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1. In ARM assembly, what is a branch? What is the alternate term for this instruction used by some other processor architectures?

A branch, or a jump in other architectures, is a break in the sequential flow of instructions that the processor is executing. Frequently it will be essential for the processor to execute instructions in a different order. This might be to perform an iterative process such as a loop where the program executes a series of instruction and then returns to the start of the sequence to repeat the same set of instructions with different values. Alternatively the processor may have to make a decision, perhaps by performing a comparison operation, and on the basis of that comparison, skip over many instructions to reach a different section of the program and continue execution from the start of the new section.

2. Explain the (B)ranch instruction (ex: B label).

The B instruction is an unconditional branch - when the processor encounters such a branch, it always jumps to the designated point.

```
B some_location
```

3. Explain how an assembly programmer represents the destination of a (B)ranch, and how the assembler translates this representation.

In assembly language, it is possible and desirable to represent the destination of the branch by a symbolic label. The assembler translates this label into the correct memory location, saving the programmer time and effort.

4. How do comparison operations work in ARM assembly? Do these operations store the results of their underlying operations?

These comparisons work by performing arithmetic or logical operations on the values stored in the source registers and setting the appropriate condition code flags in the Current Program Status Register as necessary.

The actual result of the underlying arithmetic or logical operation is not stored in any register.

5. What comparison operation would be used for a "normal" comparison of the values in two registers (e.g., r1 > r2, r1 < r2, r1 == r2)? Explain how the two operands to the instruction are used.

```
CMP r1, r2

The processor performs r1 - r2, and sets PSR flags based on the result.
```

6. What comparison operation would be used to test of specific bits in a register are set? Explain how the two operands to the instruction are used.

```
TST r1, r2

The processor uses r2 as a bitmask on r1
```

7. What is the simplest way to set the CSPR condition flags prior to branching or conditional execution?

```
Use a comparison e.g. CMP, TEQ, TST.
```

8. What is the branch instruction that branches only when the prior comparison proved that two source registers are equal in value?

```
CMP r1, r2
BEQ some_location  // This BEQ must happen immediately after the CMP
```

9. What is the branch instruction that branches only when the prior comparison proved that the first operand is lower/less than the second operand (both operands being unsigned integers)?

```
CMP r1, r2
BLO some_location // r1 < r2
```

10. Which ARM instructions can be conditionally executed?

```
Unlike most processor architectures, ALL instructions in the ARM assembly
language can be conditionally executed.

CMP r1, r2
CMPHS r3, r4      // only compare r3 and r4 if r1>= r2
ADDEQ r1, r4       // only add r4 to r1 if r3 == r4
```