GRE Architecture Session

Session 2: Saturday 23, 1995

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Review

- Homework
- Basic Gate Arithmetics
- Bubble Pushing
- Logic Design
- Complex Digital Circuits

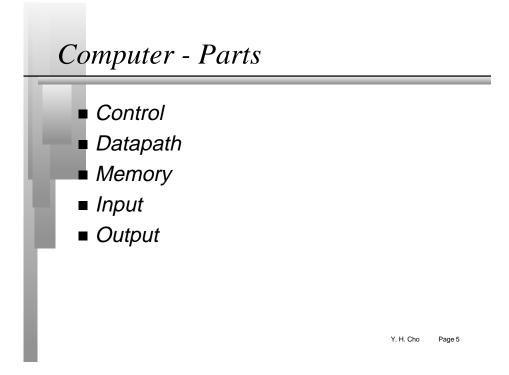
Logic Design & Complex Circuits

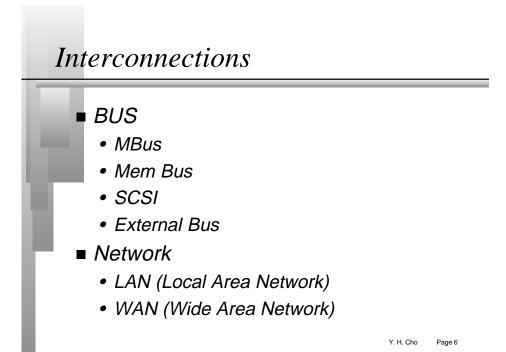
- Karnaugh-Map "K-MAP"
- Design with 4+ Variables
- Debounced Flip-Flop (D-FF)
- Culmination of small design concept

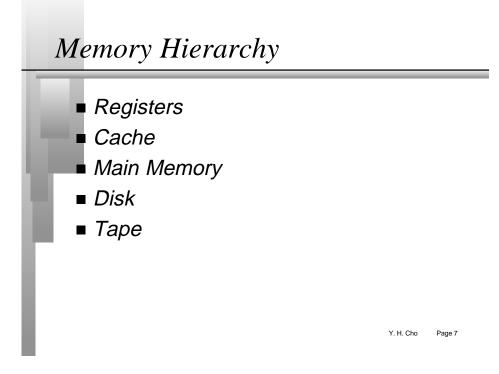
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Computer

- What is your idea?
- RISC (Reduced Instruction Set Computer)
- CISC (Complex Instruction Set Computer)
- RISC versus CISC Robot arm Analogy







Performance



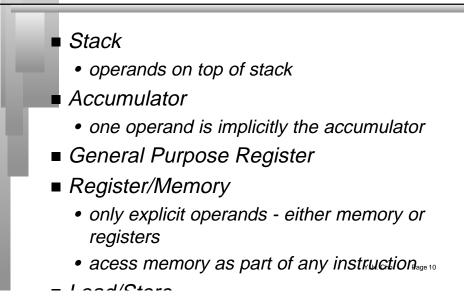
- CPI = Cycles per program/Instruction
 Count per Program
- MIPS = Instruction Count / (Time X 10^6) = Clock rate / (CPI X 10^6)
- MFLOPS = Floating point operation / (Time X 10^6)
- Benchmarks

Benchmarks

- SPEC System Performance Evaluation Cooperative
- CPU time = (Instr / Prog) X (Cycles / Instruction) X (Sec / Cycle)
- Amdahl's Law
 - Speedup(w/Enhancement) = (Exec Time without Enh) / (Exec Time with Enh)

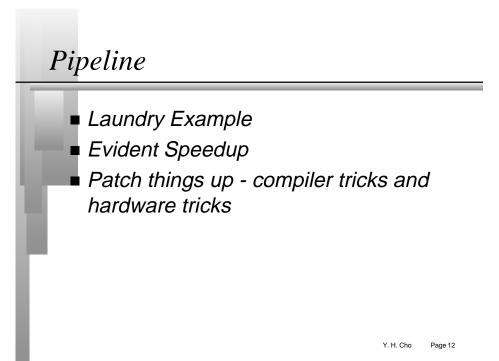
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Instruction Set Architecture (ISA)



ISA History

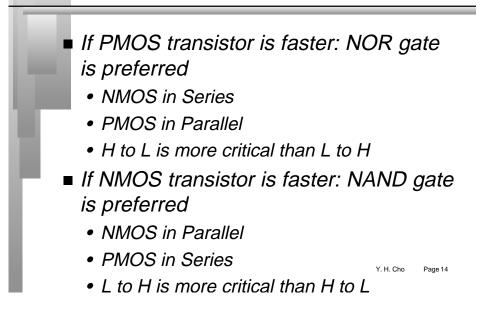
- Single Accumulator
 - EDSAC: 1950
- Accumulator + Index Registers
 - Manchester Mark I, IBM 700 series 1953
- Separation of Programming Model from Implementation
 - High-level Language Based (B5000: 1963)
 - Concept of a Family (IBM 360: 1964)
- General Purpose Register Machines
 - Oriental Instruction Orto MIAN latel 400.



Basic Technology

- Complementary Metal Oxide Silicon (CMOS) transistors
 - NMOS
 - Turns on when High (Vdd, 5V) is applied
 - Turns off when Low (Gnd, 0V) is applied
 - (Analogy: Opens the gate at the hill to let the water flow. Gate controlled by stream of water
 - Water applied to gate controls the gate.)
 - PMOS
 - Turns off when High (Vdd, 5V) is applied
 - Turns on when Low (Gnd, 0V) is applied

Gate Comparison



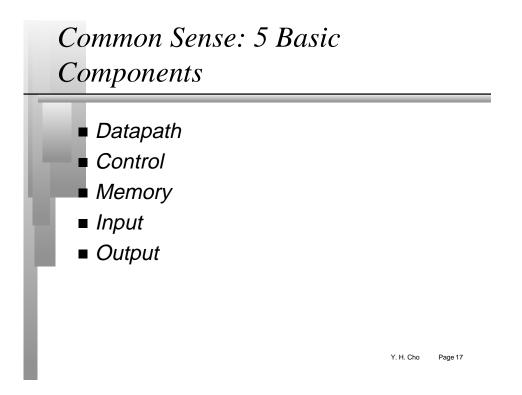
Summary

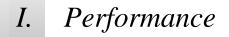
- Performance Measurements
- Instruction Set Architecture:
 - Stack
 - Accumulator
 - General Purpose Register:
 - Register/Memory
 - Load/Store

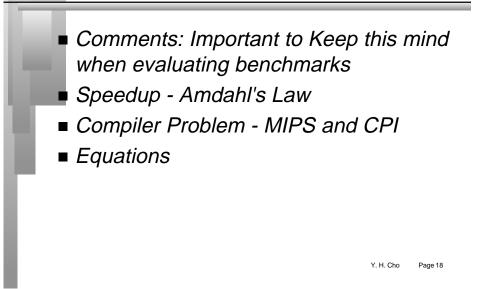
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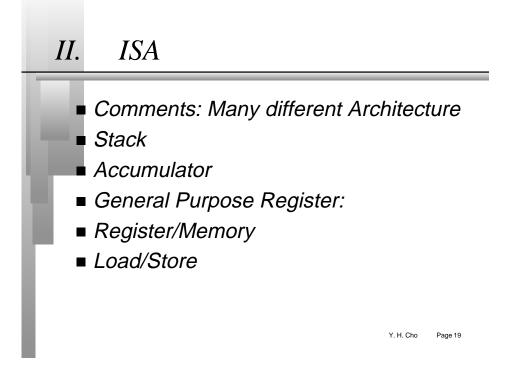
Outline

- Performance
- ISA
- Technology
- ALU
- Computer Arithmetics
 - Binary Arithmetics
 - Floating point Arithmetics
- Single cycle and pipelines

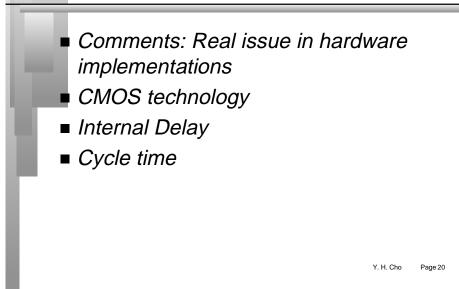








III. Technology



IV. Arithmetic Logic Unit (ALU)

 Comments: Basic intelligent unit implementations
 Carry-Look-Ahead
 Carry Select



V. Computer Arithmetics

- Binary Standard
- Multiplication
 - Booths
- Floating point (IEEE Standard)
- Multiply, Shift, and FP Number
- Comments: Important to know the concept
 - IEEE 31 / 30-23 / 22-0
 - (-1)^s * (1+significand) x 2^(exponent-bias)

VI. Single Cycle and Pipeline Datapath

- Datapath
- Draw your idea of what Computer is
- Block diagram