Tutorial 07

Question

1. What is meant by an instruction?

2. Instruction Set Architecture (ISA), is the part of the computer architecture related to?

3. Instruction format contains of two main parts. What are they?

4. Where are instructions stored?

5. How are instructions stored?

6. An instruction differs from another instruction by 3 main factors. What are they?

7. A computer that is used for simple numerical problems, uses 6 bits for an opcode, and 12 bits for a memory address. What is the size of its instruction?

8. A computer that is used for simple numerical problems, uses 6 bits for an opcode, and 12 bits for a memory address. How many different instructions can it have?

9. A computer that is used for simple numerical problems, uses 9 bits for an opcode, and 25 bits for a memory address. What is the maximum memory size that it can address? (Hint: Assume that 2^20 is about 1M).

10. Memory address of the instruction format contains of two parts. What are they?

11. Given a CPU with a 8-bit word, 8 registers, and instructions that are exactly 1 word long and which has 2 operands:

a) How long can the opcode field be in an instruction?

b) How many instructions can the CPU support?

Answers

1. Instruction is a command that tells the computer what to do. It is a sequence of bits that the CPU can understand and execute.
2. Instruction Set Architecture (ISA) is the part of the computer architecture that defines the set of instructions that a processor can execute. It includes the opcodes, addressing modes, and data formats for all the instructions in the processor's instruction set.
3. Opcode: This is the part of the instruction that tells the CPU what operation to perform.

Operands: These are the parts of the instruction that tell the CPU what data to operate on.

1. Instructions are stored in memory. This can be main memory, cache memory, or registers.
2. Instructions are stored in binary format. This means that each instruction is represented as a sequence of 0s and 1s.
3. Opcode: The opcode is the part of the instruction that tells the CPU what operation to perform. Different instructions have different opcodes.

Operands: The operands are the parts of the instruction that tell the CPU what data to operate on. Different instructions can have different operands.

Addressing mode: The addressing mode is the way that the operands are specified in the instruction. There are different addressing modes, such as immediate addressing, direct addressing, and indirect addressing.

1. A computer that uses 6 bits for an opcode and 12 bits for a memory address has an instruction size of 18 bits.
2. A computer that uses 6 bits for an opcode and 12 bits for a memory address can have 2^18 = 262,144 different instructions.
3. A computer that uses 9 bits for an opcode and 25 bits for a memory address can address a maximum memory size of 2^24 = 16,777,216 bytes.
4. Base address: This is the address of the memory location where the operand is stored.

Index: This is a value that is added to the base address to calculate the actual address of the operand.

1. a) The opcode field in an instruction can be 8 bits long because the word size is 8 bits, and the opcode field is one byte long. This means that there are 2^8 = 256 different opcodes that the CPU can support

b) The CPU can support 2^8 = 256 different instructions because there are 256 different opcodes that the CPU can support. Each instruction has a unique opcode, so the CPU can support 256 different instructions.