

## ARM Instructions Worksheet #9

# Floating-Point Compares

And their effect on the NZCV Flags in the CPSR register:

31	30	29	28	27	26	
N	Z	C	V	Q		...

Prerequisite Reading: Chapter 9

Revised: April 21, 2020

**Objectives:** To use the web-based simulator ("CPULator") to better understand ...

1. The use of VCMPL and VMRS to perform floating-point comparisons.
2. The use of VSUB and VMOV to simplify some floating-point comparisons.
3. The use of floating-point equality comparisons.

**To do offline:** Answer the questions that follow the listing below. (Numbers at far left are memory addresses.)

```

                .syntax      unified
                .global      _start

// *** EXECUTION STARTS HERE ***

00000000  _start:    MOVS        R0,#0           // N flag = 0
00000004                VLDR        S0,posPt4       // S0 = +0.4
00000008                VLDR        S1,posPt5       // S1 = +0.5
0000000C                VCMPL.F32    S0,S1          // 0.4 < 0.5 ?
00000010                VMRS        APSR_nzcv,FPSCR
00000014                LDR         R0,#1           // Assume MI
00000018                BMI         L1
0000001C                LDR         R0,#0           // Wasn't MI

00000020  L1:      VSUB.F32    S2,S0,S1           // S2 = 0.4 - 0.5
00000024                VMOV        R1,S2
00000028                LSR         R1,R1,31        // Same as R0?

0000002C                VLDR        S3,negPt1       // S3 = -0.1
00000030                VCMPL.F32    S2,S3          // S2 == S3 ?
00000034                VMRS        APSR_nczv,FPSCR
00000038                LDR         R2,#1           // Assume EQ
0000003C                BEQ         done
00000040                LDR         R2,#0           // Wasn't EQ

00000044  done:    B          done                // Infinite loop

00000048  point5:  .float      +0.5
0000004C  point4:  .float      +0.4
00000050  point1:  .float      -0.1

                .end

```

What is in the N flag (CPSR bit 31) after executing the VCMPI at address 0000000C<sub>16</sub>?

N	C	Z	V
<input type="text" value="0"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

What is in the N flag (CPSR bit 31) after executing the VMRS at address 00000010<sub>16</sub>?

N	C	Z	V
<input type="text" value="1"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

What is in register R0 *before* executing the VSUB instruction at address 00000020<sub>16</sub>?

R0 (as decimal signed)

What is in register S2 after executing the VSUB instruction at address 00000020<sub>16</sub>?

S2 (as decimal signed)

What is in register R1 after executing the VMOV instruction at address 00000024<sub>16</sub>?

R1 (as hexadecimal)

What is in register R1 after executing the LSR instruction at address 00000028<sub>16</sub>?

R1 (as decimal signed)

What is in register S3 after executing the VLDR instruction at address 0000002C<sub>16</sub>?

R2 (as decimal signed)

What is in the Z flag (CPSR bit 29) after executing the VMRS at address 00000034<sub>16</sub>?

N	C	Z	V
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="text" value="1"/>	<input checked="" type="checkbox"/>

What is in register R2 *before* executing the B instruction at address 00000044<sub>16</sub>?

R2 (as decimal signed)

**Getting ready: Now use the simulator to collect the following information and compare to your earlier answers.**

1. Click [here](#) to open a browser for the ARM instruction simulator with pre-loaded code.

*Note:* You can change the number format in the “Settings” window between hex, unsigned decimal and signed decimal as needed

**Step 1: Press F2 once per ARM instruction as needed to see what the simulator says for the following:**

What is in the N flag (CPSR bit 31) after executing the VCMPI at address 0000000C<sub>16</sub>?

N	C	Z	V
<input type="text" value="0"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

What is in the N flag (CPSR bit 31) after executing the VMRS at address 00000010<sub>16</sub>?

N	C	Z	V
<input type="text" value="1"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

What is in register R0 *before* executing the VSUB instruction at address 00000020<sub>16</sub>?

R0 (as decimal signed)

What is in register S2 after executing the VSUB instruction at address 00000020<sub>16</sub>?

S2 (as decimal signed)

What is in register R1 after executing the VMOV instruction at address 00000024<sub>16</sub>?

R1 (as hexadecimal)

What is in register R1 after executing the LSR instruction at address 00000028<sub>16</sub>?

R1 (as decimal signed)

What is in register S3 after executing the VLDR instruction at address 0000002C<sub>16</sub>?

R2 (as decimal signed)

What is in the Z flag (CPSR bit 29) after executing the VMRS at address 00000034<sub>16</sub>?

N	C	Z	V
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="text" value="1"/>	<input checked="" type="checkbox"/>

What is in register R2 *before* executing the B instruction at address 00000044<sub>16</sub>?

R2 (as decimal signed)