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Computer Science Engineering(CS)

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

OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(17) | CORRECT(6) | INCORRECT(4) | SKIPPED(7)

Q. 1

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

Solution Video | Have any Doubt ?

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?

Solution Video | Have any Doubt ?

A Linker

B Loader — Correct Option

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

C Boot module — Your answer is **Wrong**

D Compiler

QUESTION ANALYTICS +

Q. 3

Consider the following statements:
S_1 : Using larger block size is fixed partition scheme may increase internal fragmentation.
S_2 : Variable partition and segmentation suffers from external fragmentation.
Which of the following is true?

Solution Video | Have any Doubt ?

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 also 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 | Have any Doubt ?

A Only S_1 and S_3

B Only S_2 and S_3 — Your answer is **Wrong**

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.
S_2 : The pointer overhead for linked allocation is greater then indexed allocation.
Which of the above statements are not true?

FAQ Solution Video Have any Doubt ?

A Only S_1

B Only S_2 Correct Option

Solution :
(b)

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

C Both S_1 and S_2

D Neither of them Your answer is **Wrong**

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 _____.

FAQ Solution Video Have any Doubt ?

5 Correct Option

Solution :
5

$$\text{Minimum number of resources required} = (\text{Number of resources required by } P_1 - 1) + (\text{Number of resources required by } P_2 - 1) + 1$$
$$= (3 - 1) + (3 - 1) + 1 = 5$$

QUESTION ANALYTICS +

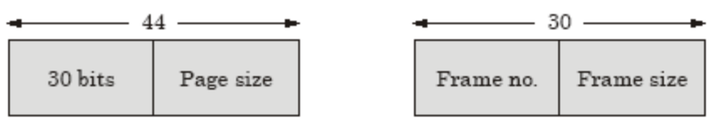
Q. 7

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 _____.

FAQ Solution Video Have any Doubt ?

3 Correct Option

Solution :
3



$$\text{Size of page table at } 1^{st} \text{ level} = \frac{2^{44}}{2^{14}} \times 2 \text{ Bytes}$$
$$= \frac{2^{45}}{2^{14}} = 2^{31} \text{ Bytes}$$
$$\text{Size of page table at } 2^{nd} \text{ level} = \frac{2^{31}}{2^{14}} \times 2 \text{ Bytes}$$
$$= \frac{2^{32}}{2^{14}} = 2^{18} \text{ Bytes}$$
$$\text{Size of page table at } 3^{rd} \text{ level} = \frac{2^{18}}{2^{14}} \times 2 \text{ Bytes}$$
$$= \frac{2^{19}}{2^{14}} = 2^{5} \text{ Bytes}$$

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 overload due to page table and internal fragmentation is _____ KB.

Solution Video | Have any Doubt ?

16 — Correct Option

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

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

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

0 = Minimal internal fragmentation

P = Maximum internal fragmentation

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

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

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

$$\text{P}^2 = 2 \times 128\text{ MB}$$

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

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_2	3	1	2	0	1	0
P_3	0	3	1	2	2	2
P_4	1	1	3	1	3	1

If currently available resources in system as (A, B, C) = (1, 1, 1), then the number of possible safe sequence possible in system with 4 processes will be _____.

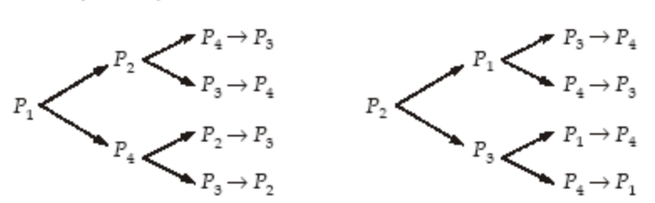
FAQ | Solution Video | Have any Doubt ?

8 — Your answer is **Correct**8

Solution :

8

With available resource (1, 1, 1):



Number of ways = 4 Number of ways = 4

Total number of ways = 4 + 4 = 8

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?

FAQ | Solution Video | Have any Doubt ?

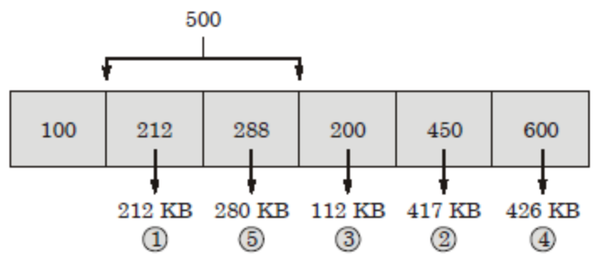
A Best fit algorithm

B First fit algorithm — Correct Option

Solution :

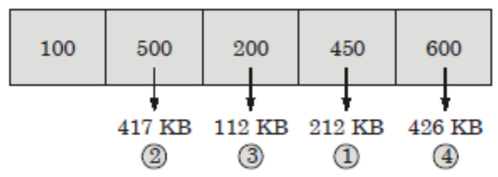
(b)

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

D None of the above

QUESTION ANALYTICS +

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.

$$\text{Max size} = \left(\frac{\text{DB size}}{\text{DBA}}\right)^3 \times \text{DB size}$$

$$= \left[\frac{4\text{ KB}}{4\text{ B}}\right]^3 \times 4\text{ KB} = \left[\frac{2^{12}\text{ B}}{4\text{ B}}\right]^3 \times 4\text{ KB}$$

$$= [2^{10}]^3 \times 4\text{ KB} = 2^{30} \times 2^{10} \times 4\text{ B}$$

$$= 4 \times 2^{40}\text{ B}$$

$$= 4\text{ TB}$$

B 256 GB

C 512 GB

D 2 TB

QUESTION ANALYTICS +

Q. 12

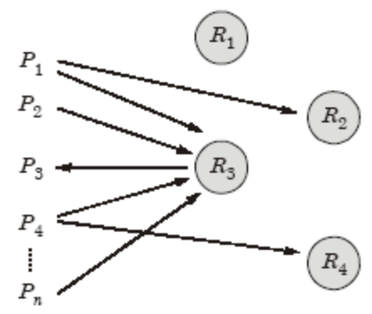
An operating system implements a policy in which resources are numbered uniquely and processes are allowed to request for resources only in increasing resource number. Which of the following is true?

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 cycle cannot be possible.
- Starvation is possible, consider the following case:



Since every process request for resource R_3, it might be the case process 1 get starve.

B Deadlock may occur but not starvation.

C Both starvation and deadlock may occur.

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)?

Solution Video | Have any Doubt ?

A 29 — Your answer is **Correct**

Solution :
(a)

$$\text{Size of virtual addresses} = 48\text{ bits}$$

$$\text{Page size} = 8\text{ KB}$$

$$\text{Page offset} = 2^{13} = 13\text{ bits}$$

$$\text{Number of bits used for indexing} = 48 - 13 = 35\text{ bits}$$

$$\text{Number of set} = \frac{256}{4} = \frac{2^8}{2^2} = 2^6 = 64 \text{ require 6 bits}$$

$$\text{Total tag bits} = 35 - 6 = 29\text{ bits.}$$

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?

Solution Video | Have any Doubt ?

A LRU = Optimal < FIFO

B Optimal < FIFO < LRU

C Optimal < LRU = FIFO

D Optimal < LRU < FIFO — Your answer is **Correct**

Solution :
(d)

Using FIFO:

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

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
Ⓕ	Ⓕ	Ⓕ	Ⓕ			Ⓕ	Ⓕ					Ⓕ				Ⓕ			

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
Ⓕ	Ⓕ	Ⓕ	Ⓕ			Ⓕ	Ⓕ				Ⓕ	Ⓕ	Ⓕ			Ⓕ			

LRU has 10 page faults
So, Optimal(8) < LRU(10) < FIFO (14).

QUESTION ANALYTICS +

Q. 15

Consider the following track requests in the disk queue:

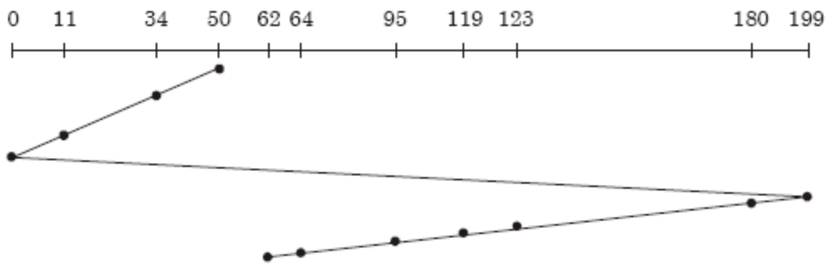
95, 180, 34, 119, 11, 123, 62, 64

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]

FAQ | Solution Video | Have any Doubt ?

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 684

QUESTION ANALYTICS +

Q. 16

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.

Solution Video | Have any Doubt ?

8 — Correct Option

Solution :
8
$2^{10} \times 4B + 2^{10} \times 4B$

4 KB + 4 KB = 8 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 faultrate is 20% then average memory access time is _____. (Upto 1 decimal place)

Solution Video | Have any Doubt ?

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 fault service time + Modified% × Page fault service time with page modified)

= 0.80 × 120 nsec + 0.20 (0.15 × 800 nsec + 0.85 × 950 nsec)

= 96 nsec + 0.20 (120 nsec + 807.5)

= 96 nsec + 185.5 nsec

= 281.5 nsec

QUESTION ANALYTICS