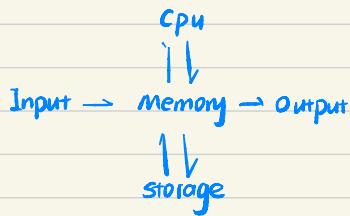




1. What are the 5 main components of a computer system?



2. What is the Moore's Law?

In 1965, Intel's Gordon Moore predicted that the number of transistors that can be integrated on single chip would double about every two years.

3. What is the SW / HW interface?

4. What is a user / system program?

5. What is abstraction in a computer system?

Abstraction helps us deal with complexity.

Instruction set architecture (ISA)

Application binary

How are data and programs represented in a computer?

Information Processing System \leftrightarrow computer system



program (instruction)

information

Data { number { integer
float numbers
text string
multimedia { audio
video
etc.

What is the interface between hardware & software ?

The Instruction Set Architecture (ISA)

What determines computer performance ?

Algorithm

Program language, compiler, architecture

Processor and memory

Application Software

System software

{ operating system .

compiler : translate HLL code to assembly language or
machine code

Scanner

Linker

Loader

1. What are the abstraction levels of a computer system ?
2. What is the process of translating a HLL program into an executable ?
3. How to write a MIPS assembly language statement ?
4. How to use MARS ?
5. What are useful MARS features ?

a - 10

b - 11

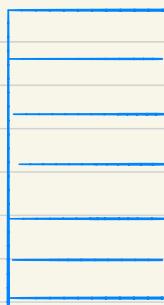
Hex ?

sw \square, \square (two operations)

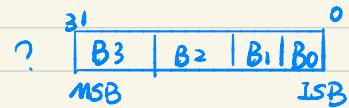
9/13/2019

Q

1. How data are stored in Memory ?
How memory is organized ?
2. what is little big Endian ?
3. What are common number bases ? 2, 8, 16, 10
How to convert between them ?
4. How to represent integers in binary ?



address
32-bit



2 ways.

Main Memory

Little-endian
Big-endian

Binary 2 0, 1

Octal 8 0~7

Decimal 10 0~9

Hexadecimal 16 0~9, A 10, B 11, C 12, D 13, E 14, F 15

$$n = \sum_{i=0}^{k-1} d_i \times \text{base}^i$$

915 12019

(27+2)

(+0 & -0)

255 (8-bit)

- How to represent negative integers in binary?

Sign-magnitude \Rightarrow msb

5 0 0 1 0 1

-5 0 1 0 1 0

↑ Sign magnitude

1 \rightarrow "neg" 0 \rightarrow "posi"

- complementary representation

5 0 0 1 0 1

-5 1 1 0 1 0

1 1 1 1 1

-0

1's complementary

+0 = 0 0 0 0 0

-0 = 1 1 1 1 1

- 2-complementary representation

1 1 0 1 0

+1

1 1 0 1 1

+
0 0 0 0 0

- What is sign-extension?

+2: 0 0 0 0 0 0 1 0 \Rightarrow 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0

-2: 0 1 1 1 1 1 1 0 \Rightarrow 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0

MSB

- How to represent floating-point number in binary?

in binary

$\pm 1 \cdot \underset{\downarrow \text{Fra}}{x \dots x} \times 2^y \rightarrow$ Exponent

IEEE Floating-point format
S Exponent Fraction

$x = (-1)^s \times (1 + \text{Fraction}) \times 2^{(\text{Exponent} - \text{Bias})}$

-0.625 \rightarrow binary

$\frac{5}{8} = \frac{5}{2^3} = \underline{5} \times 2^{-3}$

101

- How to convert between decimal FP and binary FP representations?

9/10/2019

Q1. what is CISC RISC ?

Complex instruction Set Computer

Reduced instruction Set Computer

Q2. Why RISC ?

CISC architecture were design under many constraints.

- small, slow, expensive memories
- on chip registers are expensive
- attempts to bridge the semantic gap

technologies \nearrow Constraints \searrow less relevant

Processor designers wanted to exploit new advances

Q3. What instruction formats does MIPS have ?

Q4. How to encode operands ?

add \$t0 \$t1 \$t2
 $f = (g+h) - (i+j)$ add \$t0 \$t1 \$t2 \$t3

Sub \$t0 \$t1 \$t2

addi	\$t0,	\$t1,	3	16	16	3
	16	17		8	0x11	0x10
				001000	00011	00010
					0x22	11 0 003
					

$\$s1$ $\$s2$ $\$s3$
 $g = h + A[s]$

lw $\$t0, 32($s3)$

add $\$s1, \$s2, \$t0$

$g = A[i];$
 $g: \$s1 \quad i: \$t0$

9/12/2019

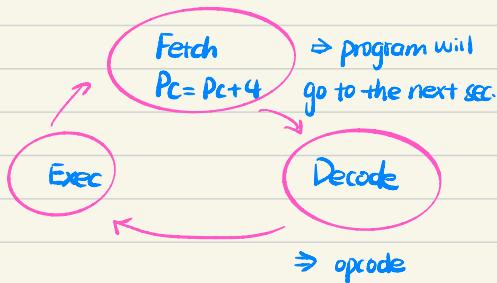
- How to categorize MIPS instructions?

1 - 31 \Rightarrow To binary form

- Instruction
- ① arithmetic logic
 - ② Data transfer / store
 - ③ branching
 - ④ Jumping

Pc = program counters

ALU = arithmetic logical unit



$$\begin{array}{l} 8 \Rightarrow 12 \\ |w \ $to , 4($s3) \\ -4 ($s3) \Rightarrow 4 \end{array}$$

- How does a MIPS processor access information in memory?

- What is the functional view of a MIPS processor?

- How to access an array item with (constant & variable) index?

op	is	rt	rd	shamt	funct	Exam Questions
\$2	\$			0	add	

op is rt id

$\$S_2$ $\$S_4$ $\$S_1$
↓ ↓ ↓
 $c = A[i] - b$
↑
 $\$S_3$

lw $\$to$

9/17/2019 =

1. what is the control flow? the sequence of executed instruction
2. How to compile If then else?
while loop?

5 16 17
bne \$s0, \$s1, lab1
add \$s3, \$s0, \$s1



PC - 4 Backward.

PC + 4 Forward

3. what branching / jumping instructions? does MIPS provide?
4. How to encode/ calculate destination address?
of a branching / jumping instruction?

Branch Range $-2^{15} \sim 2^{15}-1$ Jump if it's out of range.

J label # go to label

5. How about branching on conditions other than equal and not equal?

5. How about branching on conditions other than equal and not equal?

1. 5 Questions
2. Questions asked in class
3. syms.
4. short answers → keep to the point
5. Select all correct answers
incorrect → penalty
6. Matching

a → 1 correct full point
c → 2 wrong half point
10

7. Mistype X.
Cap X 0X

8. 2+1 Questions

4 pts
-1 a X
-1 b X
2 c ✓
2 d ✓

NO select all → 0 points