CS2100 Notes

Conrad Soon

August 28, 2022

1 Week 1

1.1 Base-n Number Systems

1.1.1 Integer Decimal to Base-n Conversion

Repeated division by n, remainder forms the n-digit of the number in base-n.

1.1.2 Fractional Decimal to Base-n Conversion

Repeated multiplication by n, ones-place forms the n-digit of the number in base-n.

1.2 Number Representation Schemes

1.2.1 Sign and Magnitude

MSB is sign bit, 0 denotes positive, 1 denotes negative. Remaining bits form the magnitude.

1.2.2 One's Complement

MSB is sign bit, 0 denotes positive, 1 denotes negative. Negative numbers by inversion of all bits. Arithmetic done by adding carry-out of MSB back into sum. Overflow can be detected by.

1.2.3 Two's Complement

MSB is sign bit, 0 denotes positive, 1 denotes negative. Negative numbers by inversion of all bits, followed by addition of 1. Arithmetic done by ignoring carry out of MSB. Overflow can be detected by.

1.2.4 Excess-n Representation

Number N represents value $N - n$. For example, 000 in excess-4 representation represents $0-4=-4$.

1.3 Real Number Representations

1.3.1 IEEE-754 Float

MSB is sign bit, 0 denotes positive, 1 denotes negative. Next 8 bits are exponent bits, represented in excess-127. Next 23 bits are magnitude bits, normalised with implicit leading bit of 1. $x=(-1)^S * M * 2^{(E-127)}$

2 Week 2

2.1 Pointer Arithmetic

++(p) increases the value of p by sizeof(*p).

2.2 Functional Prototypes

If functional prototype not declared before main, C++ assumes default return type to be int, can cause problems later when defining function.
int sumArray(int[], int);
int sumArray(int arr[], int size);
Both are acceptable ways to declare function prototype: C++ does not care about name.

2.3 Arrays

T a[] = T *a; Array bracket is just syntactic sugar for a pointer pointing to first element in array.

3 Week 3

3.1 Functional Prototypes

If functional prototype not declared before main, C++ assumes default return type to be int, can cause problems later when defining function.
int sumArray(int[], int);
int sumArray(int arr[], int size);
Both are acceptable ways to declare function prototype: C++ does not care about name.

3.2 Arrays

T a[] = T *a; Array bracket is just syntactic sugar for a pointer pointing to first element in array.

4 Week 4

4.1 MIPS Instruction Types

MIPS instructions are divided into 3 types:

4.1.1 R-Format

opcode, rs, rt, rd, shamt, funct

Arithmetic Instructions Opcode always 0. shamt always 0.

Shift Instructions Opcode always 0. rs always 0.

4.1.2 I-Format

opcode, rs, rt, immediate immediate treated as signed, except bitwise.