5.4 Addressing

- Addressing modes specify where an operand is located.
- They can specify a constant, a register, or a memory location.
- The actual location of an operand is its *effective address*.
- Certain addressing modes allow us to determine the address of an operand dynamically.

5.4.1 Data Type

- Integers
  - Signed or unsigned
  - 8, 16, 32, 64 bits
- Floating-point
  - 32, 64, 128 bits

5.4.2 Address Modes

Address mode	**Discussion**
Immediate	Data are part of the instruction.
Direct	The address of the data is given in the instruction.
Register	The data are located in a register.
Indirect	Gives the address of the address of the data in the instruction.
Register indirect	Uses a register to store the address of the address of the data.
Indexed	Uses a register (implicitly or explicitly) as an offset, which is added to the address in the operand to determine the effective address of the data.
Based	Based addressing is similar to indexed addressing. Instead of an index register a base register is used to find the effective address.
Index and base register addressing differences.	The difference between these two is that an index register holds an offset relative to the address given in the instruction, a base register holds a base address where the address field represents a displacement from this base.
Stack	The operand is assumed to be on top of the stack.

Address (Hexadecimal)	Contents
0x800	0x900
. . .	
0x900	0x1000
. . .	
0x1000	0x500
. . .	
0x1100	0x600
. . .	
0x1600	0x700

R1	0xE00

Instruction: Load 0x800

Addressing Mode	Value Loaded into AC	Computation
Immediate	0x800	The operand, 0x800, is assigned to the AC.
Direct	0x900	The effective address, 0x800, is given in the operand. The value stored at the effective address, 0x900, is assigned to the PC.
Indirect	0x1000	The effective address is given by the value stored at the address in the operand. The effective address is 0x900 and the value assigned to the AC is 0x1000.
Indexed	0x700	The index register is **R1**. The effective address is the sum of the operand and the contents of **R1**. The effective address is $0x800 + 0xE00 = 0x1600$.