

Instruction Formats Problems

Problem 1

Suppose a datapath has three operand busses (two source, one destination), 45 instruction types, and 32 registers where each register is 16 bits wide. Immediate operands can be in the range of $\pm 127K$.

Design an instruction format for instructions that have one operation, one destination register and two source registers. Label the fields and minimum number of bits need for each field.

Opcode: ? bits	Destination Register: ? bits	Source 1 Register: ? bits	Source 2 Register: ? bits
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Design an instruction format for instructions that have one operation, one destination register, one source register, and an immediate value. Label the fields and minimum number of bits need for each field.

Opcode: ? bits	Destination Register: ? bits	Source 1 Register: ? bits	Immediate Value: ? bits
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Problem 2

Suppose we are designing an instruction set architecture with 32-bit instructions and 26 different opcodes. The register file contains 128 registers. One of the instruction types we would like to support specifies an opcode, a destination register, and two immediate source values. What is the minimum number of bits that are needed to specify each field?

Opcode: ? bits	Destination Register: ? bits	Immediate Value: ? bits	Immediate Value: ? bits
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Problem 3

Suppose we are designing an instruction set architecture with 28-bit instructions and 44 different opcodes. Immediate operands can be in the range of ± 512 . How many registers can this datapath have?

Opcode	Destination Register	Source Register	Immediate
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