Problem 1:

An instruction is stored at location 300 with its address field at location 301. The address field has the value 400. A processor register R1 contains the number 200. Evaluate effective address if the addressing mode of the instruction is

a. Direct
b. Immediate
c. PC-Relative
d. Register indirect
e. Indexed with R1 as the index register.

Problem 2:

A two-word instruction is stored in memory at an address designated by the symbol W. The address field of the instruction (stored at W+1) is designated by the symbol Y. The operand used during the execution of the instruction is stored at an address symbolized by Z. An index register contains the value X. State how Z is calculated from the other addresses if the addressing mode of the instruction is:

a. Direct
b. Immediate
c. PC-Relative
d. Indexed

Problem 3:

A PC-Relative mode branch type of instruction is stored in memory at an address equivalent to decimal 750 (assume one word per instruction). The branch is made to an address equivalent to decimal 500. What should be the value of the relative address field of the instruction (in decimal)?

Problem 4:

Consider a hypothetical 24-bit microprocessor having 24-bit instructions composed of two fields: The first byte contains the Opcode and the remainder the operand address. What is the maximum directly addressable memory capacity (in bytes)?

Problem 5:

A computer has a 32-bit instructions and 12-bit addresses. If the instructions on this computer are either of type one-address instructions or two-address. If there are 250 two-address instructions, how many one-address instructions can be formulated?

Problem 6:

Consider a hypothetical 32-bit microprocessor having 32-bit instructions composed of two fields: the first byte contains the opcode and the remainder the immediate operand or an operand address.

a) What is the maximum directly addressable capacity (in bytes)?

b) Discuss the impact on the system speed if the microprocessor bus has:

   1. A 32 bit local address bus and a 16-bit local data bus.
   2. A 16 bit local address bus and a 16-bit local data bus.

c) How many bits are needed for the PC and the IR registers?