Contents
- Input/Output
- Computer Arithmetic
- Instruction Set Architecture
- Parallel and distributed computing

Input/output
- I/O Modules and peripheral devices
  - Basic components in a I/O module
- Three types of I/O
  - Program I/O
    - What
  - Memory mapped, isolated (special purpose) I/O
  - Interrupt I/O
    - Basic steps
  - DMA
    - What/why/how
    - Cycle steal, burst transfer
## Computer Arithmetic

- Integer representation and arithmetic
  - Unsigned/sign-magnitude/2's complement
    - What
    - Data range
    - Problem
  - 2's complement
    - Converting n bit to m bit
    - Addition/subtraction
      - Overflow problem

## Computer Arithmetic

- Real number representation and arithmetic
  - Representation
    - Three components
    - Biased notation and normalization
    - Floating number ↔ real number
  - Several issues
    - Expressible numbers
      - Maximum/minimum number
    - Overflow/underflow
    - Representation of zero
    - Accuracy
  - Floating point arithmetic

## Instruction Set Architecture

- Instruction
- Instruction sets
  - Numbers of addressing
  - Addressing modes
  - Tradeoffs between addressing modes vs performance
- Memory alignment and endianness
- Procedure call
Parallel and distributed computing

- Why parallel and distributed computing
- Flynn’s computer models
- Taxonomy of parallel architectures
  - Shared memory
    - SMP
    - NUMA
  - Distributed memory
- Performance limitation
  - Parallelism
  - Communication cost

Questions?