

ARM Instructions Worksheet #3

Addressing Modes



Prerequisite Reading: Chapter 4

Revised: March 26, 2020

Objectives: To use the web-based simulator ("CPULator") to better understand the four addressing modes:

I. Immediate Offset Addressing: [R1] and [R1,4]

2. Register Offset Addressing: [R1,R2] and [R1,R2,LSL 2]

3. Post-Indexed Addressing: [R1],4

4. Pre-Indexed Addressing: [R1,4]!

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

```
.syntax
                                   unified
                      .global
                                   _start
                      .skip
                                   0x100
  00000100
            Array32:
                      .word 0xBEEFBEEF
                                                // uint32_t Array[4] ;
  00000104
                      .word 0xC0DEC0DE
  00000108
                      .word 0xF00DF00D
 0000010C
                      .word 0xFACEFACE
           _start:
 00000110
                     LDR
                            R1,=Array32
                                                // *** EXECUTION STARTS HERE ***
 00000114
                     LDR
                            R0,[R1]
                                                // Address provided by R1
 00000118
                     LDR
                            R0,[R1,4]
                                                // Address = R1 + 4
 0000011C
                     LDR
                            R2.=8
                                                // R2 = Offset = 8
00000120
                     LDR
                            R0,[R1,R2]
                                                // Address = R1 + R2
00000124
                     LDR
                           R2,=3
                                                // R2 = Subscript = 3
00000128
                     LDR
                           R0,[R1,R2,LSL 2]
                                                // Address = R1 + 4*R2
0000012C
                     LDR
                           R0,[R1],4
                                                // Address = R1; Post-Increment
00000130
                    LDR
                           R0, [R1,4]!
                                                // Address = R1 + 4; Pre-Increment
00000134 done:
                           done
                                                // infinite loop
                    .end
```

What hex <u>address</u> is copied into R1 by the LDR instruction at address 00000110₁₆?

What hex <u>data</u> is copied from the address in R1 by the LDR at address 00000114₁₆?

What hex data is copied into R0 by the LDR instruction at address 00000118₁₆?

What hex address did that value come from?

What hex data is copied into R0 by the LDR instruction at address 00000120₁₆?

What hex address did that value come from?

00000100

OXBEEF BEEF

Ox CODE CODE

00000104

Ox FUDDED

1010000101

What hex data is copied into R0 by the LDR instruction at address 0000012816? What hex data is copied into R0 by the LDR instruction at address 0000012C16? What hex data is copied into R0 by the LDR instruction at address 0000012C16? What hex data is copied into R0 by the LDR instruction at address 0000012C16? What hex data is copied into R0 by the LDR instruction at address 0000013016? What hex data is copied into R0 by the LDR instruction at address 0000013016? What hex data is copied into R0 by the LDR instruction at address 0000013016? What hex data is copied into R0 by the LDR instruction at address 0000013016? What hex data is copied into R1 by the LDR instruction at address 0000013016? October Norw were the simulator to calcost the followings information and compute to your carlier answers. 1. Click here to open a browser for the ARM instruction simulator with pre-loaded code. 2. Press C1-M1 to open the memory display window and drag-n-drop it about halfway to the right. 3. In the "Memory" window, entre Px180 into the search box and press Enter to highlight that address for easy reference. Step 1: Press C2-coactiv 2 times to execute the first row LDB instructions. (The \$\frac{3}{2}\text{LDB should be highlighted in wellows)}. What hex data is copied into R1 by the LDR instruction at address 00000110102? What hex data is copied into R1 by the LDR instruction at address 0000011816? What hex data is copied into R6 by the LDR instruction at address 0000011816? What hex data is copied into R6 by the LDR instruction at address 0000012016? What hex data is copied into R6 by the LDR instruction at address 0000012016? What hex data is copied into R6 by the LDR instruction at address 0000012C16? What hex data is copied into R6 by the LDR instruction at address 0000012C16? What hex data is copied into R6 by the LDR instruction at address 0000012C16? What hex data is copied into R6 by the LDR instruction at address 0000012C16? What hex data is copied into R6 by the LDR instruction at address 0		
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What hex address is left in R1 by the LDR instruction at address 0000012C ₁₀ ? What hex address is left in R1 by the LDR instruction at address 0000013O ₁₀ ? What hex address did that value come from? What hex address is left in R1 by the LDR instruction at address 0000013O ₁₀ ? What hex address is left in R1 by the LDR instruction at address 0000013O ₁₀ ? What hex address is left in R1 by the LDR instruction at address 0000013O ₁₀ ? October 1000 Getting ready. Now we the standard to collect the following information and compare to your earlier answers. 1. Check here to open a browser for the ARM instruction simulator with pre-loaded code. 2. Press Ctrl-M to open the memory display window and drag-n-drop it about halfway to the right. 3. In the "Memory" window, enter 0x100 into the search box and press Enter to highlight that address for easy reference. Step 1: Press F2 exactly 2 times to execute the first two LDR instructions of the search box and press Enter to highlight that address for easy reference. Step 1: Press F2 exactly 2 times to execute the LDR RD, [R1, 44]. What hex address is copied from the address in R1 by the LDR address 00000110 ₁₀ ? What hex address did that value come from? Step 2: Press F2 exactly 2 times to execute the LDR RD, [R1, 44]. What hex address did that value come from? What hex address did that value come from? Occord to Cord Cord Cord Cord Occord Occ	What hex <u>address</u> did that value come from?	0000010C
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MARKET WINDEN A RELIGIOUS AND SECONDARY SECOND	What hex <u>address</u> is left in R1 by the LDR instruction at address 00000130 ₁₆ ?	0000 108