

A) Cache structure

L1: 8KB, 2-way, 16-byte block (L_B)

$$N_B = \frac{8 \cdot 2^{10}}{16} = 2^9 \quad N_{WAYS} = 2 \quad N_{SETS} = \frac{N_B}{N_{WAYS}} = \frac{2^9}{2} = 2^8$$

$$\text{index} = \log_2 N_{SETS} = \log_2 2^8 = 8$$

$$\text{displacement} = \log_2 L_B = \log_2 16 = 4$$

$$\text{tag} = 32 - 8 - 4 = 20$$

L2: 512 KB, 4-way, 32-byte block (L_B)

$$N_B = \frac{2^8 \cdot 2^{10}}{32} = 2^{14} \quad N_{WAYS} = 4 \quad N_{SETS} = \frac{N_B}{N_{WAYS}} = \frac{2^{14}}{4} = 2^{12}$$

$$\text{index} = \log_2 2^{12} = 12$$

$$\text{displacement} = \log_2 L_B = \log_2 32 = 5$$

$$\text{tag} = 32 - 12 - 5 = 15$$

L3: 1 MB, 4-way, 64-byte (L_B)

$$N_B = \frac{2^{20}}{64} = 2^{14} \quad N_{WAYS} = 4 \quad N_{SETS} = \frac{2^{14}}{4} = 2^{12}$$

$$\text{index} = \log_2 2^{12} = 12$$

$$\text{displacement} = \log_2 64 = 6$$

$$\text{tag} = 32 - 12 - 6 = 14$$