

## Tutorial 8

(Q1) Consider a computer that is used for simple numerical problems. It uses 9 bits for an opcode, and 25 bits for a memory address.

(a) What is the size of its instruction?  
= number of opcode + number of address bits  
bits

$$= 9 + 25 = \underline{\underline{34 \text{ bits}}}$$

(b) How many different instructions can it have?

$$= 2^9 = \underline{\underline{512 \text{ instructions}}}$$

(c) What is the maximum memory size that it can address?

$$\frac{2^{20}}{2^5} = \frac{1 \text{ M}}{32} = x = 2^5 = \underline{\underline{32 \text{ M}}}$$

(Q2) Given CPU with a 8 bit word, 8 registers and instructions that are exactly 1 word long and which has two operands.

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

$$8 \text{ registers} = 2^3 = 3 \text{ bits for addresses}$$

$$\text{opcode} = \text{instruction} - \text{addresses}$$

$$= 8 \text{ bits} - (2 \times 3 \text{ bits}) = 2 \text{ bits}$$

$$\text{opcode instructions} = 2^2 = \underline{\underline{4}}$$

(b) How many instructions can the CPU support.

$$= 2^8 = \underline{\underline{256 \text{ instructions}}}$$