queue of the processes

A Queue Correct Option

B Stack

C Tree

D Circular Queue — Correct Option

YOUR ANSWER - NA | CORRECT ANSWER - a,d | STATUS - SKIPPED

Solution :

(a, d)

An Circular queue is the good data structure for round-robin CPU scheduling algorithm.
In round-robin CPU scheduling if the timer goes off first, then the process is swapped out of the CPU and moved to the back end of the ready queue.
The ready queue is maintained as a circular queue, so when all processes have had a turn, then the scheduler gives the first process another turn, and so on.
Similarly, Queue can also be used for some reason.

QUESTION ANALYTICS +

Q. 10 — Solution Video | Have any Doubt ?

Consider the following statements:
S_1: Demand paging requires the programmer to instruct the operating system to load a particular virtual memory page.
S_2: Dynamic loading follows inefficient memory utilization.
S_3: Pages that are shared between 2 or more processes can never be swapped out of the memory.
Which of the above is correct?

A Only S_1

B Only S_2 and S_3

C All of the above

D None of these — Correct Option

Solution :

(d)
• S_1 is incorrect as OS automatically loads pages from disk when it is needed.
• S_2 is incorrect as dynamic follows efficient memory utilization.
• S_3 is incorrect, i.e. when pages are shared between 2 or more process then it can be swapped out from memory to disk using demand paging to swap in new pages when memory is full.

QUESTION ANALYTICS +

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Q. 11

FAQ | Solution Video | Have any Doubt ?

Consider the following page reference string:
3, 2, 1, 5, 6, 3, 2, 7, 1, 3, 6, 7, 3, 2, 6
Assume there are 4 frames are available. x represents number of page faults using FIFO, *y* represents page faults using LRU and z represents page fault using optimal technique. Which of the following is correct?

A $z < y < x$ — Correct Option

Solution :
(a)

FIFO replacement

(3)	(2)	(1)	(5)	(6)	(3)	(2)	(7)	(1)	3	(6)	(7)	(3)	(2)	6
			5	5	5	5	7	7		7		7	2	
		1	1	1	1	2	2	2		2		3	3	
	2	2	2	2	3	3	3	3		6		6	6	
3	3	3	3	6	6	6	6	1		1		1	1	

$x = 12$

LRU replacement

(3)	(2)	(1)	(5)	(6)	(3)	(2)	(7)	(1)	3	(6)	7	3	(2)	6
			5	5	5	5	7	7		7			7	
		1	1	1	1	2	2	2		6			6	
	2	2	2	2	3	3	3	3		3			3	
3	3	3	3	6	6	6	6	1		1			2	

$y = 11$

Optimal Replacement

(3)	(2)	(1)	(5)	(6)	3	2	(7)	1	3	6	7	3	(2)	6
			5	6			6						6	
		1	1	1			1						2	
	2	2	2	2			7						7	
3	3	3	3	3			3						3	

$z = 7$

So, $z < . y < x$

B $z < x < y$

C $z = x < y$

D $z = y = x$

QUESTION ANALYTICS +

Q. 12

FAQ | Solution Video | Have any Doubt ?

Consider the following statements:
S_1 : To prevent deadlock, if a OS implements a policy that requires a process to release all resources before making a request, is free from deadlock but starvation may occur.
S_2: Deadlock avoidance requires resource requirements in advance.
Which of the above is correct?

A Only S_1

B Only S_2

C Both S_1 and S_2 — Correct Option

Solution :
(c)
Both the statements S_1 and S_2 are correct.

D None of these

QUESTION ANALYTICS +

Q. 13

FAQ | Solution Video | Have any Doubt ?

Consider a system where 2-level paging is used with TLB support. The access time for TLB is 20 ns while main memory access time is 80 ns. 130 pages references found in TLB and total 400 reference is generated. What is the effective memory access time?

A 180 ns

B 208 ns — Correct Option

Solution :
(b)

$$\text{TLB hit ratio} = \frac{130}{400} = 0.325$$

$$\begin{aligned}\text{E.M.A.T.} &= P \times (t + M) + (1 - P)(t + 3M) \\ &= 0.325 \times (20 + 80) + 0.675 (20 + 3 + 80) \\ &= 32.5 \text{ ns} + 0.67 \times 260 \text{ ns} \\ &= 32.5 \text{ ns} + 175.5 \text{ ns} = 208 \text{ ns}\end{aligned}$$

C 176 ns

D 195 ns

QUESTION ANALYTICS +

Q. 14 ? FAQ | Solution Video | Have any Doubt ?

In a demand paging scheme, page fault service time is 8 ms if replaced page is not modified or there is empty frame to accommodate the new page and it takes 15 ms if the page to be replaced is modified page. Main memory access time is 5 ms and 72% of the page to be replaced is modified In percentage what can be the maximum page fault rate to get the effective memory access time not more than 7 ms?_____ (Upto 2 decimal places)

24.87 (24.80 - 24.90) — Correct Option

Solution :
24.87 (24.80 - 24.90)
Let page fault rate be P.

$$\begin{aligned}\text{EMAT} &\geq P * [0.72 * 15 + 0.28 * 8] + (1 - P) * 5 \text{ ms} \\ 7 &\geq P * 13.04 + (1 - P) * 5 \\ 7 &\geq 8.04 P + 5 \\ 8.04 P &\leq 2 \\ P &\leq 0.2487 * 100 \\ P &\leq 24.87\%\end{aligned}$$

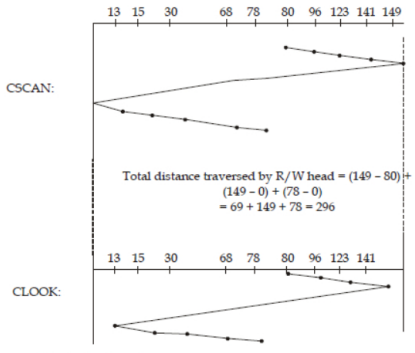
QUESTION ANALYTICS +

Q. 15 ? FAQ | Solution Video | Have any Doubt ?

Consider a disk has 150 cylinders, numbered from 0 to 149. Currently the disk arm is at 80 and moving towards higher cylinders. There is disk access requests for cylinders are 30, 78, 96, 123, 141, 15, 13, 68. What will be the absolute difference traversed by R/w head when CSCAN and CLOOK is used?

42 — Correct Option

Solution :
42



Total distance traversed by R/w head

$$= (149 - 80) + (149 - 0) + (78 - 0)$$
$$= 69 + 149 + 78 = 296$$

Figure

Total distance traversed by R/w head

$$= (141 - 80) + (141 - 13) + (78 - 13)$$
$$= 61 + 128 + 65 = 254$$

$$\text{Absolute difference} = 296 - 254 = 42$$

QUESTION ANALYTICS +

Q. 16 ? FAQ | Solution Video | Have any Doubt ?

Which of the following statement(s) is/are correct for deadlock avoidance algorithm.

A Every unsafe system leads to deadlock

B Every deadlock system implies unsafe. Correct Option

C Safe system at some point of time can lead to deadlock. Correct Option

D Unsafe system at some point of time can never result in safe state.

YOUR ANSWER - NA | CORRECT ANSWER - b,c | STATUS - SKIPPED

Solution :

(b, c)

A system in safe state if there exist safe sequence otherwise it is in unsafe states.

- If state sequence exist then no deadlock occurs in system.
- Unsafe system may lead to deadlock.
- deadlock has no safe sequence.
- Every deadlock is unsafe but every unsafe may not be deadlock.

QUESTION ANALYTICS +

Q. 17 FAQ Solution Video Have any Doubt ?

Which one of the following is/are true?

A Kernel is the program that constitutes the central core of the operating system. Correct Option

B Kernel is the first part of operating system to load into memory during booting. Correct Option

C Kernel is made of various modules which can not be loaded in running operating system.

D Kernel remains in the memory during the entire computer session. Correct Option

YOUR ANSWER - NA | CORRECT ANSWER - a,b,d | STATUS - SKIPPED

Solution :

(a, b, d)

QUESTION ANALYTICS +

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ALL(33) | CORRECT(0) | INCORRECT(0) | SKIPPED(33)

Q. 1 FAQ | Solution Video | Have any Doubt ?

Consider the following statements given below:
S_1 : LRU page replacement suffers from Belady's Anomaly.
S_2 : The set of pages that a process is currently using is called locality of reference.
S_3 : Loading the pages in memory before letting process fun is called pre paging.
Which of the above statements are true?

A S_1 and S_2

B Only S_2

C S_2 and S_3

D Only S_3 — Correct Option

Solution :
(d)
• S_1 is incorrect. FIFO having Belady's anomaly.
• S_2 is incorrect. The set of pages that a process is currently using is called working set.
• S_3 is correct.

QUESTION ANALYTICS +

Q. 2 FAQ | Solution Video | Have any Doubt ?

Consider the following program segment:
fork ( );
Printf ("Hi");
fork ( );
Printf ("Good");
fork ( );
How many times "Hi" and "Good" will be printed respectively?

A 2 and 4 — Correct Option

Solution :
(a)
"Hi" is printed twice and "Good" is printed four times.

B 2 and 2

C 4 and 4

D 3 and 2

QUESTION ANALYTICS +

Q. 3 FAQ | Solution Video | Have any Doubt ?

Consider the following statements:
S_1 : Related Kernel level threads can be scheduled on different processor in a multiprocessor system.
S_2 : On per-thread basis, operating system maintain virtual memory state.
S_3 : On per-thread basis, operating system does not maintain CPU register state.
Which of the above statements are correct?

A Only S_1 — Correct Option

Solution :
(a)
• S_1 is correct.
• On per-thread basis, operating system does not maintain virtual memory state. It maintains address space for the process not for threads. S2 is false.
• S_3 is false. Operating System maintains register state for every thread.

B Both S_1 and S_2

C Both S_2 and S_3

D Both S_1 and S_3

QUESTION ANALYTICS +

Q. 4 FAQ | Solution Video | Have any Doubt ?

Which of the following scheme does not support direct access in file allocation scheme?

A Index Allocation

B Contiguous Allocation

C Linked Allocation — Correct Option

Solution :
(c)
Index and contiguous allocation supports direct access.

D Both (b) and (c)

QUESTION ANALYTICS +

Q. 5 FAQ | Solution Video | Have any Doubt ?

If the current value of a counting semaphore s = −2, what does this imply?

A The number of processes that can enter the critical section is 2.

B The number of processes blocked from entering the critical section is 2. — Correct Option

Solution :
(b)
The number of processes blocked from entering the critical section is 2.

C No process can enter the critical section.

D Number of process that are outside critical section are 1.

QUESTION ANALYTICS +

Q. 6 FAQ | Solution Video | Have any Doubt ?

Which of the below statement is False.

A Kernel stack can be used to store the context of a process.

B User stack is used to store the function details during function calls.

C Kernel stack is used to store the user program functional arguments. — Correct Option

Solution :
(c)

D Context of the process is useful to restart the process after sometime.

QUESTION ANALYTICS +

Q. 7 FAQ | Solution Video | Have any Doubt ?

Consider the following statements regarding allocation methods:
S_1 : The pointer overhead for linked allocation is greater than indexed allocation.
S_2 : Both sequential and direct access can be supported by contiguous allocation.
Which of the above statements are not true?

A Only S_1 — Correct Option

Solution :
(a)
• The pointer overhead for indexed allocation is greater than linked allocation.
• Both sequential and direct access can be supported by contiguous allocation.

B Only S_2

C Both S_1 and S_2

None of these

D None of these

QUESTION ANALYTICS +

Q. 8 FAQ Solution Video Have any Doubt ?

Which of the following is false about User threads?

A User threads can switch fast since it does not involve kernel.

B User threads are lightweight since they do not require system calls.

C Kernel is not aware of the behavior of every user threads, i.e., if it is blocking or runnable.

D None of these Correct Option

Solution :
(d)

QUESTION ANALYTICS +

Q. 9 FAQ Solution Video Have any Doubt ?

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 implemented the above requirement then how many levels are required _____.

3 Correct Option

Solution :
3

$$\text{Page table size of } 1^{st} \text{ level} = \frac{2^{32}\text{B}}{2^{10}\text{B}} \times 4\text{B}$$
$$= 2^{24}\text{ B} > 1\text{ KB}$$
$$\text{Page table size of } 2^{nd} \text{ level} = \frac{2^{24}\text{B}}{2^{10}\text{B}} \times 4\text{B}$$
$$= 2^{16}\text{ B} > 1\text{ KB}$$
$$\text{Page table size of } 3^{rd} \text{ level} = \frac{2^{16}\text{B}}{2^{10}\text{B}} \times 4\text{B}$$
$$= 2^{8}\text{ B} < 1\text{ KB}$$

So, 3 level of page table required.

QUESTION ANALYTICS +

Q. 10 FAQ Solution Video Have any Doubt ?

Consider a system with 3-level paging with TLB support. TLB access time is 25 ns. Main memory access time is 550 ns. If the CPU found 180 page references in TLB when 920 page are referenced. What is the effective memory access time _____ (ns). (Upto 2 decimal places)

1903.25 (1900.00 – 1915.00) Correct Option

Solution :
1903.25 (1900.00 – 1915.00)

$$\text{TLB hit ratio} = \frac{180}{920} = 0.195$$

System using 3 level paging effective memory access time

$$= x(T + M) + (1 - x)(T + 4m)$$
$$= 0.195(25 + 550) + 0.805(25 + 4 \times 550)$$
$$= 0.195 \times 575 + 0.805 \times 2225 = 112.125 + 1791.125$$
$$= 1903.25$$

QUESTION ANALYTICS +

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ALL(33) | CORRECT(0) | INCORRECT(0) | SKIPPED(33)

Q. 11 FAQ | Solution Video | Have any Doubt ?

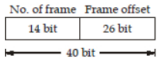
Consider a system with physical address of 40-bit, 16 K frame and page table contains 64 K entries. The number of bits in virtual address will be _____.

42 — Correct Option

Solution :
42

Number of pages in page table

$= 64\text{ K} = 16\text{ bit}$



$$\text{Virtual address} = \underbrace{16}_{\text{Page table entry}} + \underbrace{26}_{\text{Page offset}}$$

$= 42\text{ bit}$

QUESTION ANALYTICS +

Q. 12 FAQ | Solution Video | Have any Doubt ?

Consider a system using demand paging architecture where it take 6 ms to serve a page fault. Main memory access time is 1 ms. The maximum acceptable page fault rate to get the effective memory access not to be more than 1.25 ms is _____ %.

5 — Correct Option

Solution :
5

Let P is the page fault rate.

$$\text{E.M.A.T.} \le P \times \text{Page Fault Service Time} + (1 - P) \times \text{Main Memory Access Time}$$

$$1.25 \le P \times 6 + (1 - P) \times 1$$

$$1.25 \le 6P + 1 - P$$

$$5P \ge 0.25$$

$$P = \frac{0.25}{5} = 5\%$$

QUESTION ANALYTICS +

Q. 13 FAQ | Solution Video | Have any Doubt ?

Unix-Inode has block size 16 KB and file possible with triple indirect pointer is 32 GB. The number of bits that disk block address contains is _____.

1024 — Correct Option

Solution :
1024

Assume disk block address be x bits.

Number of disk block pointer in one block $= \frac{16\text{ KB}}{x\text{ bits}} = \frac{2^{17}}{x}$ $[16\text{ KB} = 2^4 \times 2^{10} \times 2^3\text{ bit} = 2^{17}\text{ bit}]$

Minimum file size due to triple indirect pointer = 32 GB

$$\Rightarrow \left[\frac{2^{17}}{x}\right]^3 \times 2^{14}\text{ B} = 2^{35}\text{ B}$$

$$\frac{2^{51+14}}{2^{35}} = x^3$$

$$2^{30} = x^3$$

$$x = 2^{10} = 1024\text{ bit}$$

QUESTION ANALYTICS +

Q. 14 FAQ | Solution Video | Have any Doubt ?

Consider three process P_1, P_2 and P_3 with arrival time (0, 1, 3) and burst time (6, 5, 4) respectively, (Assume time slice of 2 units). Which of the following are correct when

Round Robin (RR) scheduling is used?

A The order of completion in RR schedule is P_1, P_2, P_3.

B The order of completion in RR schedule is P_1, P_3, P_2. Correct Option

C Completion time of P_3 is 14. Correct Option

D Completion time of P_2 is 15. Correct Option

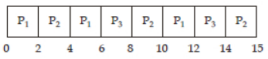
YOUR ANSWER - NA | CORRECT ANSWER - b,c,d | STATUS - SKIPPED

Solution :

(b, c, d)

Process	AT	BT
P_1	0	6
P_2	1	5
P_3	3	4

Gantt Chart:



Hence, order of completion:

$\Rightarrow P_1, P_3, P_2$

QUESTION ANALYTICS +

Q. 15 Solution Video | Have any Doubt ?

Consider a main memory with 4 page frames and the following sequence of page reference:
9, 1, 4, 2, 1, 0, 5, 8, 2, 4, 5, 8, 3, 5
Assume CPU uses Least Recently Used (LRU) page replacement algorithm. Which of the following are correct?

A Total 10 page faults after servicing all page reference. Correct Option

B Total 12 page faults after servicing all page reference.

C Pages 2 and 8 are in main memory after executing all page references.

D Page 4 and 8 are in main memory after executing all page references. Correct Option

YOUR ANSWER - NA | CORRECT ANSWER - a,d | STATUS - SKIPPED

Solution :

(a, d)

References : 9, 1, 4, 2, 1, 0, 5, 8, 2, 4, 5, 8, 3, 5

Total page = faults = 10

QUESTION ANALYTICS +

Q. 16 FAQ | Solution Video | Have any Doubt ?

Consider the following set of processes that need to be scheduled on a single CPU. Operating system uses pre-emptive shortest remaining time first algorithm. Assume ties are broken on basis of the lowest process id (Assume all times in ms)

Process	Arrival Time	Burst Time
P_0	5	3
P_1	3	4
P_2	2	2
P_3	8	4

Which of the following are correct?

A The average waiting time of all the process is 2 ms.

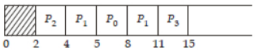
B The average waiting time of all the process is 1.75 ms. Correct Option

C The throughput of the processes are 0.26.

D The throughput of the processes are 0.30. Correct Option

YOUR ANSWER - NA | CORRECT ANSWER - b,d | STATUS - SKIPPED

Solution :
(b, d)



$$\text{Waiting Time} = \frac{\text{Turn around time} - \text{Execution time}}{\text{Total number of processes}}$$

$$= \frac{1+3+0+3}{4} = 1.75 \text{ ms}$$

$$\text{Throughput} = \frac{4}{13} = 0.30$$

QUESTION ANALYTICS +

Q. 17 FAQ | Solution Video | Have any Doubt ?

Consider the following solution of critical section problem for two process:

```
        Boolean Val [2] = {False, False};
            int turn = 0;
Void Pi ( )
{
    while (1)
    { Val [i] = TRUE;
    turn = J;
    while (Val[J] && turn == J);
        Critical Section
        Val [i] = FALSE;
        Remainder section
    }
}
```

Here Val and turn are shared variable between two process P_0 and P_1. P_0 = 0 or 1 and P_1 = 0 or 1.
Which of the following is true about the above solution?

A Mutual exclusion satisfied but not prevent deadlock.

B Both mutual exclusion and deadlock freedom satisfied. Correct Option

Solution :
(b)
P0 : Val [0] = TRUE
turn = 1
P1 : Val [1] = TRUE
turn = 0
Now P0 enter into critical section. Only one process can enter into critical section and there is no deadlock.

C Mutual exclusion not satisfied.

D Mutual exclusion not satisfied but progress is satisfied.

QUESTION ANALYTICS +

Q. 18 FAQ | Solution Video | Have any Doubt ?

Consider the following code:

```
Px :
while (TRUE)
{
    while (TRUE)
{
    while (x! = i);
        Critical Section
    x = J;
        Remainder Section
}
```

If P_x executes the above code where x is the current process and J is another process. Which of the following is correct? (x is shared variable initialized to i)

A Mutual Exclusion Satisfied Correct Option

Solution :
(a)
- If process P_i want re-enter and execute then P_i will not able to execute if another process P_j does not want to execute critical section. So, progress is not satisfied.
- Mutual exclusion is satisfied.

B Progress Satisfied

C Both (a) and (b)

D None of these

QUESTION ANALYTICS +

Q. 19 FAQ | Solution Video | Have any Doubt ?

Consider the following snapshot of the processes in the system:

Process	Allocated			Remaining Need		
	R_1	R_2	R_3			
P_1	3	1	2	1	0	1
P_2	2	1	1	0	2	3
P_3	2	0	0	0	3	2

Assume (R_1, R_2, R_3) has (7, 4, 7) resource available before the allocation. Which of the option are correct?

A System is in unsafe state.

B System is in safe state and P_3 executed first.

C System is in safe state and P_2 executed last.

D None of these — Correct Option

Solution :
(d)

	R_1	R_2	R_3
Total →	7	4	7
Allocated →	7	2	3
Available →	0	2	4

With the available resources P_2 can be satisfied. Now (2, 3, 5) is available and P_1 and P_3 can be executed in any order. Hence, none of the option matches.

QUESTION ANALYTICS +

Q. 20 FAQ | Solution Video | Have any Doubt ?

Consider the following code:

```
Program concurrency;
    int a = 0;                  /*int a initialized to 0*/
    int b = 0;                  /*int b initialized to 0*/
begin ( )                       /*main program*/
        parbegin
            thread P( );
            thread Q( );
        parend
    end;
    procedure thread P( );
        begin
            a = 2;              /*statement 1*/
            b = b + a;          /*statement 2*/
            end;
    procedure thread Q( );
        begin
            b = 4;              /*statement 3*/
            a = a + 6;          /*statement 4*/
        end;
```

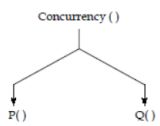
Suppose a process has 2 concurrent threads; one thread executes statement 1 and 2 and other thread executes statement 3 and 4. What are the possible values of variable '*a*' and '*b*' when the code finishes execution? (Assume all the statements are atomic no preemption is allowed when the statement is currently in execution)

A $a = \{2, 4, 8\}$
$b = \{4, 6, 12, 14\}$

B $a = \{2, 6, 8\}$
$b = \{4, 6, 12\}$

C $a = \{2, 8\}$
$b = \{4, 6, 12\}$ — Correct Option

Solution :
(c)



Sequences possible are for statements are:
1. 1 2 3 4 : Possible values for a and b are 8 and 4
2. 1 3 2 4 : Possible values for a and b are 8 and 6
3. 1 3 4 2 : Possible values for a and b are 8 and 12
4. 3 4 1 2 : Possible values for a and b are 2 and 6
5. 3 1 2 4 : Possible values for a and b are 8 and 6
6. 3 1 4 2 : Possible values for a and b are 8 and 12

Here possible values are:

a = {2, 8}
and b = {4, 6, 12}

D $a = \{2, 8\}$
$b = \{4, 12\}$

QUESTION ANALYTICS +

Kunal Jha
Course: GATE
Computer Science Engineering(CS)

OPERATING SYSTEM (GATE - 2021) - REPORTS

OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(33) | CORRECT(0) | INCORRECT(0) | SKIPPED(33)

Q. 21 FAQ | Solution Video | Have any Doubt ?

Consider the following problems:
P_1 : Starvation P_2 : Deadlock
P_3 : Inconsistent data P_4 : Priority inversion
Which of the above problem may occur due to the use of locking resources?

A P_1, P_2 and P_3 only

B P_1 and P_2 only

C P_2 and P_3 only

D All the given problems — Correct Option

Solution :
(d)
Locking of resource can create:
1. **Starvation:** P_1 wants resource R_1, which is locked by process P_2, when process P_2 completes another process P_3 locks resource R_1 before process P_1, it will happen for indefinite time, so process P_1 is in starvation.
2. **Inconsistent data:** This problem occur when one process fail in between and another dependent process read updated value of failed process.
3. **Deadlock:** When two process both want two resources to complete but currently lock one-one resources. This will create deadlock since both are waiting for resource to be free.

QUESTION ANALYTICS +

Q. 22 FAQ | Solution Video | Have any Doubt ?

Consider the following segment:

```
int count = 0;
void tally( )
{
    for (int i = 1; i <=5; i++)
        count = count + 1;
}
main( )
{
    parbegin
        tally( );
        tally( );
        tally( );
    parend
}
```

Note : Assume the count = count + 1; will execute in '3' different instructions.
I. Load R_i, m[count]
II. INC R_i
III. Store m[count], R_i
where *m*[count] refers to memory value of count variable.
Preemption can occur while executing the above instructions. Each of the tally function has a separate register *R* allocated to it in which the value of count is stored. After completion of main function, what will be the minimum and maximum values of count in the end of the program?

A min = 5, max = 15

B min = 2, max = 15 — Correct Option

Solution :
(b)
- To get the minimum value of count.

Tally1( )	Tally2( )	Tally3( )
Iteration 1. I : count = 0, R_1 = 0 II : count = 0, R_1 = 0		
	Iteration 1. count = 1, R_2 = 1 2. count = 2, R_2 = 2 3. count = 3, R_2 = 3 4. count = 4, R_2 = 4 5. count = 5, R_2 = 5	
		Iteration 1. count = 6, R_3 = 6 2. count = 7, R_3 = 7 3. count = 8, R_3 = 8 4. count = 9, R_3 = 9
Iteration 1. III : count = 0, R_1 = 1		
		Iteration 5. I : count = 1, R_3 = 1 II : count = 1, R_3 = 2
Iteration 2. count = 2, R_1 = 2 3. count = 3, R_1 = 3 4. count = 4, R_1 = 4 5. count = 5, R_1 = 5		
		Iteration 5. III. count = 2, R_3 = 2

- To get the maximum value, execute P_1, P_2 and P_3 completely in sequence.
  $\therefore$ Count = 15.

C min = 15, max = 15

D min = 3, max = 15

QUESTION ANALYTICS +

Q. 23 ? FAQ ▶ Solution Video Have any Doubt ?

A system has 64 KB memory and buddy system is used to allocate the memory for process during time. Consider the following situation:

- Process P_0 of size 21 KB loaded.
- Process P_1 of size 18 KB loaded.
- Process P_1 is terminated and removed from memory.
- Process P_2 of size 7 KB loaded.
- Process P_3 of size 14 KB loaded.
- Process P_4 of size 6 KB loaded.

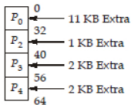
The space wasted due to internal fragmentation is

A 16KB Correct Option

Solution :
(a)
Buddy system allocate the space for every process only in power of 2.

- P_0 and P_1 loaded.

- P_1 terminated and P_2, P_3 and P_4 loaded.



Total = 16 KB extra
Space = Internal Fragmentation

B 21 KB

C 19 KB

D 13 KB

QUESTION ANALYTICS +

Q. 24 ? FAQ ▶ Solution Video Have any Doubt ?

Consider the following code, comprising of a swap function which is atomic.

```
    void swap (bool *a, bool *b)
{
    Bool temp;
    temp = *a;
    *a = *b;
    *b = temp;
}
Bool lock = False;
void process (int i)
{
    Bool key;
    while(1)
    {
        //non-critical section
        Key = True;
        while (key == True) swap (&lock, &key);
        //critical-section
        Lock = False;
    }
}
```

Which of the following statement is best possible?

A Mutual exclusion Correct Option

Solution :
(a)
The code solves mutual exclusion and also satisfied progress but not the bounded wait.

B No progress

C Bounded wait

D The code solves the synchronization problem

QUESTION ANALYTICS +

Q. 25 ? FAQ ▶ Solution Video Have any Doubt ?

Consider a paging scheme, in which average process size is 16 MB and each page table entry size is 16 B. The optimal size of page to minimize the total overhead due to page table and internal fragmentation is _____ KB. (Upto 1 decimal place)

22.6 (22.6 - 22.7) Correct Option

Solution :
22.6 (22.6 - 22.7)

Assume page size = x bytes

Process overhead = Page table overhead + Overhead due to internal fragmentation

Now, Page table overhead = Number of pages per process × Page table entry size

$$= \left(\frac{\text{Process Size}}{\text{Page Size}}\right) \times 16\text{B} = \left(\frac{16\text{ MB}}{x\text{ B}}\right) \times 16\text{B}$$

Average overhead due to internal fragmentation

$$= \frac{0+x}{2} = \frac{x}{2}$$

So, total overhead of paging

$$= \frac{256\text{ MB}}{x} + \frac{x}{2}$$

For minimizing overhead, differentiation with respect to 'x', then

$$\frac{-256\text{ MB}}{x^2} + \frac{1}{2} = 0$$

$$x^2 = 2 \times 256\text{ MB}$$

$$x = \sqrt{512\text{ MB}}$$

$$x = 22.6\text{ KB}$$

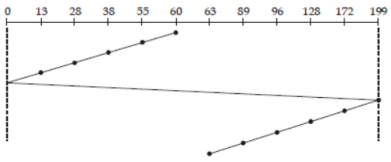
QUESTION ANALYTICS +

Q. 26 ? FAQ ▶ Solution Video Have any Doubt ?

Consider the following track requests in the disk queue:
38, 55, 96, 13, 28, 128, 89, 63, 172
The C-SCAN scheduling algorithm is used and R/W head is positioned at location 60. If tracks are numbered from 0 to 199. Head is moving toward lower track number on its servicing pass. The time to move from one track to next track is 3 ns. The total seek time required for servicing these request is _____ µs. (Assume moving from one end to another end takes 15 ns). (Upto 2 decimal places).

0.60 (0.60 - 0.61) Correct Option

Solution :
0.60 (0.60 - 0.61)



Total head movement = (60 – 0) + (199 – 63)

$\Rightarrow$ 60 + 136 = 196

Total seek time = 196 × 3 + 15 = 588 + 15 = 603 ns = 0.60 µs

QUESTION ANALYTICS +

Q. 27 ? FAQ ▶ Solution Video Have any Doubt ?

In a demand paging system with a paging disk that has an average access and transfer time of 45 milliseconds. Address are mapped through a page table in main memory, with an access time of 75 µs per memory access. An associative memory (TLB) is added to reduce the access time if the page table is in the associative memory. TLB and page table access time is almost negligible. Assume that 65% of the access in the association memory and 30% of remaining causes page fault.
The effective memory access time is _____ ms. (Upto 2 decimal place).

4.79 (4.78 – 4.80) Correct Option

Solution :
4.79 (4.78 – 4.80)

E.M.A.T. = TLB_{hit} × (Memory Access Time) + TLB_{miss} × (Page fault rate × Page service time + (1 – Page fault rate) × Memory Access Time)

= 0.65 × 75 µs + 0.35 × (0.3 × 45000 + 0.7 × 75)

= 4.79 ms

QUESTION ANALYTICS +

Q. 28 ? FAQ ▶ Solution Video Have any Doubt ?

Consider the following 3 programs Program 1, Program 2, Program 3 with execution time of process-a, process-b, process-c being 2 ms, 3 ms and 4 ms respectively.

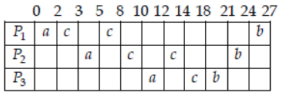
Program 1	Program 2	Program 3
begin	begin	begin
process-a	process-a	process-a
Lock(x)	Lock(x)	Lock(y)
process-c	process-c	Lock(x)
Unlock(x)	Unlock(y)	process-c
process-b	Unlock(x)	Unlock(x)
end	process-b	Unlock(y)
	end	process-b
		end

Program	Arrival Time	Priority
1	0	1 (lowest)
2	3	5
3	10	10 (highest)

Assume x and y are locks initially in Free state i.e., set to 0 and Lock (x) make x = 1, i.e., Busy state and Unlock (x) make x = 0, i.e., Free state and preemptive priority scheduling is used. Then the average turnaround time of Program 1, 2 and 3 is _____. (Upto 2 decimal places).

19.66 (19.65 – 19.67) Correct Option

Solution :
19.66 (19.65 – 19.67)



$$\text{Average Turn Around Time} = \frac{(27-0)+(24-3)+(21-10)}{3} = 19.66$$

QUESTION ANALYTICS +

Q. 29 FAQ Solution Video Have any Doubt ?

A computer system has 24 bit virtual and 30 bit physical address and 16 KB page size. Assume that the table is entirely in hardware with 24-bit word per entry. Open a process starts, the page table is copied to the hardware from memory at 1 word in 50 µs. If each process runs for 400 msec which include the time to load the page table as well. The percentage of CPU time is devoted to loading the page table is _____. (Upto 2 decimal places).

12.80 (12.79 – 12.81) Correct Option

Solution :
87.2 (87.10 – 87.30)

$$\text{Number of entries in the page table is } \frac{2^{24}}{2^{14}} = 1024.$$

- 50 µs is required to load one word to MM then for 1024 word.

$$1024 \times 50 \times 10^{-6} = 51.2 \text{ m/s}$$

• If a process gets 400 ms, this includes 51.2 ms
• CPU devoted time for page table loading is
(51.2/400)*100=12.80

QUESTION ANALYTICS +

Q. 30 Solution Video Have any Doubt ?

A computer system with 40 bit virtual addressing and 45 bit physical addressing. The page size is 4 KB and each page table entry contain 1 valid bit, 3 protection bit and 3 reference bit. The approximate size of page table if system uses single level paging is _____ MB.

1280 Correct Option

Solution :
1280

$$\text{Page table size} = \text{Number of page} \times \text{Page table entry size}$$

$$\text{Number of frames} = \frac{2^{45}}{2^{12}} = 2^{33}$$

$$\text{Page table entry size} = 33 + 1 + 3 + 3 = 40 \text{ bit}$$

$$\text{Page table size} = \frac{2^{40}}{2^{12}} \times 5 \text{ B}$$

$$= 2^{28} \times 5 \text{ B} = 2^{8} \times 5 \text{ MB} = 1280 \text{ MB}$$

QUESTION ANALYTICS +

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ALL(33) | CORRECT(0) | INCORRECT(0) | SKIPPED(33)

Q. 31

? FAQ | Solution Video | Have any Doubt ?

Consider the table given below for four process P_0, P_1, P_2 and P_3. Each process has CPU boost followed by an I/O burst followed by another CPU burst as shown in table from left to right respectively.

Process	Arrival Time (A.T.)	Priority	Burst Time		
			CPU	I/O	CPU
P_0	1	0 (highest)	3	8	2
P_1	3	3 (lowest)	4	6	4
P_2	5	1	1	3	3
P_3	3	2	5	2	7

Assume preemptive priority scheduling is used. Which of the following are correct?

A. The CPU idle time is 19.44% and P_1 finishes last. — Correct Option

B. The CPU idle time is 21.4% and P_3 finishes last.

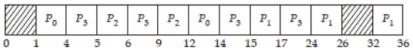
C. The throughput of the algorithm is 0.11 — Correct Option

D. The throughput of the algorithm is 0.11 and process P_3 finishes last.

YOUR ANSWER - NA | CORRECT ANSWER - a,c | STATUS - SKIPPED

Solution :

(a, c)



$$\text{CPU idle time} = \frac{7}{36} \times 100 = 19.44\%$$

$$A + B = 33.44$$

$$\text{Throughput} = \frac{4}{35} = 0.11$$

QUESTION ANALYTICS +

Q. 32

? FAQ | Solution Video | Have any Doubt ?

Which of the following are incorrect?

A. Pages that are shared between two or more processes can never be swapped out to the disk. — Correct Option

B. Demand paging requires the programmer to instruct the operating system to load a particular virtual memory page. — Correct Option

C. The translation look aside buffer is a software data structure that supports the virtual memory address translation operation. — Correct Option

D. None of these

YOUR ANSWER - NA | CORRECT ANSWER - a,b,c | STATUS - SKIPPED

Solution :

(a, b, c)

- Pages that are shared between two or more processes can be swapped out to disk when demand paging is applied and we have to swap in new pages and main memory is full.
- The operating system automatically loads pages from disk when necessary when it is needed.
- The translation look aside buffer is a hardware data structure.

QUESTION ANALYTICS +

Q. 33

? FAQ | Solution Video | Have any Doubt ?

Which of the following are correct?

A. A solution to the Dining Philosophers problem which avoids deadlock is to ensure that one particular philosopher picks up the left fork before the right fork and that all other philosophers pick up the right fork before the left fork. — Correct Option

B. If each resource type has exactly one instance and if resources allocation graph contain a cycle then the system may or may not be in deadlock.

C Race condition occurs when the result of a computation depends on the order of the processes executed. Correct Option

D For a system to be in deadlock. Only mutual exclusion hold and wait, no-preemption condition must be satisfied.

YOUR ANSWER - NA | CORRECT ANSWER - a,c | STATUS - SKIPPED

Solution :

(a, c)
- Option (a) and (c) are correct.
- Option (b) is incorrect, if each resource type has single instance then cycle in resource allocation graph implies deadlock.
- Option (d) is incorrect, for a system to be in deadlock mutual exclusion, hold and wail, nopreemption and circular wait must be satisfies.

QUESTION ANALYTICS +

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OPERATING SYSTEM-2: (GATE - 2021) - REPORTS

OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(17) | CORRECT(0) | INCORRECT(0) | SKIPPED(17)

Q. 1 FAQ | Solution Video | Have any Doubt ?

Consider the following program:

```
int main( )
{
    for (i = 1; i < n; i ++)
    { if (fork( ) = = 0)
    printf("OS");
    }
    printf("GATE");
}
```

Number of times OS and GATE printed respectively are:

A 2^n and 2^n

B 2^{n-1} and 2^{n-1}

C $2^{n-1}-1$ and 2^{n-1} — Correct Option

Solution :
(c)
OS Printed $\rightarrow 2^{n-1}-1$
Gate Printed $\rightarrow 2^{n-1}$

D 2^n and 2^{n-1}

QUESTION ANALYTICS +

Q. 2 FAQ | Solution Video | Have any Doubt ?

Which of the below statement is false:

A Kernel stack can be used to store the context of a process.

B User stack is used to store the function details during function calls.

C Kernel stack is used to store the user program functional arguments. — Correct Option

Solution :
(c)
All the options are correct except option (c).

D Context of the process is useful to restart the process after some time.

QUESTION ANALYTICS +

Q. 3 FAQ | Solution Video | Have any Doubt ?

Consider a program, which spawn 20 threads to find out the sum of elements in a shared array of 200. Each thread i, takes elements $A[i]$ to $A[(20 * i) - 1]$ and compute local sum loc-sum[i] and eventually adds loc_sum[i] to a shared variable tot_sum for total sum which of the following needs to be placed inside a critical section?

A Reading array valves

B Add to tot_sum — Correct Option

Solution :
(b)
Only tot_sum need to be access exclusively as it shares the same variable.

C Both (a) and (b)

D None of these

QUESTION ANALYTICS +

Q. 4

Consider a system having n CPU's, K processes and K > *n*. Calculate the upper bound and lower bound for the number of processes in the RUNNING, READY and BLOCKED states respectively in lower and upper bound is

A Upper bound is K, K, K and lower bound is 1, 1, 1

B Upper bound is *n*, K, K and lower bound is 0, 0, 0. Correct Option

Solution :
(b)
Upper bound is RUNNING, READY and BLOCKED states respectively are *n*, K, K and similarly in lower bound are 0, 0, 0.

C Upper bound is K, K, *n* and lower bound is 0, 0, 0.

D Upper bound is K, *n*, K and lower bound is 1, 1, 0.

QUESTION ANALYTICS +

Q. 5 FAQ Solution Video Have any Doubt ?

Suppose we want to synchronize two concurrent process *P* and *Q* using binary semaphores *S* and *T*.

```
Process P:                Process Q:
While(1) {                While(1) {
    W:                        Y:
        Print '5';                Print '6';
        Print '5';                Print '6';
    X:                        Z:
}                         }
```

Synchronization statements can be inserted only at point W, X, Y, Z respectively. Which of the following can lead to an output starting with '66556655'?

A P(S), V(T), P(T), V(S) and initially S = 0 and T = 1 Correct Option

Solution :
(a)

```
Process P:                Process Q:
    W: P(S)                   Y: P(T)
        Print '5';                Print '6';
        Print '5';                Print '6';
    X : V(T)                  Z : V(S)
```

If initially S = 0 and T = 1, then we will get the designed result as output. Because initially process Q would be executed then process P.
Hence option (a) is correct.

B P(S), V(S), P(T), V(T) and initially S = 0 = T = 1

C P(S), V(S), P(T), V(T) and initially S = 1 and T = 0

D P(S), V(T), P(T), V(S) and initially S = 1 and T = 0

QUESTION ANALYTICS +

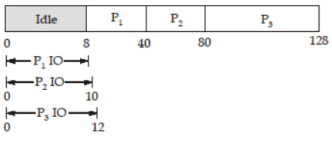
Q. 6 FAQ Solution Video Have any Doubt ?

Consider 3 processes that start simultaneously. Each process from start to finish takes 40, 50 and 60 ms respectively of this 20% of the time is spent waiting for i o events and then next 80% time for computation.
The scheduler uses FCFs scheduling. Assuming that all I/O operations are overlapped. The minimum time in milli-seconds for which the CPU idle is _____.

8 Correct Option

Solution :
8

Process	Burst time	I/O time
P_1	32	8
P_2	40	10
P_3	48	12



QUESTION ANALYTICS +

Q. 7 FAQ Solution Video Have any Doubt ?

Consider the following statements:
I. User threads can switch fast since it does not involve Kernel.
II. User threads are light weight since they do not requires system calls.
III. Kernel is not aware of the behaviour of every user threads i.e. if it is blocking or runnable.
The number of false statements is/are _____.

0 — Correct Option

Solution :
0
All the three statements I, II and III are correct.

QUESTION ANALYTICS +

Q. 8 — FAQ | Solution Video | Have any Doubt ?

Which of the following should be allowed only in Kernel mode?

A. Changing mapping from virtual to physical address — Correct Option
B. Disabling all the interrupts — Correct Option
C. Reading time of the clock
D. Mask and Unmask interrupts — Correct Option

YOUR ANSWER - NA | CORRECT ANSWER - a,b,d | STATUS - SKIPPED

Solution :
(a, b, d)
(a) **Change mapping from virtual to physical address:** It will be done in Kernel mode only because mapping is done with the help of page table, which are managed by OS.
(b) **Disabling all the interrupts:** It required to be operated/handled in Kernel mode since it will effect the functioning of I/O devices.
(c) **Reading time of clock:** No need to handle request in Kernel mode.
(d) **Mask and Unmask interrupt:** It will effect the functioning of Input/Output devices. Hence required to be operated in Kernel mode.

QUESTION ANALYTICS +

Q. 9 — FAQ | Solution Video | Have any Doubt ?

Which of the following suffers from starvation?

A. Longest Job First — Correct Option
B. Pre-emptive Priority — Correct Option
C. Round Robin
D. Multi-level Feedback Queue Scheduling with Aging

YOUR ANSWER - NA | CORRECT ANSWER - a,b | STATUS - SKIPPED

Solution :
(a, b,)

QUESTION ANALYTICS +

Q. 10 — FAQ | Solution Video | Have any Doubt ?

Consider the following code comprising of a swap function which is atomic.

```
void swap (bool * a, bool * b)
{
bool temp;
temp = *a;
*a = *b;
*b = temp;
}
bool Lock = false;
void process (int i)
{
bool Key;
while(1)
{
// Non-critical sectiono
Key = True;
While (Key = = True)
Swap (&Lock, & Key);
// Critical-section
Lock = false;
}
```

}
Which of the following is correct regarding above code?

A The code provides mutual exclusion but not progress.

B The code provides progress but not mutual exclusion

C The code provides bounded waiting but not mutual exclusion.

D The code provides mutual exclusion but not bounded waiting. Correct Option

Solution :
(d)
The above codes provides mutual exclusion, progress but not bounded waiting. Let's see how.
• No two process can be in the critical section at any point of time. Hence it provides mutual exclusion.
• The same process can again enter in the critical section after just exciting from critical section. Hence it provides progress.
• Assume process P_1 is in critical section and P_2 is waiting to enter in the critical section. Once P_1 is finished in critical section and suddenly a new process P_3 executed "Swap (&Lock, &Key)"; first than P_2 and gets into critical section. Hence it violates bounded waiting property. So, code does not provide bounded waiting.

QUESTION ANALYTICS +

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OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(17) | CORRECT(0) | INCORRECT(0) | SKIPPED(17)

Q. 11 FAQ | Solution Video | Have any Doubt ?

Consider 2 process A( ) and B( ) that are concurrent and uses 3 semaphore i.e. mutex, Q and R and all are initialized to 1 and these semaphores are shared between the processes. Q is a semaphore on file 1 and R on file 2.

```
A( )                              B( )
{                                 {
    P(mutex);                         P(Q);
    P(Q);                             *read from file 1*
    *write to file 1*                 P(R);
    P(R);                             *write to file 2*
    *write to file 2*                 V(Q);
    V(Q);                             V(R);
    V(mutex);                         P(mutex);
    P(Q);                             P(Q);
    *read from file 1*                *write to file 1*
    *read from file 2*                V(Q);
    V(R);                             V(mutex);
    V(Q);                         }
}
```

Which of the following is true for above process?

A. No deadlock but starvation occurs.

B. Both deadlock and starvation occurs. — Correct Option

Solution :
(b)

1. A( )
   P(mutex) ⇒ mutex = 0
   P(Q) ⇒ Q = 0
2. B( )
   P(Q) ⇒ Process B( ) goes in sleep mode
3. A( )
   P(R) ⇒ R = 0
   V(Q) ⇒ Q = 1 ⇒ Process B( ) awake
4. B( )
   P(Q) ⇒ Q = 0
   P(R) ⇒ Process B( ) goes in sleep mode
5. A( )
   V(mutex) ⇒ mutex = 1
   P(Q) ⇒ Process A( ) goes in sleep mode

Now both process A( ) and B( ) are in sleep mode and waiting for each another to execute.
Hence deadlock occurs. Since there is deadlock surely there will be starvation.
So, option (b) is correct.

C. Deadlock but no starvation occurs.

D. Neither deadlock nor starvation occurs.

QUESTION ANALYTICS +

Q. 12 FAQ | Solution Video | Have any Doubt ?

Which of the following is correct about monitors?

A. Prevents multiple process from executing monitor code of the same time. — Correct Option

Solution :
(a)

B. Mutual exclusion not guaranteed.

C. Process can access the monitor's data from procedures declared outside the monitor.

D. None of these

QUESTION ANALYTICS +

Q. 13 FAQ | Solution Video | Have any Doubt ?

Consider the following statements:
S_1: A lock that uses busy waiting will not waste CPU time.
S_2: Inter process communication message passing requires Kernel supports.
S_3: User level threads are not suitable for non blocking tasks.
Which of the above statements are correct?

A Only S_1 and S_2

B Only S_2 — Correct Option

Solution :
(b)

C Only S_1

D All of these

QUESTION ANALYTICS +

Q. 14 ? FAQ | Solution Video | Have any Doubt ?

Consider the following code segment:

```
P1( )                    P2( )
{                        {
    P(S)                     P(S)
    a = a + 15;              a = b + 20
    V(S)                     V(S)
}                        }
```

Assume initial value of a = 0 and b = 20 and semaphore S = 1. P( ) and V( ) are usual semaphore up and down operation a and b are shared variable.
The numbers of distinct values that a can possibly take after concurrently executing the above code segment is_____.

2 — Correct Option

Solution :
2
P_1 executed first then P_2

$a = 0 + 15 = 15$
$a = 20 + 20 = 40$

P_2 executed first then P_1

$a = 20 + 20 = 40$
$a = 40 + 15 = 55$

Total 2 different values that a can have i.e. 40 and 55.

QUESTION ANALYTICS +

Q. 15 ? FAQ | Solution Video | Have any Doubt ?

Consider the following statements:
I. Multiprogramming is used to increase CPU utilization, which time sharing is used to increase CPU responsiveness in interacting with user.
II. With a multi-level feedback queue scheduler, high priority jobs will be placed in the top level queue and low priority jobs will be placed in the bottom level queue.
III. If all the jobs have identical run lengths, a RR scheduler provides better average turnaround time than FCFS.
The number of correct statements is/are:

1 — Correct Option

Solution :
1
statement 1 is correct.

QUESTION ANALYTICS +

Q. 16 ? FAQ | Solution Video | Have any Doubt ?

Consider the following concurrent program:

```
Int x = 0;
Int y = 0;
Parbegin {
    Begin {
        x = 2;
        y = y + x;
        }
    Begin {
        y = 5;
        x = x + 5;
        }
    }
```

What will be the final value of x and y after completion of the above concurrent program?
Which of the following is/are correct value of x and y that can come after the end of the program?

A $x = 2, y = 12$

B $x = 2, y = 7$ — Correct Option

C $x = 7, y = 12$ Correct Option

D $x = 6, y = 7$

YOUR ANSWER - NA | CORRECT ANSWER - b,c | STATUS - SKIPPED

Solution :
(b, c)

QUESTION ANALYTICS +

Q. 17 FAQ | Solution Video | Have any Doubt ?

Test and Set Lock guarantees

A Progress Correct Option

B Bounded waiting

C Mutual exclusion Correct Option

D No deadlock Correct Option

YOUR ANSWER - NA | CORRECT ANSWER - a,c,d | STATUS - SKIPPED

Solution :
(a, c, d)
There is no limit on the number of times a process can enter into critical section after it has made request to enter critical section and before that request is granted. Therefore bounded waiting is not followed in Test and Set Lock.

QUESTION ANALYTICS +