

CPE 221 CLASSWORK 11: MACHINE CODE IN ARM

Student Name (as in Canvas): _____

A Number: _____

Points: 20

1 Identify Instruction Type**(10 Points)**

Determine the instruction type (data-processing, memory, or branch) for the machine code: 0xE5923004

Solution

This is a memory instruction.

Explanation

Looking at bits 27-26 (op code), we extract 01 which indicates a memory instruction where:

- op code 00 = data-processing instruction
- op code 01 = memory instruction
- op code 10 = branch instruction

2 Encode SUB Instruction

(10 Points)

Encode the assembly instruction SUB R0, R1, #15 into machine code.

Solution

0xE241000F

Explanation

- Cond (31-28): 1110 (AL - Always execute)
- Op (27-26): 00 (data-processing)
- I bit (25): 1 (immediate operand)
- Funct (24-21): 0100 (SUB operation)
- S bit (20): 0 (don't set condition flags)
- Rn (19-16): 0001 (R1)
- Rd (15-12): 0000 (R0)
- Rotation (11-8): 0000 (no rotation)
- Immediate (7-0): 00001111 (15 decimal)