

计算机系统 III 作业 1

For a direct-mapped cache design with a 64-bit address, the following bits of the address are used to access the cache.

Tag	Index	Offset
63-10	9-5	4-0

- (1) What is the cache block size (in words)?
 - Offset bits: 5
 - Block size = $2^5 = 32$ bytes = 8 words
- (2) How many blocks does the cache have?
 - Index bits: 5
 - #blocks = $2^5 = 32$
- (3) What is the ratio between total bits required for such a cache implementation over the data storage bits?
 - Tags occupy 54 bits (63-10)
 - Data storage bits = $32^5 = 256$ bits
 - Total bits = $256 + 54 = 310$ bits
 - Ratio = $310/256 = 1.21$

Beginning from the power on, the following byte-addressed cache references are recorded.

Address												
Hex	00	04	10	84	E8	A0	400	1E	8C	C1C	B4	884
Dec	0	4	16	132	232	160	1024	30	140	3100	180	2180

- (1) For each reference, list
 - i) its tag, index, and offset,
 - ii) whether it is a hit or a miss
 - iii) which bytes were replaced (if any).
 - tag: 0 index: 0 offset: 0 miss 0~0x1F
 - tag: 0 index: 0 offset: 0b100 hit
 - tag: 0 index: 0 offset: 0b10000 hit
 - tag: 0 index: 0b100 offset: 0b00100 miss 0x80~0x9F
 - tag: 0 index: 0b111 offset: 0b01000 miss 0xE0~0xFF
 - tag: 0 index: 0b101 offset: 0 miss 0xA0~0xBF
 - tag: 0b1 index: 0 offset: 0 miss 0x400~0x41F
 - tag: 0 index: 0 offset: 0b11110 miss 0~0x1F
 - tag: 0 index: 0b100 offset: 0b01100 hit
 - tag: 0b11 index: 0 offset: 0b11100 miss 0xC00~0xC1F
 - tag: 0 index: 0b101 offset: 0b10100 hit
 - tag: 0b10 index: 0b100 offset: 0b00100 miss 0x880~0x89F
- (2) What is the hit ratio
 - $4/12 = 0.33$