

CSE140-HW5

2. a) continued...

Tag: Address = Tag + set + offset

$$32 \text{ bits} = \text{Tag} + 17 \text{ bits} + 7 \text{ bits}$$

$$\begin{array}{rcl} 32 \text{ bits} & = & \text{Tag} + 24 \text{ bits} \\ -24 \text{ bits} & & \cancel{-24 \text{ bits}} \end{array}$$

$$\boxed{\text{Tag} = 8 \text{ bits}}$$

b) Consider a cache with 1024 sets, 4-way set associativity, and 10-bit tags. How many bytes can the cache store? (What is the data capacity is not including overhead of storing tags, valid bits, etc...)

$$\cdot \text{Sets} = 1024 = 2^{10}$$

$$- \text{Set} = \log_2 (\text{No. of Sets})$$

$$\cdot \text{Tag} = 10 \text{ bits}$$

$$= \log_2 (2^{10}) = 10 \cdot \log_2 (2) = 10 \cdot 1 = 10$$

$$\boxed{\text{Set} = 10 \text{ bits}}$$

- Address = Tag + Set + Offset

$$32 \text{ bits} = 10 \text{ bits} + 10 \text{ bits} + \text{Offset}$$

$$32 \text{ bits} = 20 \text{ bits} + \text{Offset}$$

$$\begin{array}{rcl} 20 \text{ bits} & & -20 \text{ bits} \\ & & \hline \end{array}$$

$$12 \text{ bits} = \text{Offset} \Rightarrow \boxed{\text{Blocksize} = 2^{12}}$$

- Cache size = No. of Sets . Associativity . Blocksize

$$= 2^{10} \cdot 4 \cdot 2^{12} \quad \cdot 4 = 2^2$$

$$= 2^{24} \Rightarrow 2^4 \cdot 2^{20}$$

$$16 \cdot 2^{20} = \boxed{16 \text{ MB} = \text{Cache size}}$$