

Operating Systems

Memory Management

DPP 08

[NAT]

1. Consider the following statements:
- (i) Paging never suffers from internal fragmentation.
 - (ii) Segmentation never suffers from external fragmentation.
 - (iii) Segmentation may suffer from internal fragmentation.
- How many of the above statements are correct?

[MSQ]

2. Consider the following segment table:

| Segment No. | Base | Length |
|-------------|------|--------|
| 0 | 5519 | 400 |
| 1 | 2500 | 15 |
| 2 | 100 | 500 |
| 3 | 1257 | 600 |
| 4 | 1859 | 500 |

Which of the following logical address will generate trap addressing error?

- (a) 0000110011010
- (b) 0010000001111
- (c) 0100100101100
- (d) 1000111110011

[MCQ]

3. Virtual memory can be implemented using _____.
 (a) Thrashing (b) Segmentation
 (c) Demand paging (d) None of these

[MCQ]

4. If x is TLB or cache access time, y is main memory access time, and z is page fault service time or disk

access time. Then, which of the following relation are correct regarding access time.

- (a) $x > y = z$
- (b) $x < y = z$
- (c) $x < y < z$
- (d) $x > y > z$

[MCQ]

5. The size of virtual memory is limited by _____.
 (a) Main memory size.
 (b) Capacity of page table registers.
 (c) Logical address space.
 (d) Disk size.

[MCQ]

6. How many levels of paging is required if it is desired to limit page table to 1 page by assuming page size = 4KB, $e = 4B$, $LA = 64$ bits.
 (a) 1 (b) 2
 (c) 4 (d) 6

[NAT]

7. Consider a system using segmented paging architecture, where segment is divided into 16K pages each of size 4KB and segment table is divided into 8k pages of each size of 2KB (Byte addressable memory) PAS is 64MB, then calculate page table size of segment (in MB).

Answer Key

- | | |
|-----------|---------|
| 1. (0) | 6. (d) |
| 2. (a, b) | 7. (16) |
| 3. (c) | |
| 4. (c) | |
| 5. (d) | |



Hints & Solutions

1. (0)

Paging may have internal fragmentation but never suffers from external fragmentation.

Segmentation never have internal fragmentation but may have external fragmentation.

2. (a, b)

(a) 000 0110011010

↓ ↓
0 410

This will generate trap.

(b) 001 0000001111

↓ ↓
1 15

This will also generate trap.

(c) 010 0100101100

↓ ↓
2 300

No trap will be generated.

(d) 100 0111110011

↓ ↓
4 499

No trap will be generated.

Therefore, a and b are correct

options.

3. (c)

Virtual memory is implemented through demand paging. Loading the pages on demand during run time is demand paging.

4. (c)

TLB or cache access time is less than main memory access time and main memory access time is less than disk access time.

$x < y < z$.

5. (d)

Virtual memory is stored in disk and so its size is limited by disk size.

6. (d)

Number of pages = $\frac{PTS}{PS}$ or $\frac{LAS}{PS}$

$$= \frac{2^{64}}{2^{12}} = 2^{52}$$

Level 1:

$$PTS = 2^{52} * 4 \\ = 2^{54} > 2^{12}$$

Level 2:

$$\text{Number of pages} = \frac{PTS}{PS} = \frac{2^{54}}{2^{12}} = 2^{42}$$

$$PTS = 2^{42} * 4 \\ = 2^{44} > 2^{12}$$

Level 3:

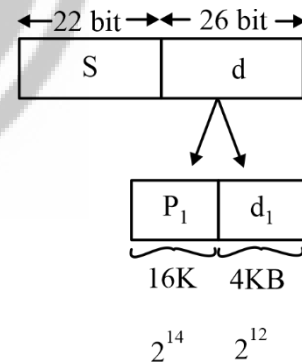
$$\text{Number of pages} = \frac{PTS}{PS} = \frac{2^{44}}{2^{12}} = 2^{32}$$

$$= PTS = 2^{32} * 4 \\ = 2^{34} > 2^{12} = 2^{34}$$

and so on...

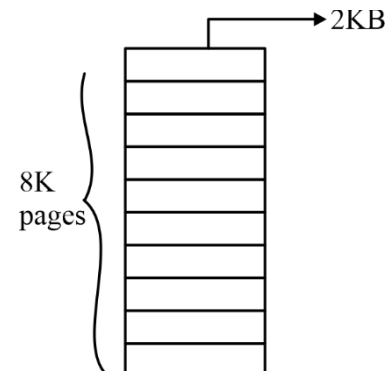
by solving we get 6 levels of paging and the page table size at level 6 is 2^2 which is less than 2^{12} . Hence 6 is correct answer. So, option d is correct.

7. (16)



$$14 + 12 \Rightarrow 26 \text{ bits}$$

Segment Table



$$\begin{aligned}\text{Segment Table Size} &\Rightarrow 8K \times 2KB \\ &\Rightarrow 2^{13} \times 2^{11} \Rightarrow 2^{24} \\ &= 16MB\end{aligned}$$



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