



Ashima Garg

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TOPICWISE : OPERATING SYSTEM-1 (GATE - 2019) - REPORTS

OVERALL ANALYSIS    COMPARISON REPORT    **SOLUTION REPORT**

ALL(17)    CORRECT(8)    INCORRECT(7)    SKIPPED(2)

Q. 1

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

Your answer is **Correct**

**Solution :**  
(a)  
Linked allocation does not support direct access but indexed and contiguous allocation support direct access.

B  
Indexed allocation

C  
Contiguous allocation

D  
Both (a) and (b)

QUESTION ANALYTICS

Q. 2

Which of the following components is responsible for loading the initial value in the program counter for an application program before it start running?  
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A  
Linker

B  
Loader

Your answer is **Correct**

**Solution :**  
(b)  
Loader is responsible for loading initial value in the program counter while groups different modules and resolves external references.

C  
Boot module

D  
Compiler

QUESTION ANALYTICS

Q. 3



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Which of the following is true.

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A  
Only  $S_1$

B  
Only  $S_2$

C  
Both  $S_1$  and  $S_2$

Your answer is **Correct**

**Solution :**  
(c)

- As the size of block in fixed partition scheme increases, chances of internal fragmentation increases. Because with larger block size, if a smaller process arrives; remaining block will be wasted. This is because one block can be allocated to only one process at a time.
- Variable partition scheme suffers from external fragmentation, segmentation is one of the variable partition scheme.

D  
None of the above

QUESTION ANALYTICS

Q. 4

Which of the following is deadlocks prevention scheme?  
 $S_1$  : Whenever a process requests a resource, it does not hold any other resources.  
 $S_2$  : If a process is holding some resources and requests another resource that can not be immediately allocated to it, all resources being hold are preempted.  
 $S_3$  : Each process requests resources either in only increasing order or in only decreasing order of enumeration.

Solution Video

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A  
Only  $S_1$  and  $S_3$

Your answer is **Wrong**

B  
Only  $S_2$  and  $S_3$

C  
Only  $S_2$  and  $S_3$

D  
All  $S_1$ ,  $S_3$  and  $S_3$

Correct Option

**Solution :**  
(d)

- Scheme 1 protocol ensures that hold and wait condition never occurs in the system.
- Scheme 2 ensures that there will be preemption of resources that have already been allocated.
- Scheme 3 ensures the circular wait condition.

QUESTION ANALYTICS

Q. 5

Consider the following statements regarding allocation methods:  
 $S_1$  : Both sequential and direct access can be supported by contiguous allocation.



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A

Only  $S_1$ Your answer is **Wrong**

B

Only  $S_2$ 

Correct Option

Solution :

(b)

- Accessing a file that has been allocated contiguously is easy. For sequential access, the system remembers the disk address of the last block referenced and when necessary, re the next block. For direct access to block  $i$  of a file that starts at block  $b$ , we can immedia access block  $b + i$ .
- This statement is not correct as indexed allocation has one more index block. So inde allocation has greater pointer overhead than linked allocation in many number of cases.

C

Both  $S_1$  and  $S_2$ 

D

Neither of them

QUESTION ANALYTICS

## Q. 6

Consider two processes  $P_1$  and  $P_2$ , each needed 3 resources 1, 2 and 3 in a database. If each processes ask them in any order, then the number of ways possible in which system is guaranteed to be deadlock free

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5

Correct Option

Solution :

5

$$\begin{aligned}\text{Minimum number of resources required} &= (\text{Number of resources required by } P_1 - 1) + (\text{Num} \\ &\quad \text{of resources required by } P_2 - 1) + 1 \\ &= (3 - 1) + (3 - 1) + 1 = 5\end{aligned}$$

Your Answer is 6

QUESTION ANALYTICS

## Q. 7

A computer uses 44 bit virtual address space, 1 GB of physical memory with page size of 16 KB. The page table entry size is 2 bytes and if each page table must fit in a single page then number of level of paging required is \_\_\_\_\_.

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Your answer is **Correct3**

Solution :

3


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$$\begin{aligned}\text{Size of page table at 1}^{\text{st}} \text{ level} &= \frac{2^{44}}{2^{14}} \times 2 \text{ Bytes} \\ &= \frac{2^{45}}{2^{14}} = 2^{31} \text{ Bytes}\end{aligned}$$

$$\begin{aligned}\text{Size of page table at 2}^{\text{nd}} \text{ level} &= \frac{2^{31}}{2^{14}} \times 2 \text{ Bytes} \\ &= \frac{2^{32}}{2^{14}} = 2^{18} \text{ Bytes}\end{aligned}$$

$$\begin{aligned}\text{Size of page table at 3}^{\text{rd}} \text{ level} &= \frac{2^{18}}{2^{14}} \times 2 \text{ Bytes} \\ &= \frac{2^{19}}{2^{14}} = 2^5 \text{ Bytes}\end{aligned}$$

So, 3 levels of paging is required.

QUESTION ANALYTICS

**Q. 8**

Consider a paging scheme, in which average process size is 32 MB and each page table entry size is 4 B. The optimal size of page to minimize the total overhead due to page table and internal fragmentation is \_\_\_\_\_ KB.

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16

 Your answer is **Correct**16

**Solution :**

16

Suppose, page size = P Bytes

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

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

$$= \left( \frac{\text{Process size}}{\text{Page size}} \right) \times 4B = \frac{32MB}{P} \times 4B$$

$$\text{Average overhead due to internal fragmentation} = \frac{0+P}{2} = \frac{P}{2}$$

0 = Minimal internal fragmentation

P = Maximum internal fragmentation

$$\text{Overhead is paging} = \frac{32M \times 4}{P} + \frac{P}{2}$$

To minimize overhead i.e. take differentiation with respect to 'P'.

$$\frac{-128M}{P^2} + \frac{1}{2} = 0$$

$$P^2 = 2 \times 128 MB$$

$$P = \sqrt{256 MB}$$

$$P = 16 KB$$

QUESTION ANALYTICS

**Q. 9**

Consider a system with following snapshot of allocation and remaining need of each process. Here allocation shows the current number of resources of each type allocated to each process and remaining need shows number of resources remains required to complete execution process.

Process	Allocation			Remaining need		
	A	B	C	A	B	C
$P_1$	2	3	0	1	1	0
$P_n$	3	1	2	0	1	0



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possible in system with 4 processes will be \_\_\_\_\_.

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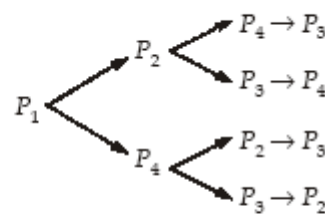
8

Correct Option

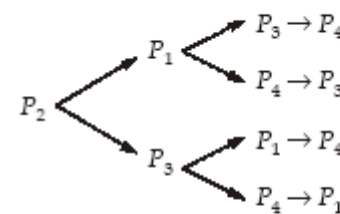
Solution :

8

With available resource (1, 1, 1):



Number of ways = 4



Number of ways = 4

Total number of ways = 4 + 4 = 8

Your Answer is 12

QUESTION ANALYTICS

### Q. 10

Consider five memory partitions of size 100 KB, 500 KB, 200 KB, 450 KB and 600 KB in same order. If sequence of requests for blocks of size 212 KB, 417 KB, 112 KB, 426 KB and 280 KB in same order come and partitioning can be done in block, then which of the following algorithm satisfy all the block requests?

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A

Best fit algorithm

B

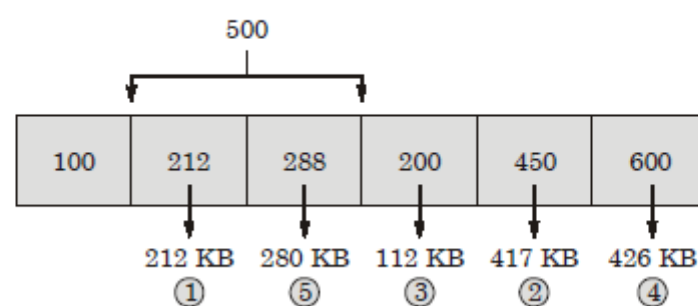
First fit algorithm

Correct Option

Solution :

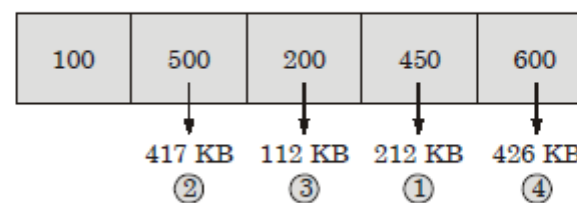
(b)

1. Using First Fit:



All request will be fit in memory.

2. Using Best Fit:



Request 280 KB will not fit in memory.

C

Both next fit and best fit results in same

Your answer is Wrong

D

None of the above



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**Q. 11**

Consider a unix inode which maintains 5 direct disk blocks, 1 single indirect, 1 double indirect and 1 triple indirect DBA. Disk block size is 4 KB and disk block address is 32 bits. Which of the following is maximum possible file size?

[Have any Doubt ?](#)

 A  
 4 TB

Correct Option

**Solution :**

(a)

Only triple indirect blocks are responsible for maximum file size.

$$\begin{aligned}
 \text{Max size} &= \left( \frac{\text{DB size}}{\text{DBA}} \right)^3 \times \text{DB size} \\
 &= \left[ \frac{4 \text{ KB}}{4 \text{ B}} \right]^3 \times 4 \text{ KB} = \left[ \frac{2^{12} \text{ B}}{4 \text{ B}} \right]^3 \times 4 \text{ KB} \\
 &= [2^{10}]^3 \times 4 \text{ KB} = 2^{30} \times 2^{10} \times 4 \text{ B} \\
 &= 4 \times 2^{40} \text{ B} \\
 &= 4 \text{ TB}
 \end{aligned}$$

 B  
 256 GB

 C  
 512 GB

 D  
 2 TB

[QUESTION ANALYTICS](#)
**Q. 12**

An operating system implements a policy in which resources are numbered uniquely and processes are allowed to request for resources only in increasing resource number. Which of the following is true?

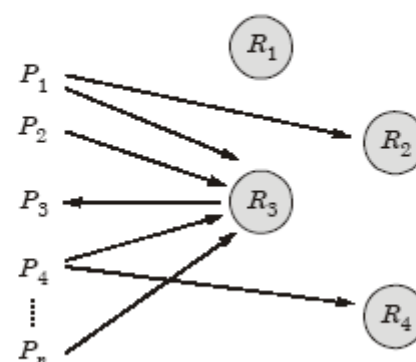
[Solution Video](#) | [Have any Doubt ?](#)

 A  
 Starvation may occur but not deadlock.

 Your answer is **Correct**
**Solution :**

(a)

- Given policy is one of the deadlock prevention policy so, deadlock not possible since cannot be possible.
- Starvation is possible, consider the following case:











Since every process request for resource  $R_4$ , it might be the case process 1 get starve.

 B  
 Deadlock may occur but not starvation.





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D  
Neither starvation nor deadlock is possible.

QUESTION ANALYTICS

Q. 13

A CPU generates 48 bit virtual addresses. The page size is 8 KB. The processor has a translation look aside buffer (TLB) which can hold a total 256 page table entries and 4-way associative. What is the minimum size of TLB tag (in bits)?

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A  
29

Your answer is **Correct**

**Solution :**  
(a)  
$$\begin{aligned} \text{Size of virtual addresses} &= 48 \text{ bits} \\ \text{Page size} &= 8 \text{ KB} \\ \text{Page offset} &= 2^{13} = 13 \text{ bits} \\ \text{Number of bits used for indexing} &= 48 - 13 = 35 \text{ bits} \\ \text{Number of set} &= \frac{256}{4} = \frac{2^8}{2^2} = 2^6 = 64 \text{ require 6 bits} \\ \text{Total tag bits} &= 35 - 6 = 29 \text{ bits.} \end{aligned}$$

B  
35

C  
6

D  
None of these

QUESTION ANALYTICS

Q. 14

Consider there are 16 virtual pages and 4 page frames which are initial empty. If the page reference string is:  
1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6

Which of the following is correct about page fault?

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A  
LRU = Optimal < FIFO

B  
Optimal < FIFO < LRU

C  
Optimal < LRU = FIFO

D  
Optimal < LRU < FIFO

Your answer is **Correct**

**Solution :**  
(d)



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		3	3	3	3	3	3	2	2	2	2	2	6	6	6	6	6	6	6
	2	2	2	2	2	2	2	6	6	6	6	6	7	7	7	7	7	7	3
1	1	1	1	1	1	1	5	5	5	5	5	3	3	3	3	3	1	1	1
F	F	F	F				F	F	F	F		F	F	F		F	F		F

FIFO has 14 page faults.

Using Optimal:

1	2	3	4	2	1	5	6	2	1	2	3	7	6	3	2	1	2	3	6
			4	4	4	5	6	6	6	6	6	6	6	6	6	6	6	6	6
		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	7	7	7	7	1	1	1	1
F	F	F	F				F	F				F				F			

Optimal has 8 page faults.

Using LRU:

1	2	3	4	2	1	5	6	2	1	2	3	7	6	3	2	1	2	3	6
			4	4	4	4	6	6	6	6	6	7	7	7	7	1	1	1	1
		3	3	3	3	5	5	5	5	5	3	3	3	3	3	3	3	3	3
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	6	6	6	6	6	6	6
F	F	F	F				F	F				F	F	F		F			

LRU has 10 page faults

So, Optimal(8) &lt; LRU(10) &lt; FIFO (14).

QUESTION ANALYTICS

## Q. 15

Consider the following track requests in the disk queue:

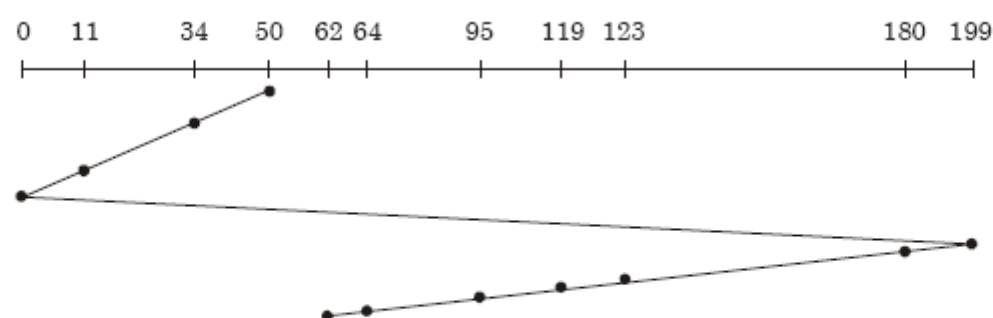
95, 180, 34, 119, 11, 123, 62, 64

The C-scan scheduling algorithm is used and the read/write head is positioned at location 50. If tracks are numbered from 0 to 199 and head moving toward smaller track number on its servicing pass, then total seek time needed with 2 msec time to move from one track to another while servicing these requests is \_\_\_\_\_ msec. [Assume moving from one end to another end will take 10 msec]

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384

Correct Option

 Solution :  
 384


$$\begin{aligned}
 \text{Total head movement} &= 50 \times 2 + 137 \times 2 + 10 \\
 &= 100 + 274 + 10 \\
 &= 384 \text{ msec}
 \end{aligned}$$

Your Answer is 110





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Consider a machine with byte addressable memory 32 bits virtual addresses, 32 bits physical addresses and 4 KB page size page table is divided into 1 K pages, each page has 1 K size. If a twolevel page table system is used where each page table occupies one page and page table entries of 4 B each, then the memory overhead for storing top level page table and along with page of second leve page table is \_\_\_\_\_ KB.

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8

Correct Option

Solution :

$$2^{10} \times 4B + 2^{10} \times 4B$$
$$4\text{ KB} + 4\text{ KB} = 8\text{ KB}$$

QUESTION ANALYTICS

Q. 17

Consider a demand paged memory system, page table is held in registers. It takes 800 nsec to service a page fault if empty page is available or replaced page is not modified and 950 nsec if the replaced page is modified, main memory access time is 120 nsec. If page to be replaced is modified 85% of time and page fault rate is 20% then average memory access time is \_\_\_\_\_. (Upto 1 decimal place)

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281.5(281.1 - 281.9)

Correct Option

Solution :

281.5(281.1 - 281.9)

Effective Memory Access Time = (1 - P) × Memory Access Time + P(Non modified% × Page  
service time + Modified% × Page fault service time with page modified)

$$= 0.80 \times 120\text{ nsec} + 0.20 (0.15 \times 800\text{ nsec} + 0.85 \times 950\text{ nsec})$$
$$= 96\text{ nsec} + 0.20 (120\text{ nsec} + 807.5)$$
$$= 96\text{ nsec} + 185.5\text{ nsec}$$
$$= 281.5\text{ nsec}$$

Your Answer is 305.5

QUESTION ANALYTICS