

CS & IT ENGINEERING



Operating System

Memory Management

DPP 01 Discussion Notes

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[MCQ]



#Q. Consider a fixed partition contiguous memory management technique, where there are 5 partitions of size 100MB, 250MB, 200MB, 500MB and 300MB. All Partitions are initially empty. The following process requests are made in the given order:

The following 2 answers are calculated for First fit, Best fit and Worst Fit policies

- ✓ 1. Maximum degree of multiprogramming?
- ✓ 2. What is the total internal fragmentation size?

For which of the following partition allocation policy the above two calculations are not exactly same as other 2 policies?

Process	Size
P1 .	150 MB
P2 .	400 MB
P3 .	270MB
P4 .	180MB
P5 .	80MB

A

Best fit ✓

B

First fit ✓

C

Worst fit

D

None of the above ✓

	P_4 80	P_5 120	P_1 350	P_3 30
100 MB	250 MB	200 MB	<u>500 MB</u>	300 MB

I. F·F

$$1. MDM \Rightarrow 5$$

$$2. \underline{T \cdot I \cdot F} \Rightarrow 20 + 100 + 20 + 100 + 30 \Rightarrow \underline{270.}$$

P_1	150
P_2	400
P_3	<u>270</u>
P_4	180
P_5	<u>80</u>

II. B·F

$$1. MDM \Rightarrow 5$$

$$2. \underline{T \cdot I \cdot F} \Rightarrow 20 + 70 + 50 + \underline{100} + 30 \Rightarrow \underline{270.}$$

III. W·F

$$1. MDM \Rightarrow 4$$

$$2. T \cdot I \cdot F \Rightarrow 80 + 120 + 350 + 30 \Rightarrow \underline{\underline{570 MB}}$$



[NAT]

#Q. Consider a paged memory system where the logical address is 25 bits and physical address is 33 bits. The page size is 4KB. The approximate size of page table size is 2^{21} k bytes ($1k = 2^{10}$)?

$$4KB = 2^{12} B$$

$$P.T.S \Rightarrow \frac{\text{No. of pages}}{} * P.T.E.$$

$$\# \text{ of pages} \Rightarrow \frac{2^{25}}{2^{12}} \Rightarrow 2^{13} = \underline{8K}.$$

$$\log_2 2^{12} \Rightarrow 12 \text{ bits.}$$

$$\# \text{ of frames} \Rightarrow \frac{2^{33}}{2^{12}} \Rightarrow 2^{21} = \log_2 2^{21} = \underline{21 \text{ bits.}}$$

P.T.E = Translation
bits + other info.

$$P.T.S \Rightarrow 2^{13} \times 21 \text{ bits} \Rightarrow \frac{2^{13} \times 21}{2^3} = 21 \times 2^{10} = \underline{\underline{21KB}}.$$

#Q. Consider a paged memory system where the page number is 12 bits and physical address is 33 bits. The page size is 2KB. The approximate size of page table size is 11 k bytes ($1k = 2^{10}$)?

$$P.T.S = \# \text{ of pages} * \underline{\underline{P.T.E}}$$

$$\# \text{ of pages} \Rightarrow 2^{12}$$

$$\# \text{ of frames} \Rightarrow \frac{2^{33}}{2^{11}} = 2^{22} \Rightarrow 4M$$

$$P.T.S \Rightarrow 2^{12} \times 22 \text{ bits} = \underline{\underline{11KB}}$$

#Q.

Consider a paged memory system which has 4k pages each with 8kbytes size. The system maintains page table of 12k bytes. Each page table entry contains frame number, 1 valid bit, 1 modified bit and 1 replacement bit. The number of frames in the main memory is $2 \cdot * 2^{20}$?

$$\frac{P.T.S}{\downarrow} = \frac{\# \text{ of } \text{pages}}{\downarrow} * P.T.E .$$

$$12 \text{ KB} = 4 \text{k} * (F + 1 + 1 + 1) \text{ bits}$$

~~$$3 \cancel{12 \text{k} * 8 \text{ bits}} = \cancel{4 \text{k}} (F + 3) \text{ bits}$$~~

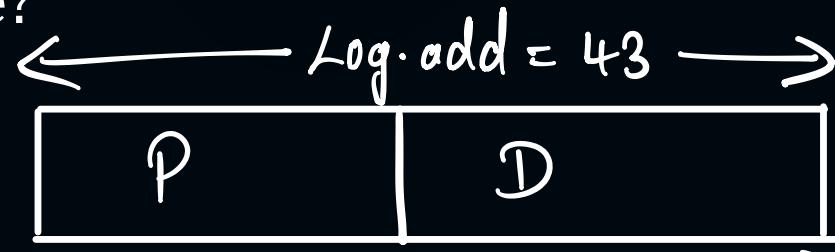
$$24 \text{ bits} = F + 3 \text{ bits}$$

$$F = 21 \text{ bits} . \Rightarrow 2^{21} \Rightarrow 2 * 2^{20}$$

[MCQ]

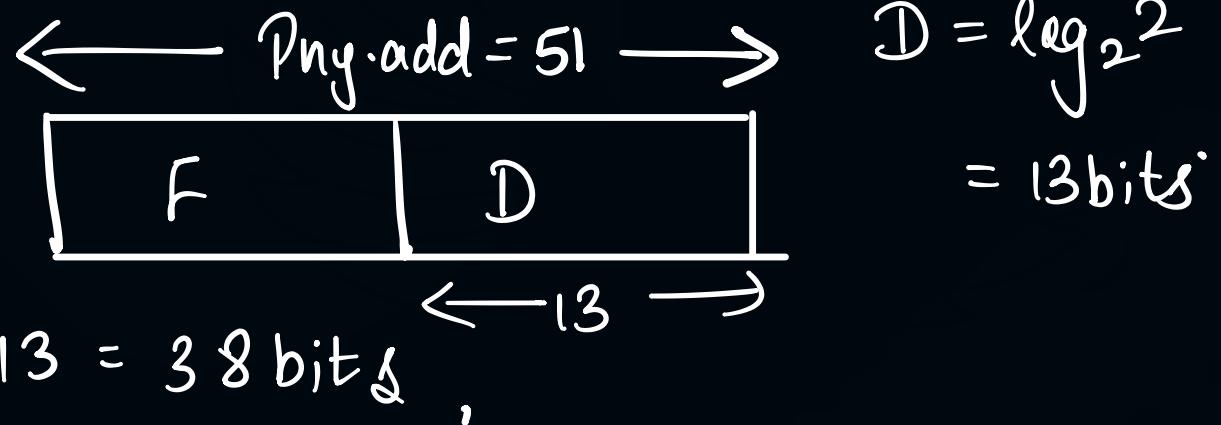
#Q. A system has 43-bit logical addresses and 51-bit physical addresses. If the pages are 8 kB in size, the number of bits required for logical page number and physical frame number will be?

- A 43 bits, 51 bits
- B 30 bits, 51 bits
- C 43 bits, 38 bits
- D 30 bits, 38 bits



$$P = 43 - 13 = 30 \text{ bits}$$

$$8\text{ kB} = 2^{13} \text{ B}$$



$$F = 51 - 13 = 38 \text{ bits},$$

$$\begin{aligned} D &= \log_2 2^{13} \\ &= 13 \text{ bits} \end{aligned}$$

#Q. Consider a logical-address space of 8 pages, with page size 1024 bytes.
The physical memory contains 32 frames. The page table size is _____ bits?

$$P.T.S = \# \text{ of } \cancel{\text{pages}} * P.T.E .$$

$$= 8 * 5 \text{ bits}$$

$$\log_2 32 = 5 \text{ bits.}$$

$$= 40 \text{ bits} .$$

$$P.T.E = 5 \text{ bits}$$

#Q. Consider a system using TLB for paging with TLB access time of 40ns. The hit ratio is to be used for TLB to reduce the effective memory access time from 400ns without using TLB to 280ns with using TLB, is 80 %??

$$\text{without TLB} \Rightarrow 2^* M \cdot M$$

$$0.8 \times 100 = 80\%$$

$$400 \text{ ns} \Rightarrow 2^* M \cdot M$$

$$M \cdot M = 200 \text{ ns}$$

$$\text{with TLB} \Rightarrow n (\underline{\text{TLB}} + MM) + (1-n) (\text{TLB} + 2 M \cdot M)$$

$$280 \Rightarrow n (40 + 200) + (1-n) (40 + 400)$$

$$280 \Rightarrow 240n + 440 - 440n, \boxed{n = 0.8}$$

#Q. A computer system implements a 42-bit virtual address, 512GB physical address space, page size of 2KB, and an 8KB look-aside buffer (TLB) organized as direct mapped. Each page table entry contains a valid bit, a dirty bit and 2 protection bits along with the translation. The minimum length of the TLB tag in bits is 20?

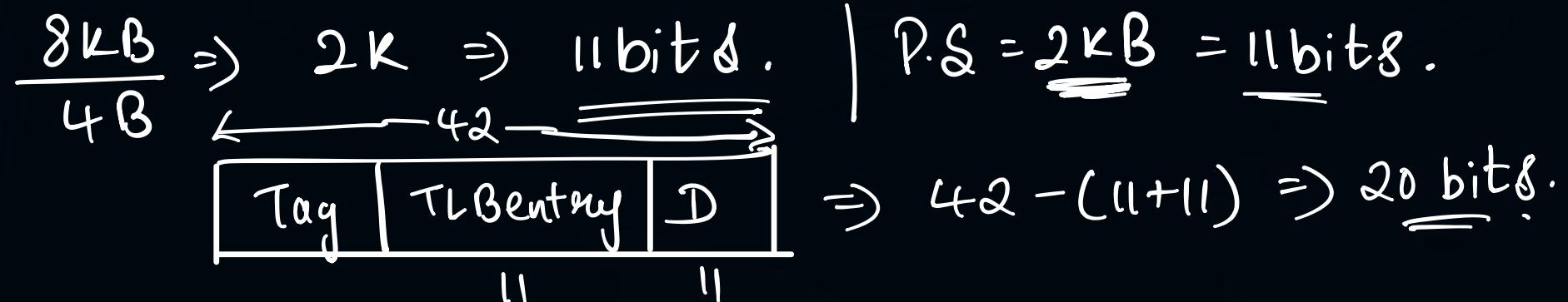
I. Frame bits :

$$\frac{512\text{ GB}}{2\text{ KB}} \Rightarrow 256\text{ M} = 2^{28}$$

$$\log_2 2^{28} = 28 \text{ bits.}$$

$$\text{P.T.E} = 28 + 1 + 1 + 2 \Rightarrow 32 \text{ bits.} \Rightarrow 4 \text{ Bytes.}$$

II.





THANK - YOU

