Laboratory 2: Post Index-Preindex, Conditional Instructions and Comparisons

Experiment Sheet

Purpose

The purpose of this laboratory is to learn how to use post index, pre index addressing modes, conditional instructions (EQ, NE, LT, GT, LE, GE), comparison operations (CMP, TST, TEQ, CMN), and memory access commands (LDRB, LDRH, LDR, STR, STRB, STRH) in ARM assembly language programming.

Essential Knowledge

1. **Memory Access Commands: Post Index and Pre Index**
   - **Post Index**: This addressing mode uses the current memory address first and then updates the address by adding an offset (increment or decrement). It's useful when you want to perform memory access and increment the pointer afterward.
   - **Pre Index**: This addressing mode updates the memory address before using it. The address is incremented or decremented first, and the updated address is used for the memory access operation.

   Memory Access Commands:

   - **LDRB**: Loads an 8-bit value from memory.
   - **LDRH**: Loads a 16-bit value from memory.
   - **LDR**: Loads a 32-bit value from memory.
   - **STR**: Stores a value (32-bit) into memory.
   - **STRB**: Stores an 8-bit value into memory.
   - **STRH**: Stores a 16-bit value into memory.
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2. **Conditional Instructions and Their Usage**
   Conditional instructions allow the program to perform operations based on the result of comparisons. ARM assembly provides several condition codes that can be used to modify instructions to execute only if a condition is met.

   Conditional Codes:

   - **EQ (Equal)**: Executes if two values are equal.
   - **NE (Not Equal)**: Executes if two values are not equal.
   - **LT (Less Than)**: Executes if the first value is less than the second value.
   - **GT (Greater Than)**: Executes if the first value is greater than the second value.
   - **LE (Less Than or Equal)**: Executes if the first value is less than or equal to the second value.
   - **GE (Greater Than or Equal)**: Executes if the first value is greater than or equal to the second value.

Comparison Operations
Comparison operations are used to evaluate relationships between values and set flags based on the results. ARM has several commands that perform different kinds of comparisons.

Comparison Commands:

- **CMP (Compare)**: Compares two values by subtracting the second from the first and sets flags based on the result.
  - **Z (Zero) Flag**: Set if the two values are equal.
  - **N (Negative) Flag**: Set if the result is negative (first value < second value).
  - **C (Carry) Flag**: Set if the first value is greater than or equal to the second value.
- **TST (Test)**: Performs a bitwise AND operation on two values and sets flags without storing the result.
  - **Z (Zero) Flag**: Set if the result of the AND operation is zero.
  - **N (Negative) Flag**: Set if the result is negative (not applicable for unsigned values).
- **TEQ (Test Equivalence)**: Performs a bitwise XOR operation and updates the flags based on the result.
  - **Z (Zero) Flag**: Set if the two values are equal.
- **CMN (Compare Negative)**: Adds two values and sets flags based on the result (similar to CMP but performs addition instead of subtraction).
  - **Z (Zero) Flag**: Set if the sum is zero.
  - **N (Negative) Flag**: Set if the result is negative (not applicable for unsigned values).