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HW 9

TLB:

1.

Valid	Tag or Virtual Number	Physical Number
1	11	12
1	7	4
1	3	6
1	4	9
1		

For page number: 4669 → 1   Then page table is:

2227 → 0
13916 → 3
34587 → 8
48870 → 11
12608 → 7
49225 → 12

Valid	Physical Number
1	5
0	Disk
0	Disk
1	6
1	9
1	11
0	Disk
1	4
0	Disk
0	Disk
1	3
1	12
0	Disk
0	Disk
0	Disk
0	Disk

Page hit table:

4669	Fault
2227	Fault
13916	Hit
34587	Fault
48870	Hit
12608	Fault
49925	Hit

Final TLB

valid	Tag	Physical
1	3	3
1	11	11
1	12	12
1	4	9

Page hit

2. For page number: 4669 → 0   Fault

2227 → 0   Fault
13916 → 0   Fault
34587 → 2   Fault
48870 → 2   Fault
12608 → 1   Fault
49925 → 3   Hit

Advantage: one access fetch more data, lower page fault rate

3. TLB

Valid	Tag	Physical Page Number
1	0	3
1	0	4
1	0	7
1	0	11

TLB is important to avoid paying high access times to memory. without it, CPI will be much higher

4. $4 \times 2^{32-13} = 4 \times 2^{19} = 2MB$

5. $2^{43-12} = 2^{31} = 2GB$

Physical Memory needed: $2^3 \times 2^2 = 2^{33} = 8GB$

6. Since tabe. size is $2^{33}B$ and page size is $2^{12}B$

so two page tables are required and reference need $2^{23}B$

7.
$$\begin{matrix} 0 \\ 2 \\ 4 \\ 8 \end{matrix} \rightarrow \begin{matrix} 10 \\ 2 \\ 4 \\ 8 \end{matrix} \rightarrow \begin{matrix} 10 \\ 12 \\ 4 \\ 8 \end{matrix} \rightarrow \begin{matrix} 10 \\ 12 \\ 14 \\ 8 \end{matrix} \rightarrow \begin{matrix} 10 \\ 12 \\ 14 \\ 16 \end{matrix} \rightarrow \begin{matrix} 0 \\ 12 \\ 14 \\ 16 \end{matrix}$$ 0 hit

8.
$$\begin{matrix} 0 \\ 2 \\ 4 \\ 8 \end{matrix} \rightarrow \begin{matrix} 0 \\ 2 \\ 4 \\ 10 \end{matrix} \rightarrow \begin{matrix} 0 \\ 2 \\ 4 \\ 12 \end{matrix} \rightarrow \begin{matrix} 0 \\ 2 \\ 4 \\ 14 \end{matrix} \rightarrow \begin{matrix} 0 \\ 2 \\ 4 \\ 16 \end{matrix}$$ 1 hit

9.
$$\begin{matrix} 0 \\ 2 \\ 4 \\ 8 \end{matrix} \rightarrow \begin{matrix} 0 \\ 10 \\ 4 \\ 8 \end{matrix} \rightarrow \begin{matrix} 12 \\ 10 \\ 4 \\ 8 \end{matrix} \rightarrow \begin{matrix} 14 \\ 10 \\ 4 \\ 8 \end{matrix} \rightarrow \begin{matrix} 14 \\ 10 \\ 16 \\ 8 \end{matrix} \rightarrow \begin{matrix} 0 \\ 10 \\ 16 \\ 8 \end{matrix}$$ 0 hit