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Relevant Formulae: Caches

Nomenclature Note

- Ratio == Rate

Cache Information

- Blocksize = $2^{\#\text{ Bits in Offset}}$
- # Rows = $2^{\#\text{ Bits in Index}}$

- # Entries = Cache Size (without metadata) / Blocksize
- # Bits in Address = # Bits in Tag + # Bits in Index + # Bits in Offset

- Cache Size (without metadata) = # Rows • Associativity • Blocksize in bits
- Cache Size (with metadata) = # Rows • Associativity • (Blocksize in bits + Valid Bit + # Bits in Tag)

- Hit Ratio = # Hits / (# Hits + # Misses)
- Miss Ratio = 1 - Hit Ratio
- Average Memory Access Time = Hit Time + Miss Ratio * Miss Penalty

For Access

- BlockID = Address // Blocksize
- Row = BlockID % # Rows
- Tag = BlockID // # Rows

Cache Access

- Hit = Same Row; Same Block
- Miss = Block empty
- Miss & Evict = Same Row; Different Block

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Relevant Formulae: Virtual Memory

Information

- Page Size = $2^{\#\text{ Bits in offset}}$
- Offset = Address % Page Size

- Virtual Memory Size = $2^{\#\text{ Bits in Virtual Address}}$
- Physical Memory Size = $2^{\#\text{ Bits in Physical Address}}$

- # Virtual Pages = Virtual Memory Size / Page Size
- # Physical Pages = Physical Memory Size / Page Size

For Access

- Virtual Page Number = Address // Page Size
- Physical Page Number = Look up from the page table

- Physical Address = PPN • Page Size + Offset
- # Bits in PPN = Physical Address Size - Offset

- # Entries = # Virtual Pages
- Page Table Entry Size = Valid Bit + Dirty Bit + Protect Bit + # Bits in PPN
- Page Table Size = # Entries • Page Table Entry Size

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Useful Conversions

- 1 Byte = 8 bits
- 1 MB = 2^{20} Bytes
- 1 GB = 2^{30} Bytes