

## Subject : OPERATING SYSTEMS

## Topic : Memory Management

DPP 03

**[MCQ]**

1. Consider a paging system with a 32 MB of physical memory and 512 pages of Logical Address Space and page size of 2KB.
- Then number of bits in Logical Address is? and
  - Number of bits in Physical Address is?
- 20, 25
  - 25, 20
  - 32, 64
  - None of the above.

**[MSQ]**

2. Which of the following are correct statements:
- To reduce the effective memory access time of simple paging, concept of TLB (Translation look aside buffer) was introduced.
  - TLB contains the most frequently referred pages along with their frame number.
  - Size of TLB is smaller than actual page table size.
  - None of the above.

**[NAT]**

3. Consider a paging system with a 4 GB of logical address space with frame size of 4KB, page table entry size (e) is 2B and physical address space is 256MB.  
Then how many levels are required to fit into 1 frame?

**[MCQ]**

4. Consider a paging system with 16GB of logical address space with frame size of 16KB, with page table entry size of 8B and physical address space is 512MB. Find the levels that are required to fit into 1 frame is?
- 1
  - 2
  - 3
  - 4

**[MCQ]**

5. 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.
- 1
  - 2
  - 4
  - 6

**[MCQ]**

6. Memory protection in a paged system is achieved by \_\_\_\_\_.
- Protection bit with each page.
  - Restriction on page visibility.
  - Protection algorithm with each page.
  - None of the above.

**[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.

## Answer Key

1. (a)
2. (a, b, c)
3. (2)
4. (b)

5. (d)
6. (a)
7. (16MB)



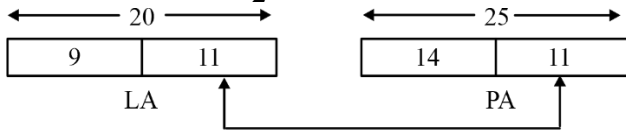
## Hints & Solutions

1. (a)

**Sol.** Given P.A.S = 32 MB  
 $= 2^{25}$

Page Size  
 $= 2 * 2^{10}$   
 $= 2^{11}$

Number of pages = 512  
 $= 2^9$



Note that frame size is always equals to page size.

2. (a, b, c)

- Sol.**
- TLB reduces the effective memory access time of simple paging.
  - TLB contains the pages which are accessed frequently (or) frequently referred pages.
  - Size of TLB is smarter than the page table size.

3. (2)

**Sol.** Number of entries =  $\frac{\text{LAS}}{\text{F.S}} = \frac{4\text{GB}}{4\text{KB}} = 2^{20}$

**Level 1:**

Page table size = number of entries \* Entry size  
 $= 2^{20} * 2\text{B}$   
 $= 2\text{MB} > \text{page size}$

**Level 2:**

Number of pages =  $\frac{\text{PTS}}{\text{PS}} = \frac{2\text{MB}}{4\text{KB}} = \frac{2 * 2^{20}}{4 * 2^{10}} = 2^9$

Page Table Size =  $2^9 * 2\text{B}$   
 $= 2^{10}\text{B}$   
 $= 1\text{KB} < \text{P.S}$

Hence it requires 2 levels.

4. (b)

**Sol. Level 1:**

Number of pages =  $\frac{\text{LAS}}{\text{F.S}} = \frac{16\text{GB}}{16\text{KB}}$   
 $= \frac{2^4 * 2^{30}}{2^4 * 2^{10}}$   
 $= 2^{20}$

PTS =  $2^{20} * 8\text{B}$   
 $= 2^{23}$   
 $= 8\text{MB}$

$8\text{MB} > 8\text{KB}$

**Level 2:**

Number of pages =  $\frac{8\text{MB}}{8\text{KB}} = \frac{2^{23}}{2^{14}} = 2^9$

PTS =  $2^9 * 8\text{B}$   
 $= 2^{12}$

$2\text{KB} < 8\text{KB}$

5. (d)

Number of pages =  $\frac{\text{PTS}}{\text{PS}}$  or  $\frac{\text{LAS}}{\text{PS}}$   
 $= \frac{2^{64}}{2^{12}} = 2^{52}$

**Level 1:**

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

**Level 2:**

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

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

**Level 3:**

Number of pages =  $\frac{\text{PTS}}{\text{PS}} = \frac{2^{44}}{2^{12}} = 2^{32}$   
 $= \text{PTS} = 2^{32} * 4$   
 $= 2^{34} > 2^{12} = 2^{34}$

and so on...

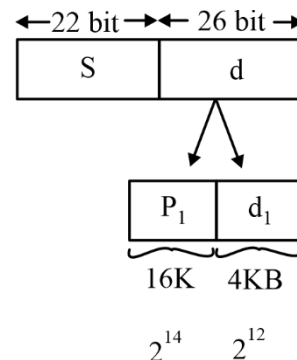
by solving we get 6 levels of paging and the page table size at level 6 is  $2^2$  which is less than  $2^{12}$ . Hence 6 is correct answer. So, option d is correct.

6. (a)

**Sol.** Memory protection in a paged system is achieved by protection bit with each page.

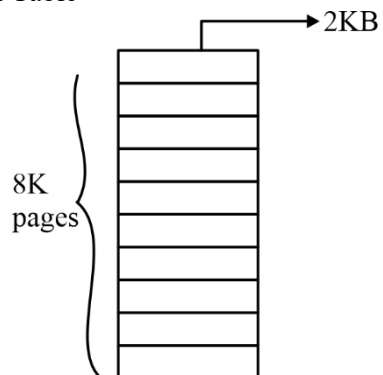
7. (16MB)

**Sol.**



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

Segment Table



$$\text{Segment Table Size} \Rightarrow 8K \times 2KB$$

$$\Rightarrow 2^{13} \times 2^{11} \Rightarrow 2^{24}$$

$$= 16MB$$



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