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 ±128K.

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

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

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