Tutorial 09: ARM Pseudo Instructions

Computer Science Department
CS2208: Introduction to Computer Organization and Architecture
Winter 2021-2022
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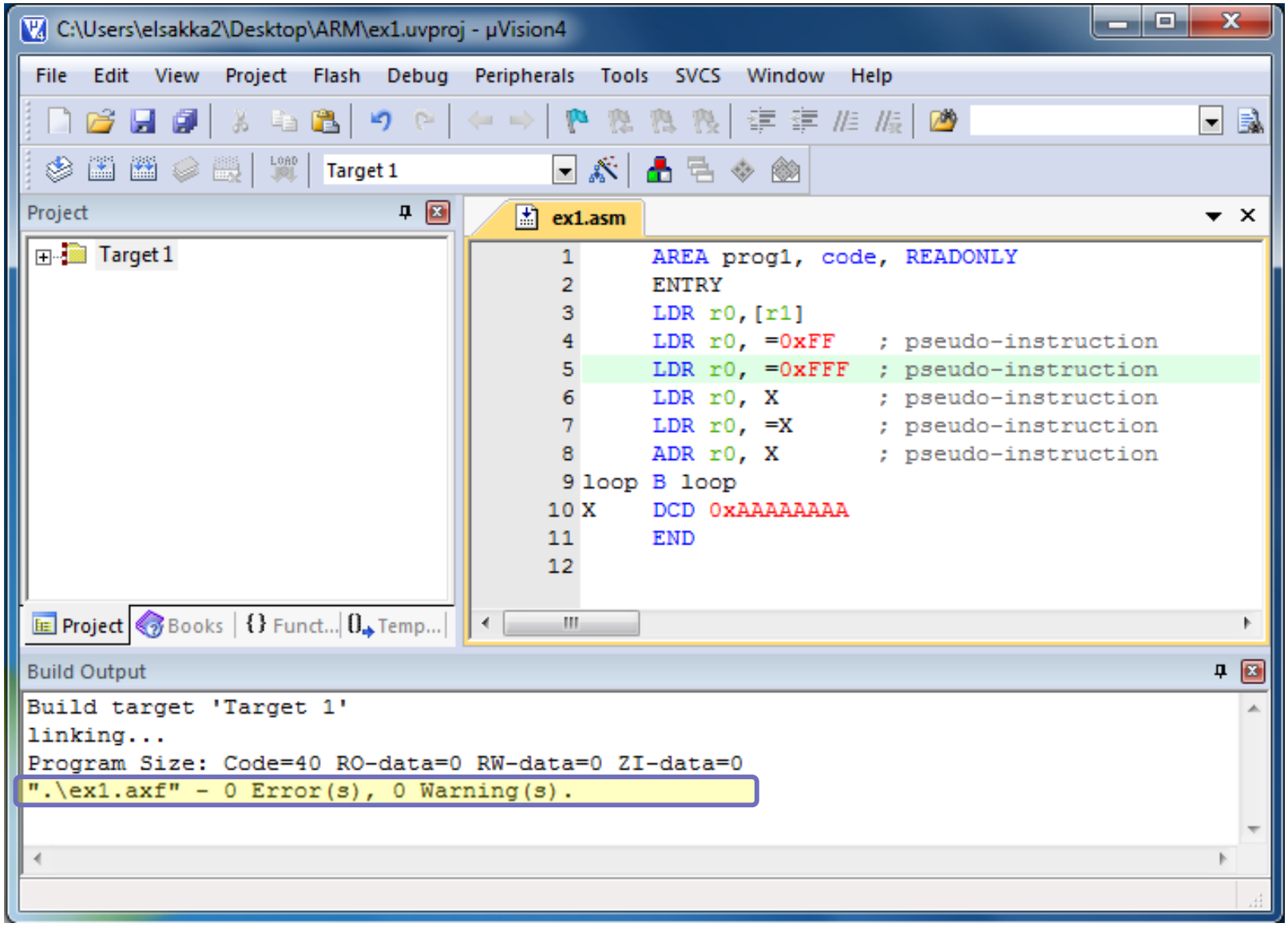
ARM pseudo-instructions

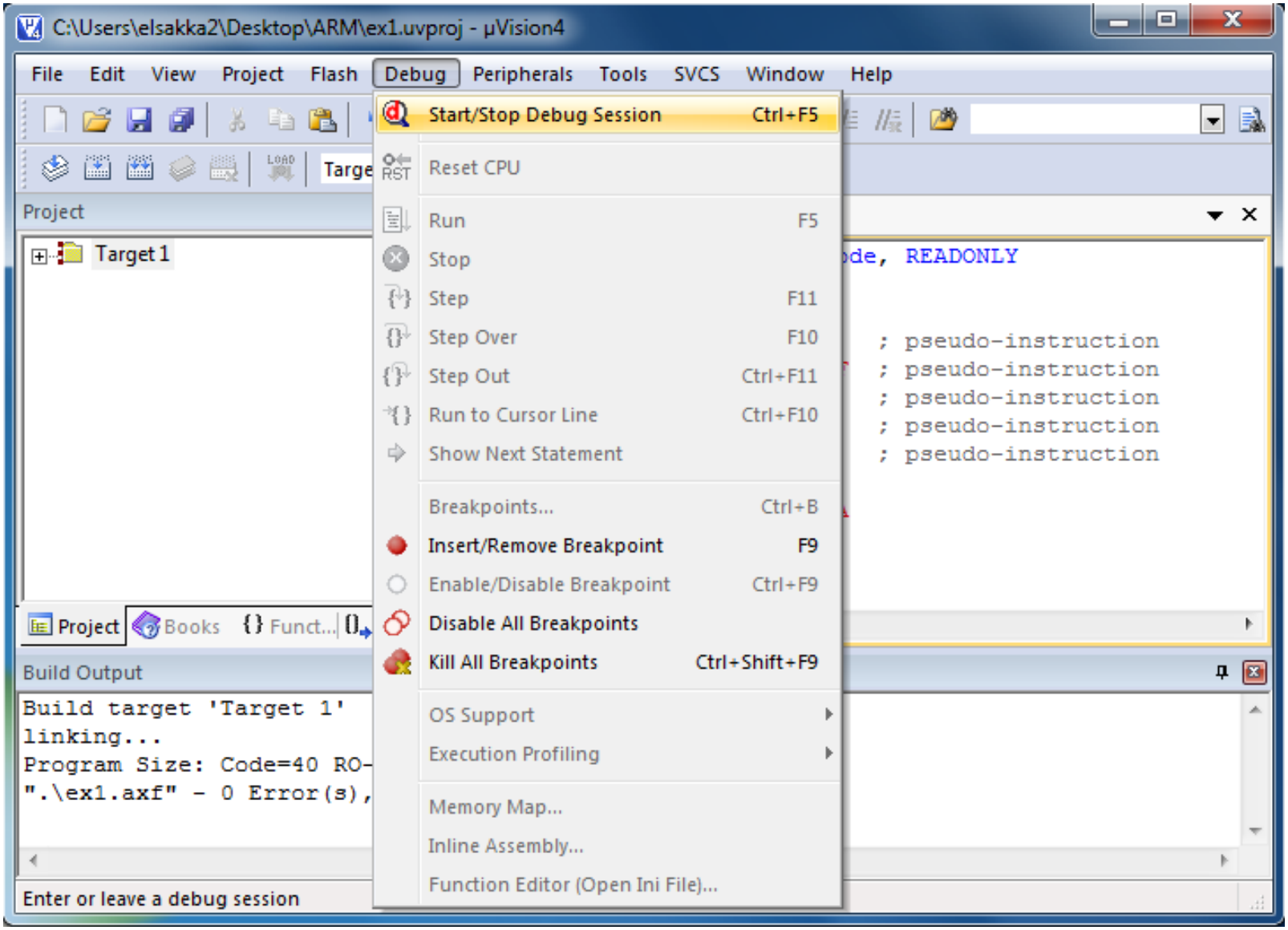
- The ARM assembler supports several *pseudo instructions* that are translated into the appropriate combination of ARM words at assembly time.
- Consider the following assembly program:

```
      AREA prog1, code, READONLY
      ENTRY
      LDR r0,[r1]
      LDR r0, =0xFF    ; pseudo-instruction
      LDR r0, =0xFFF   ; pseudo-instruction
      LDR r0, X        ; pseudo-instruction
      LDR r0, =X       ; pseudo-instruction
      ADR r0, X        ; pseudo-instruction
loop  B loop
X     DCD 0xAAAAAAAA
      END
```

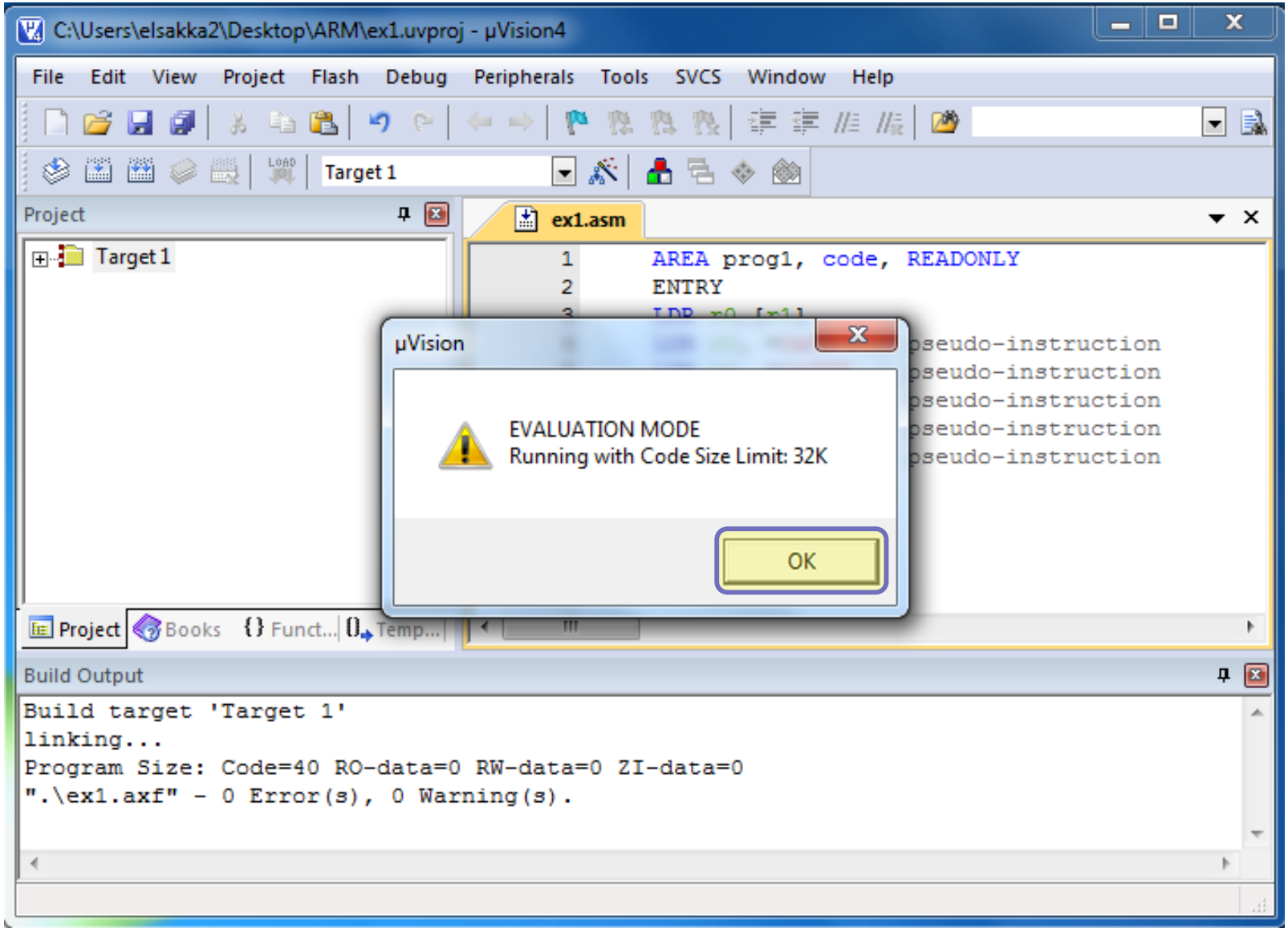
ARM pseudo-instructions



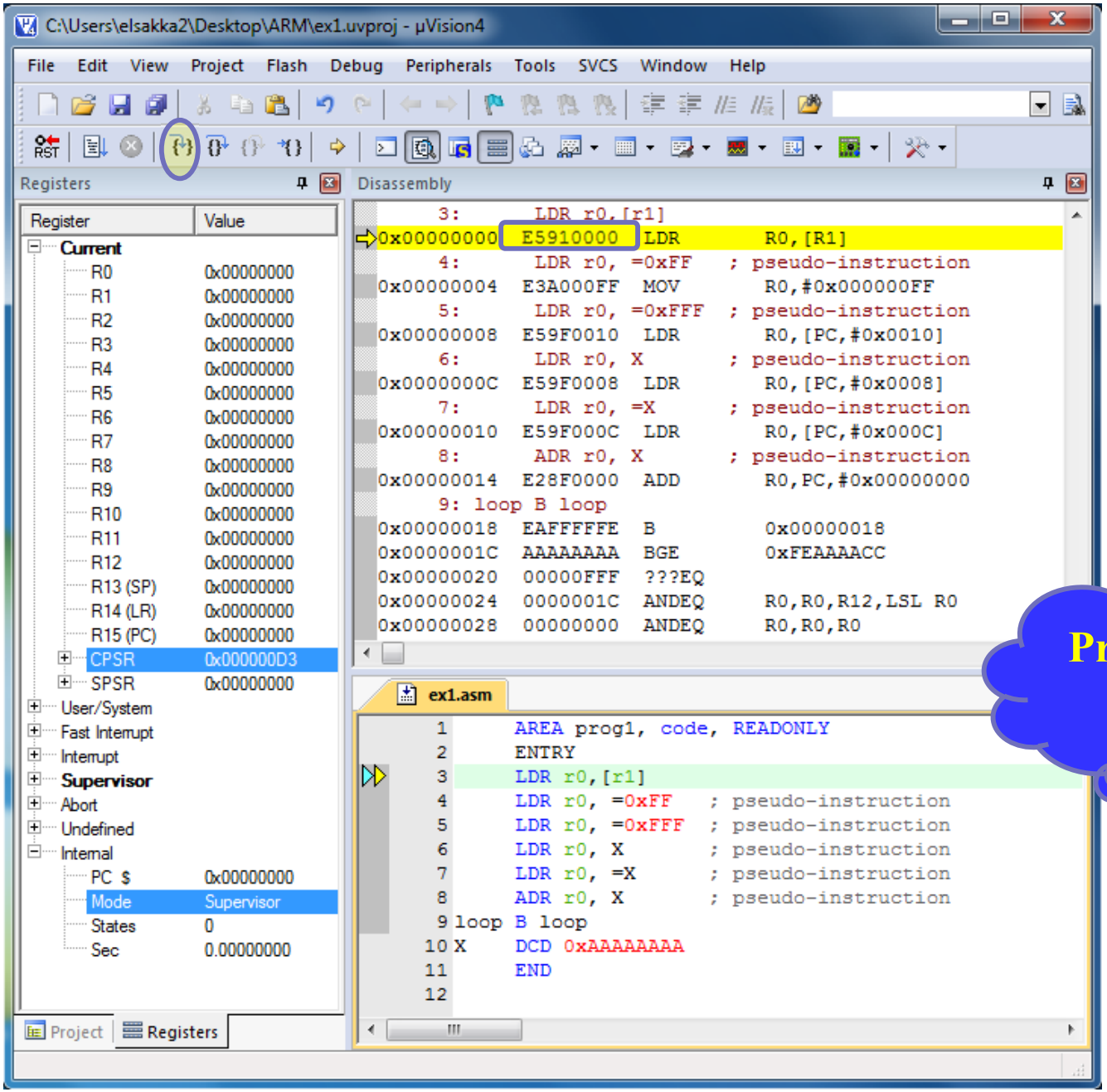
ARM pseudo-instructions



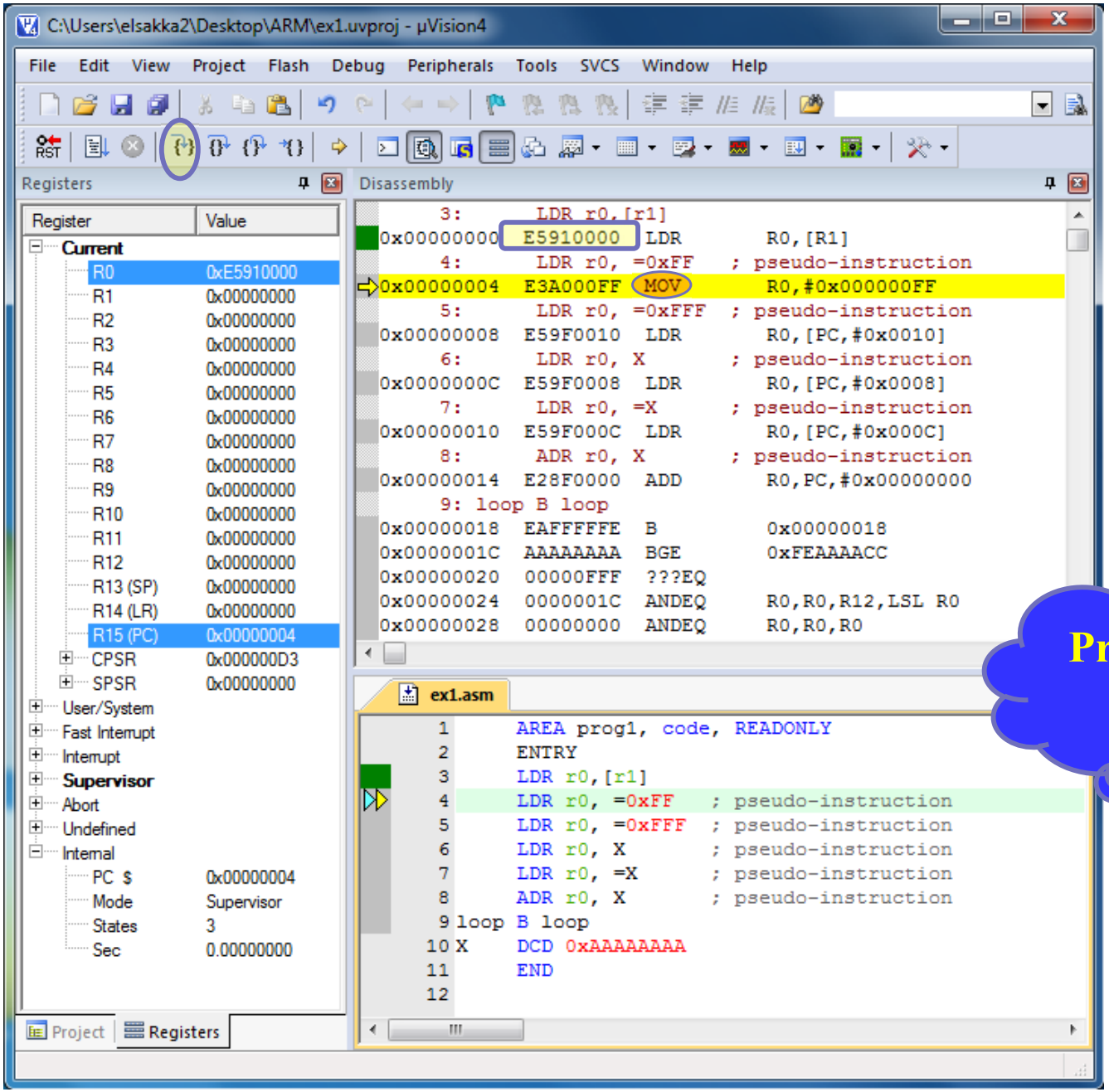
ARM pseudo-instructions



ARM pseudo-instructions



ARM pseudo-instructions

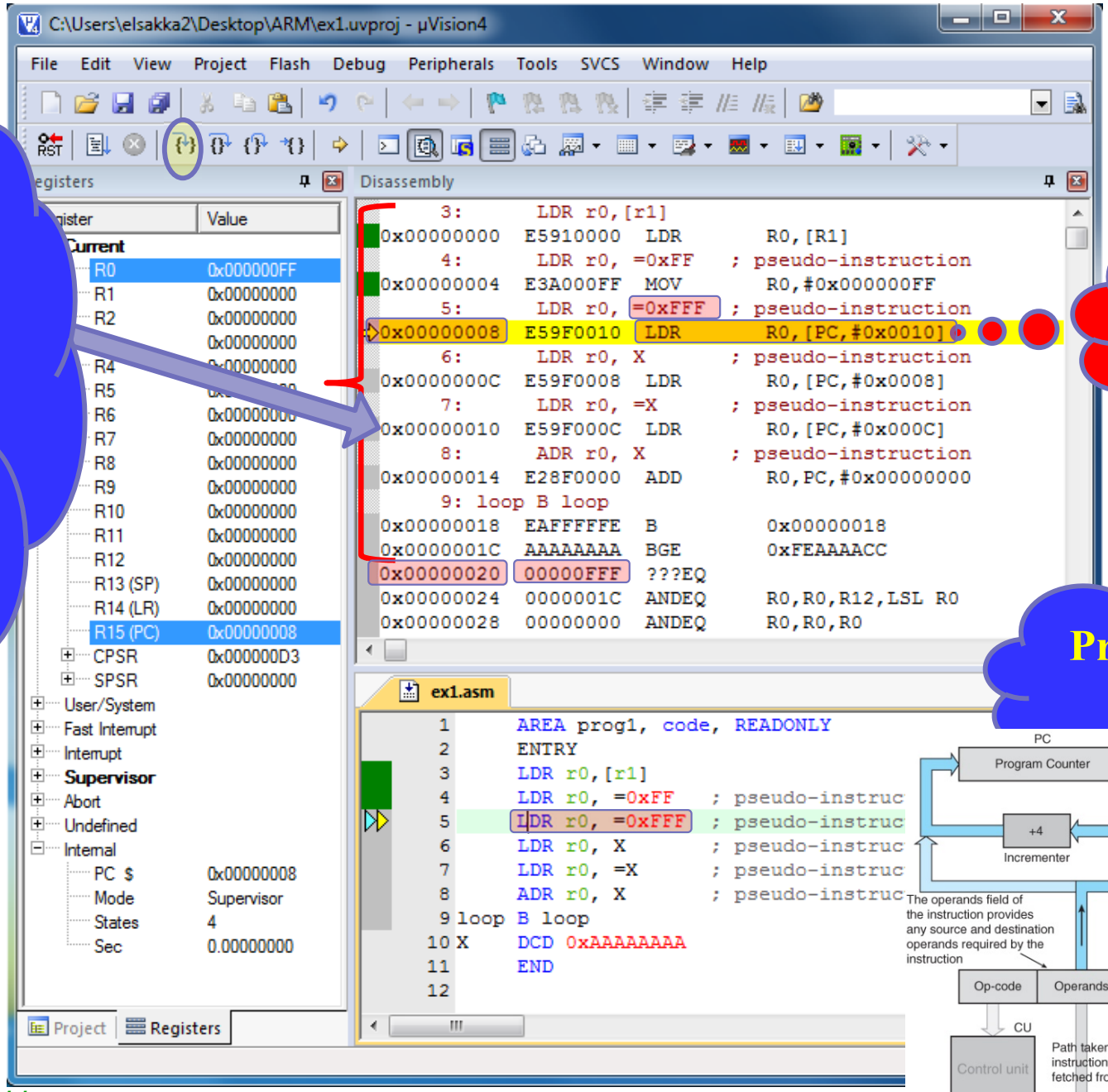


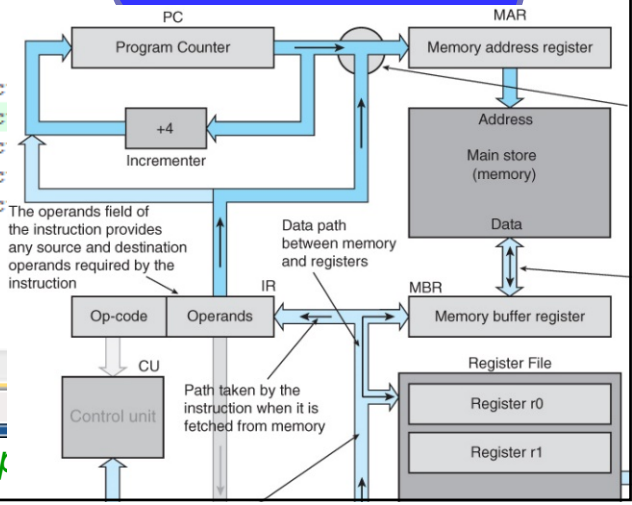
ARM pseudo-instructions

When executing the instruction at location 0x00000008, the PC value will be 0x00000010

How is this offset calculated?

Press Step, or F11



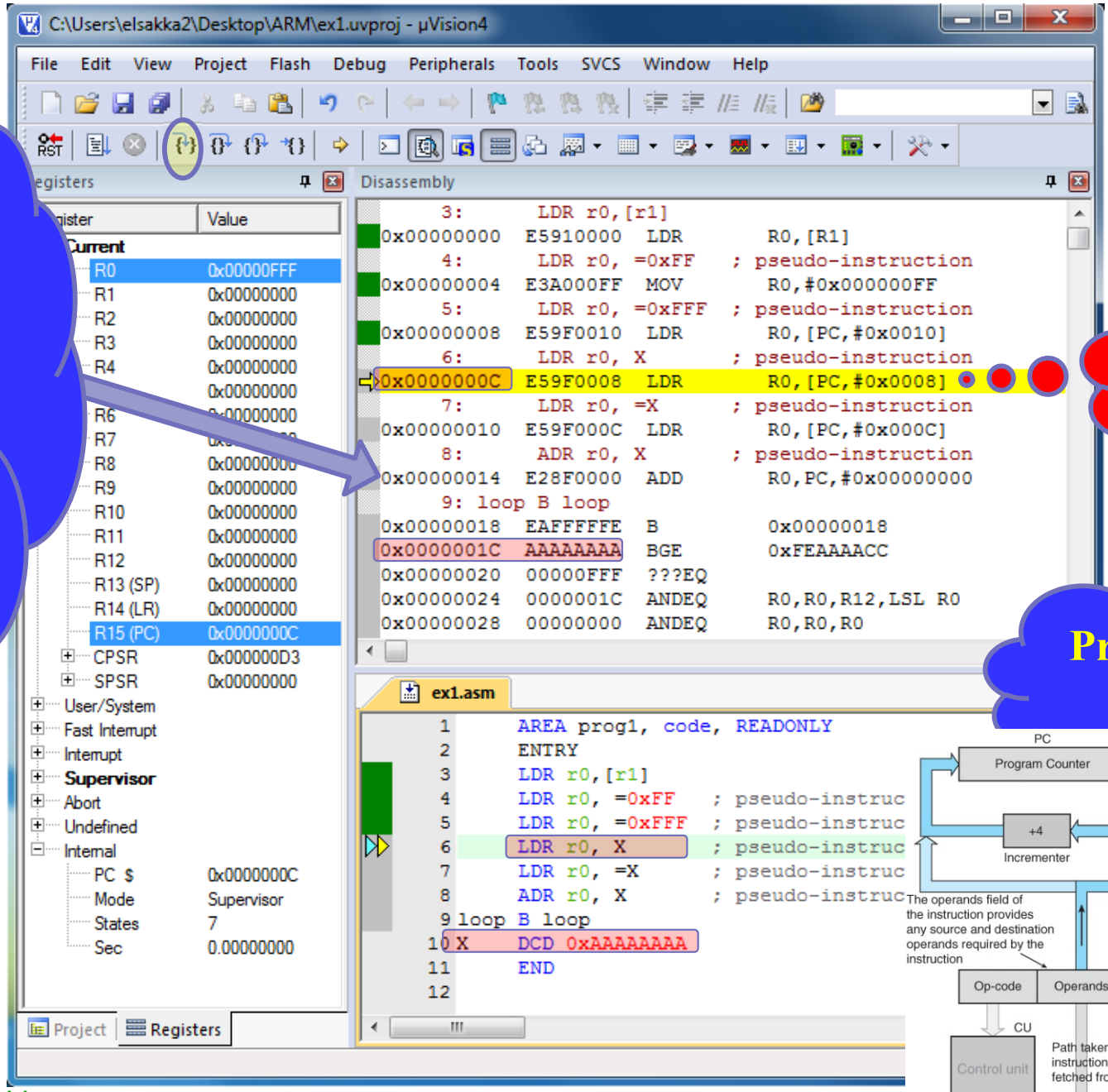


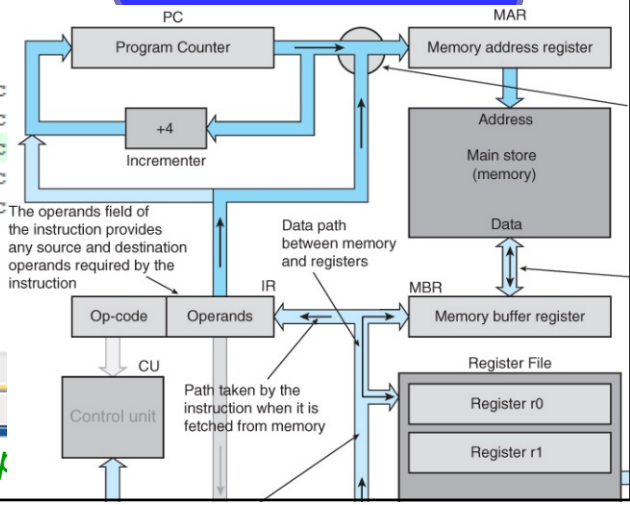
ARM pseudo-instructions

When executing the instruction at location 0x0000000C, the PC value will be 0x00000014

How is this offset calculated?

Press Step, or F11



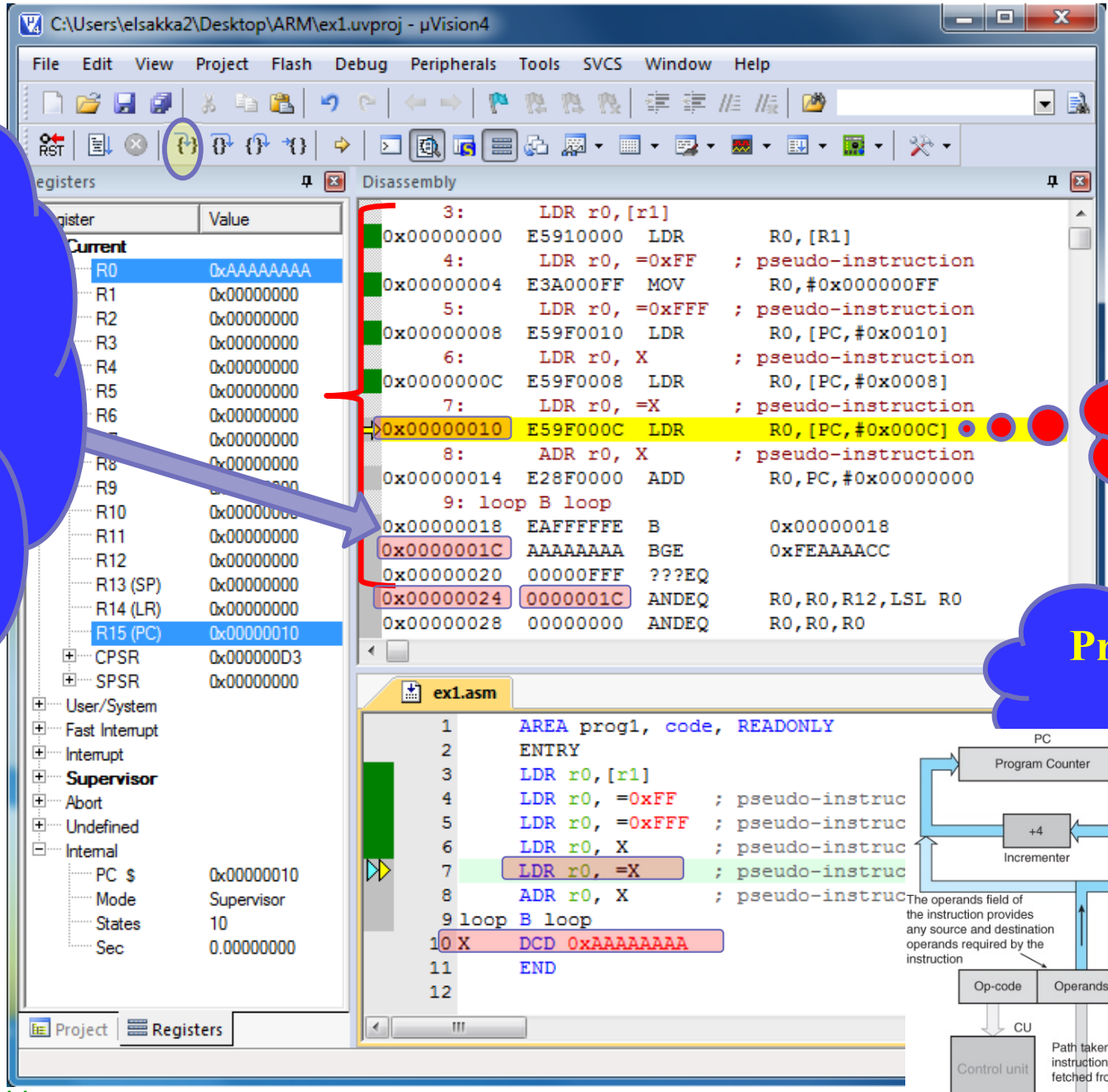


ARM pseudo-instructions

When executing the instruction at location 0x00000010, the PC value will be 0x00000018

How is this offset calculated?

Press Step, or F11



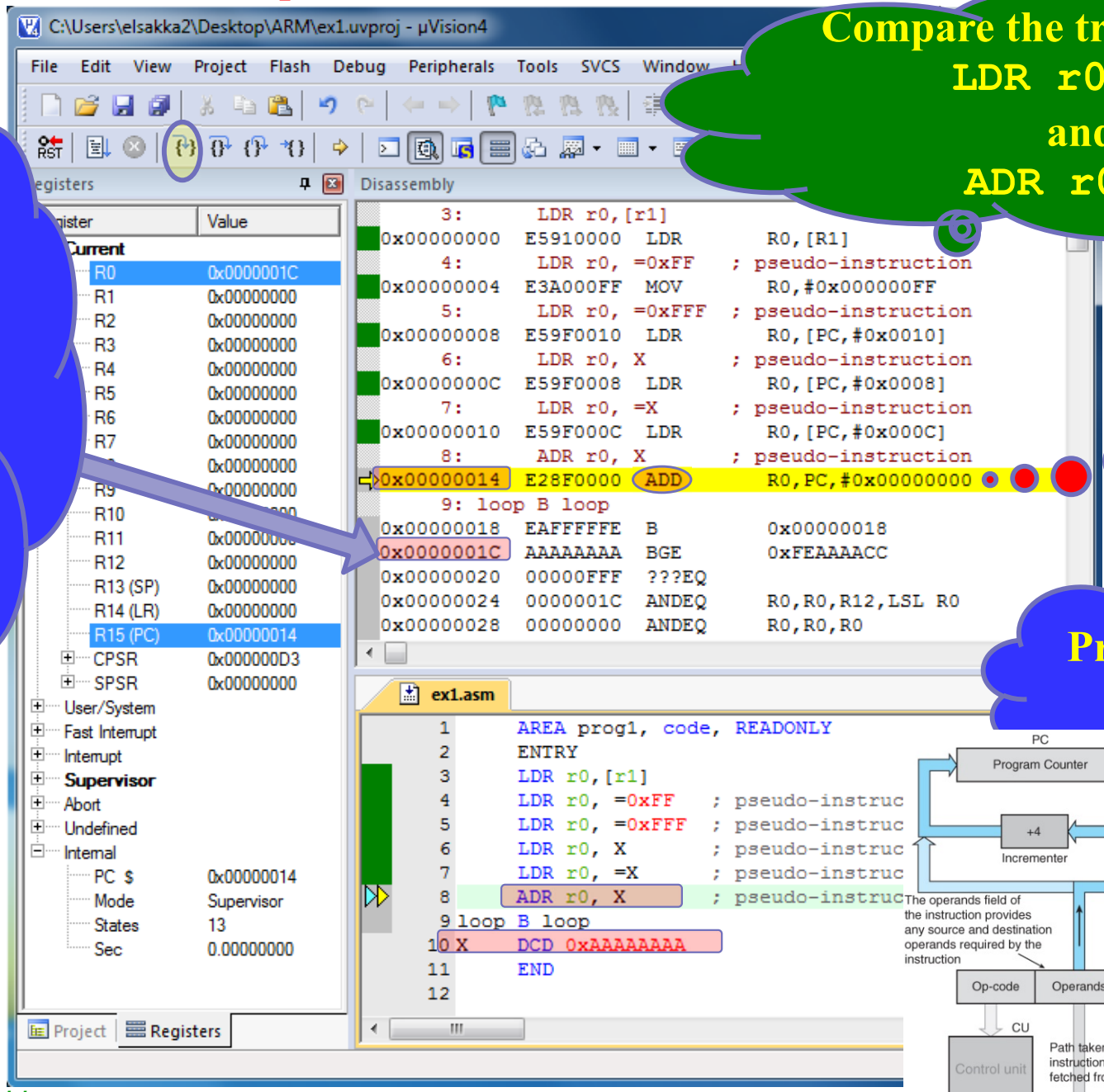
ARM pseudo-instructions

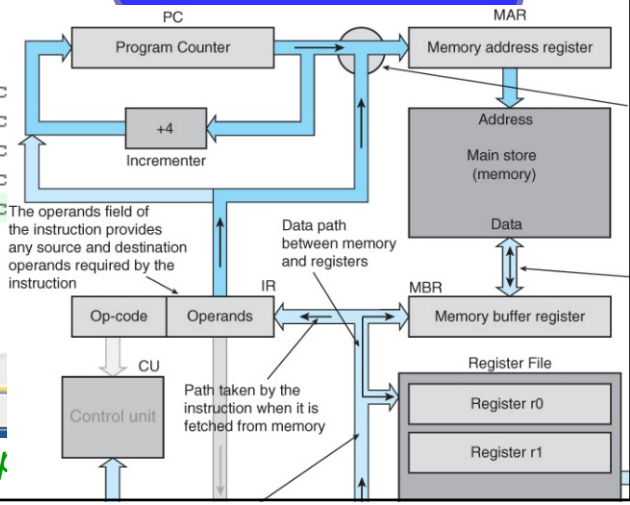
When executing the instruction at location 0x00000014, the PC value will be 0x0000001C

Compare the translations of `LDR r0, =X` and `ADR r0, X`

How is this offset calculated?

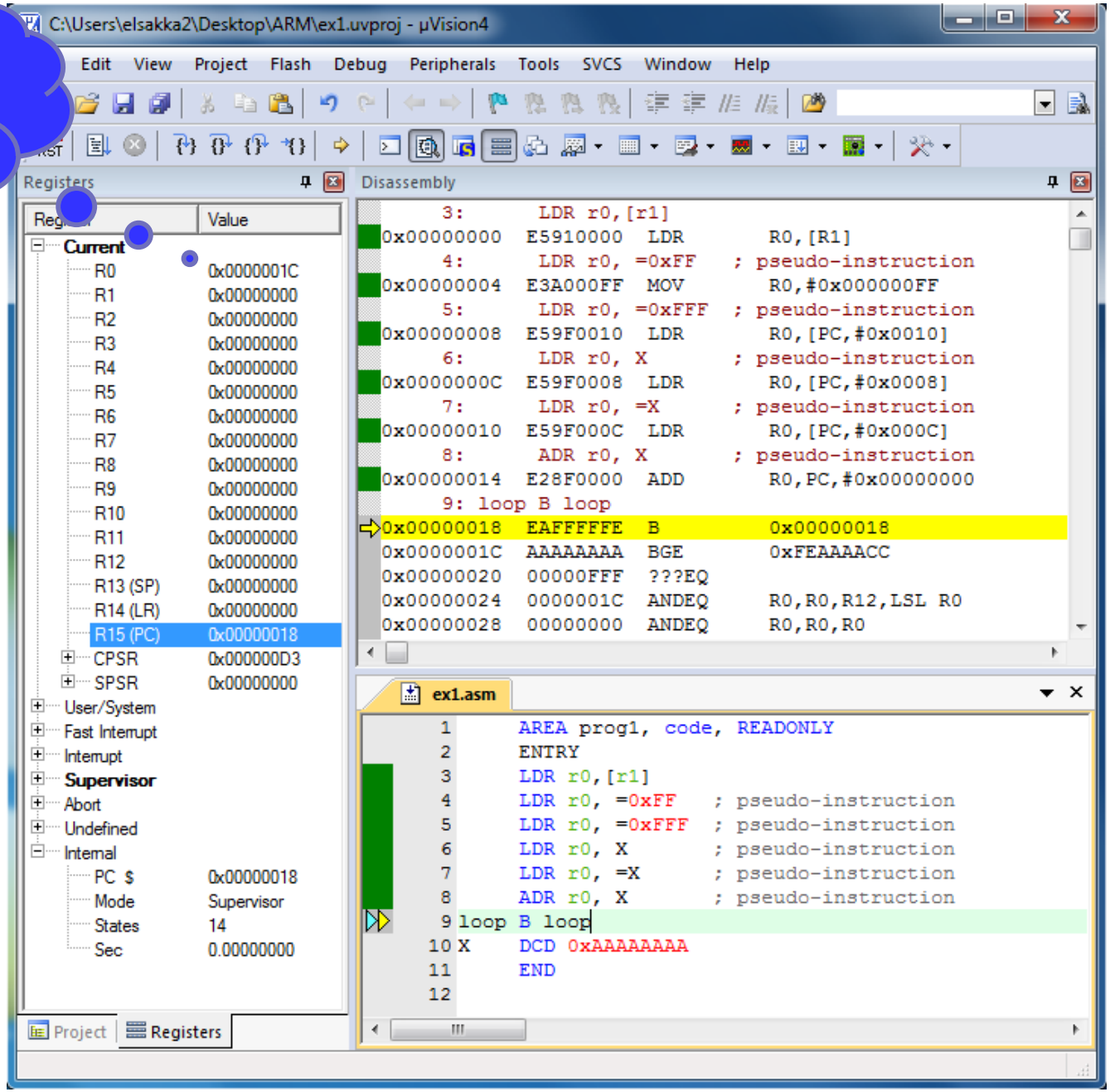
Press Step, or F11





ARM pseudo-instructions

Same address (no change)



ARM pseudo-instructions

- Consider we changed the previous program as follow:

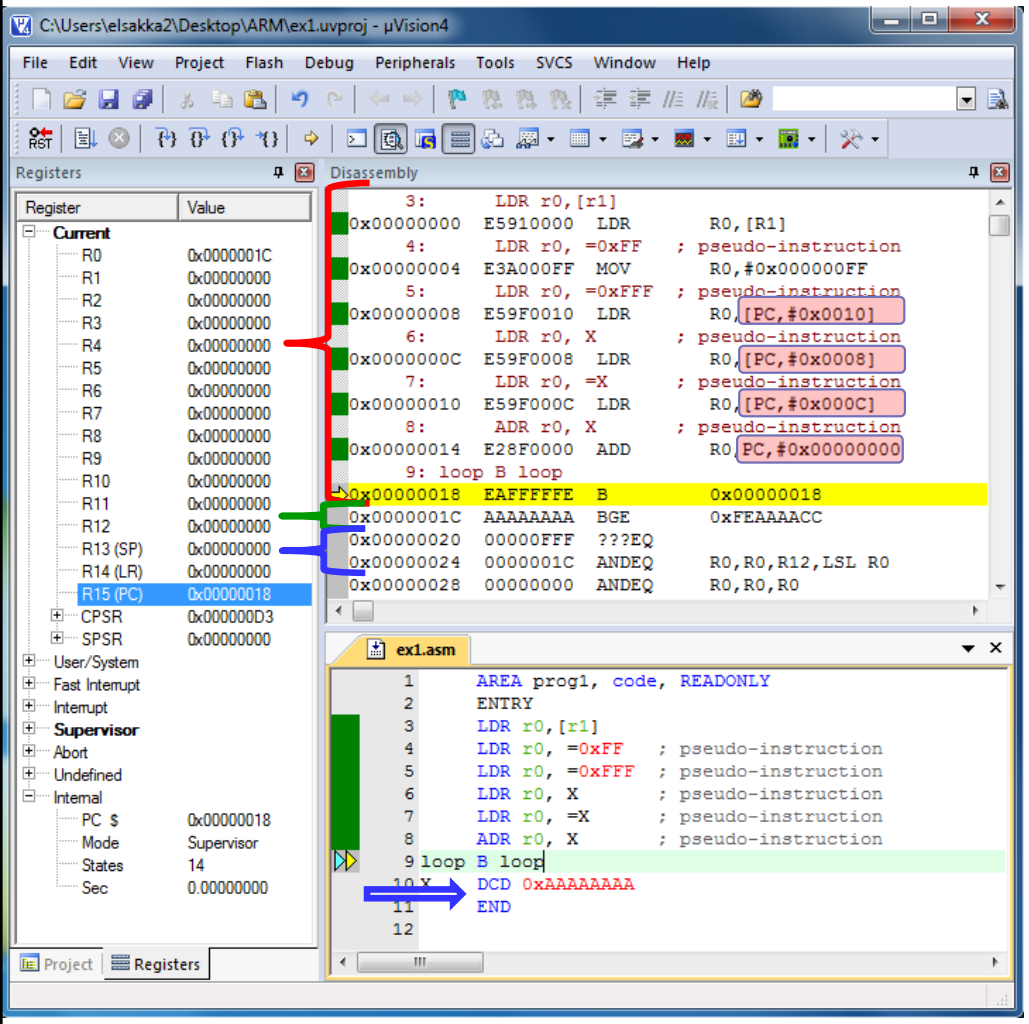
```
AREA prog1, code, READONLY
     ENTRY
     LDR r0,[r1]
     LDR r0, =0xFF    ; pseudo-instruction
     LDR r0, =0xFFF   ; pseudo-instruction
     LDR r0, X        ; pseudo-instruction
     LDR r0, =X       ; pseudo-instruction
     ADR r0, X        ; pseudo-instruction
loop B loop
X    DCD 0xAAAAAAAA
     END
```

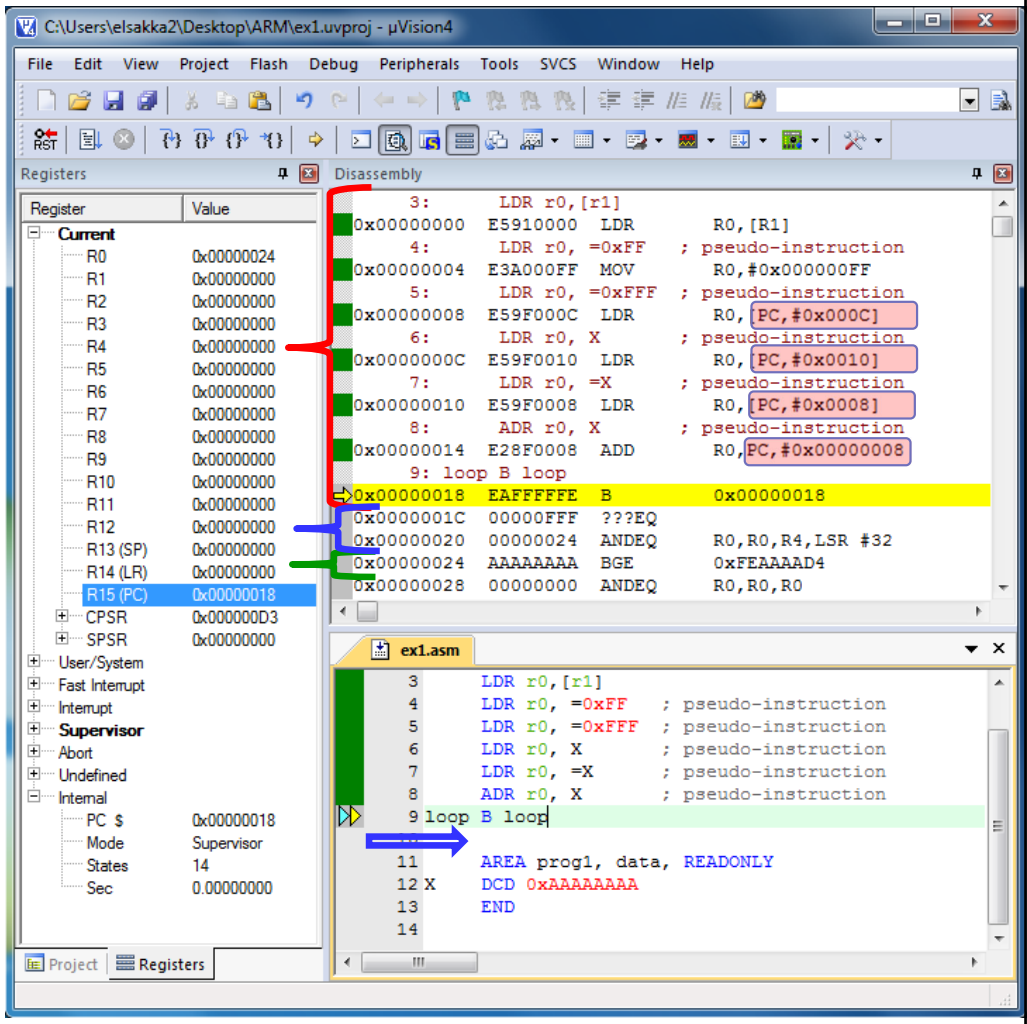
```
     AREA prog1, code, READONLY
     ENTRY
     LDR r0,[r1]
     LDR r0, =0xFF    ; pseudo-instruction
     LDR r0, =0xFFF   ; pseudo-instruction
     LDR r0, X        ; pseudo-instruction
     LDR r0, =X       ; pseudo-instruction
     ADR r0, X        ; pseudo-instruction
loop B loop

     AREA prog1, data, READONLY
X    DCD 0xAAAAAAAA
     END
```

- What is the effect of this change on the generated code?

ARM pseudo-instructions



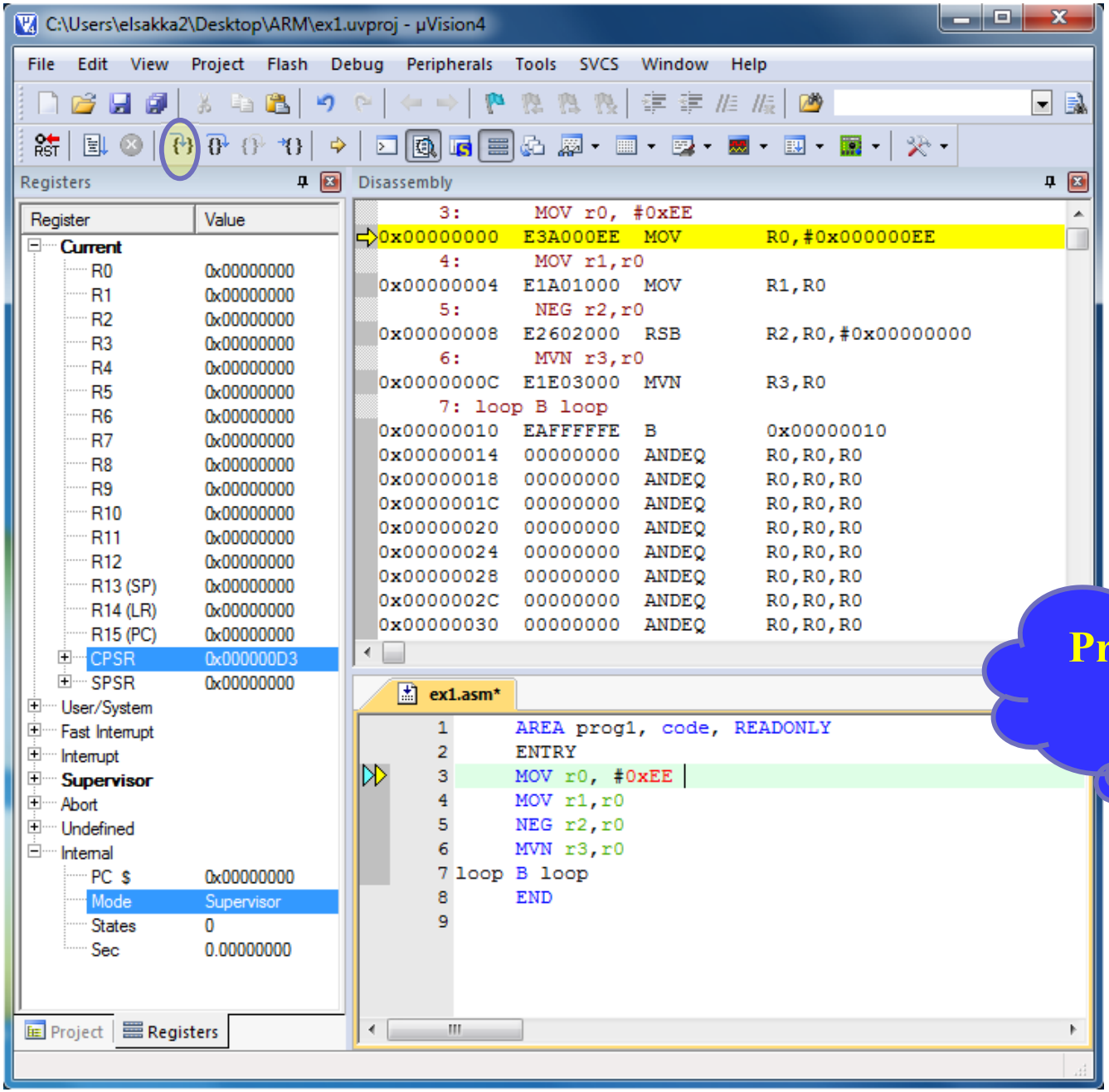


ARM pseudo-instructions

- Consider the following assembly program:

```
      AREA prog1, code, READONLY
      ENTRY
      MOV r0, #0xEE
      MOV r1,r0
      NEG r2,r0
      MVN r3,r0
loop  B loop
      END
```

ARM pseudo-instructions



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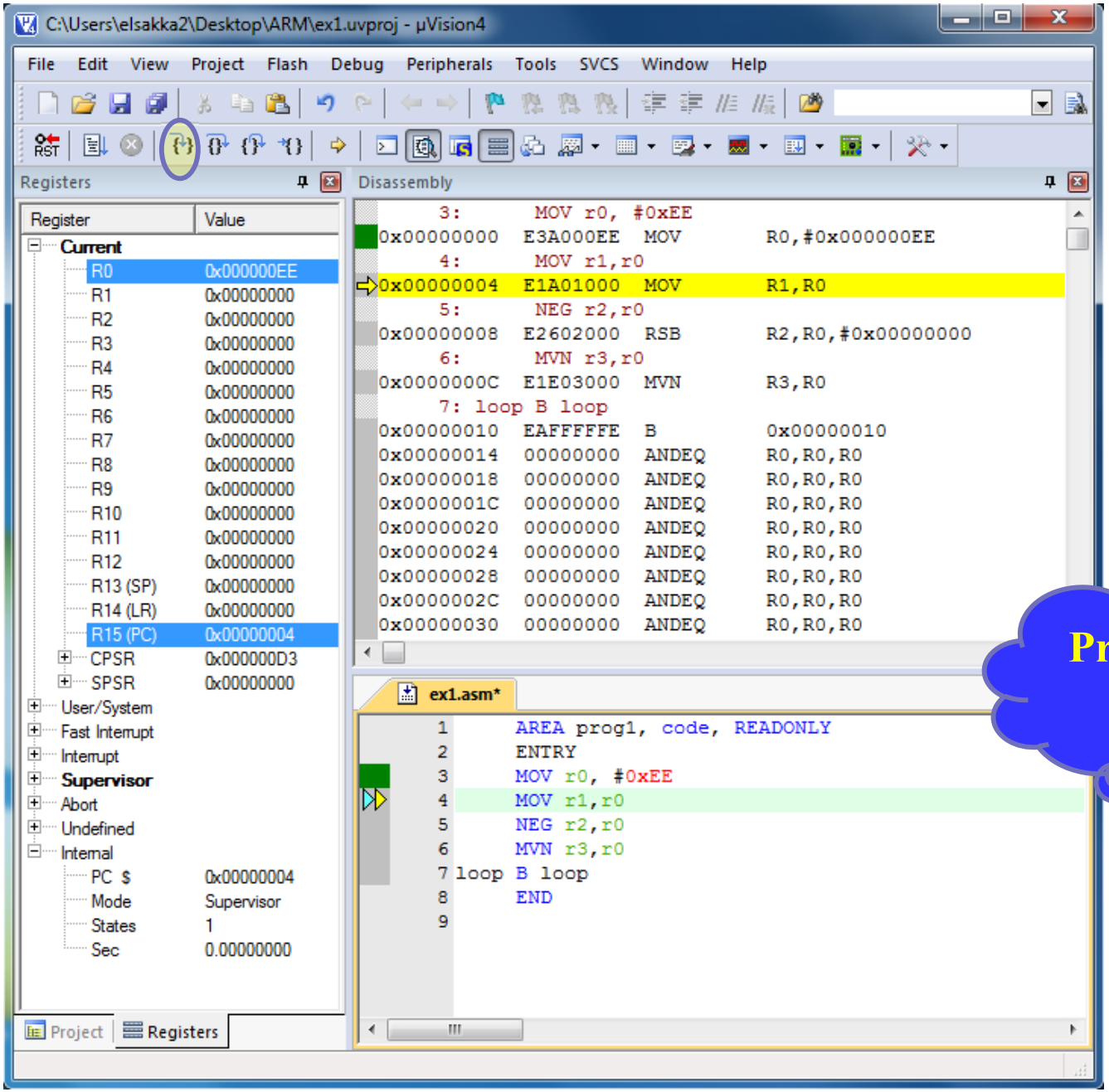

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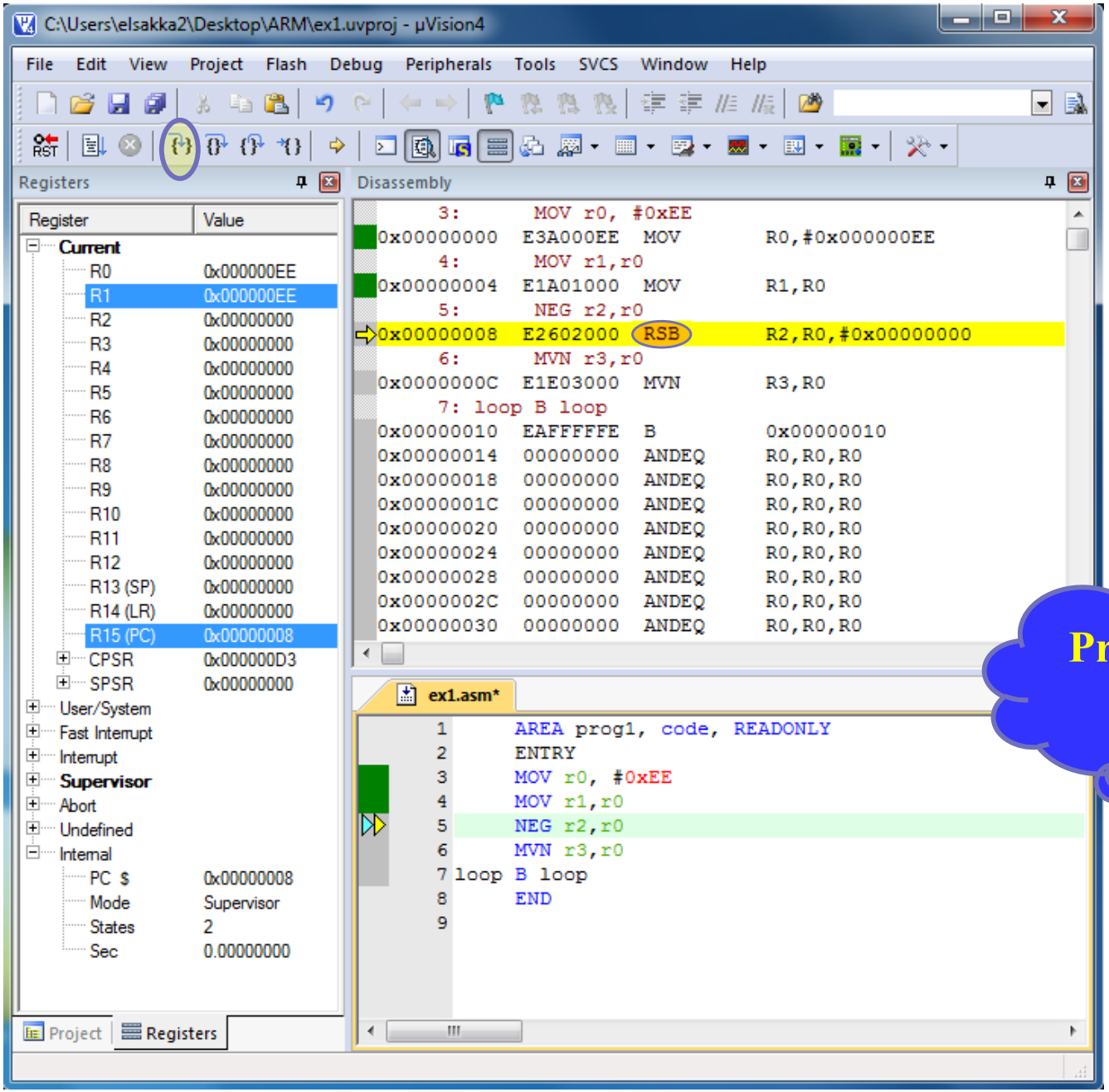

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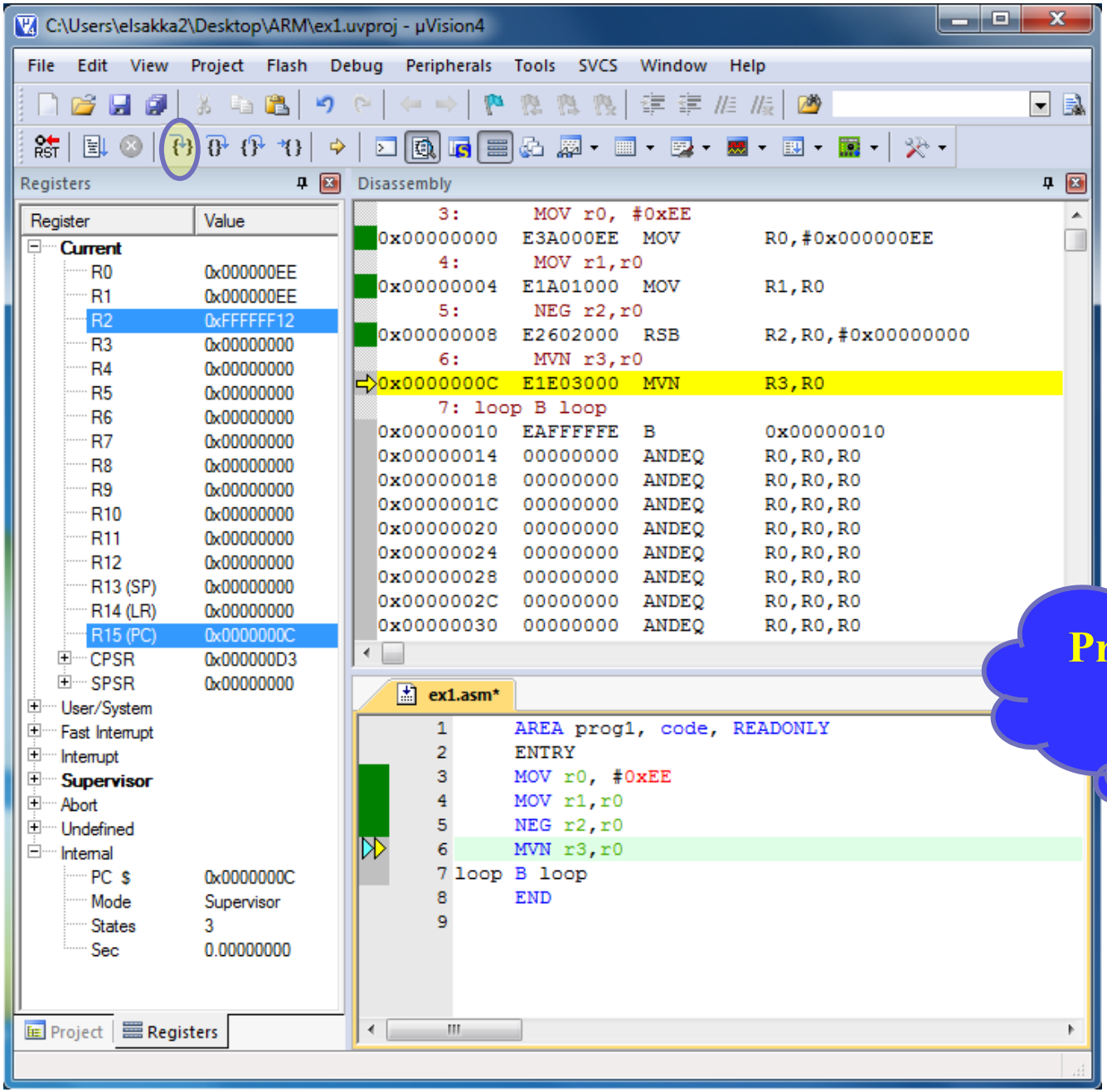

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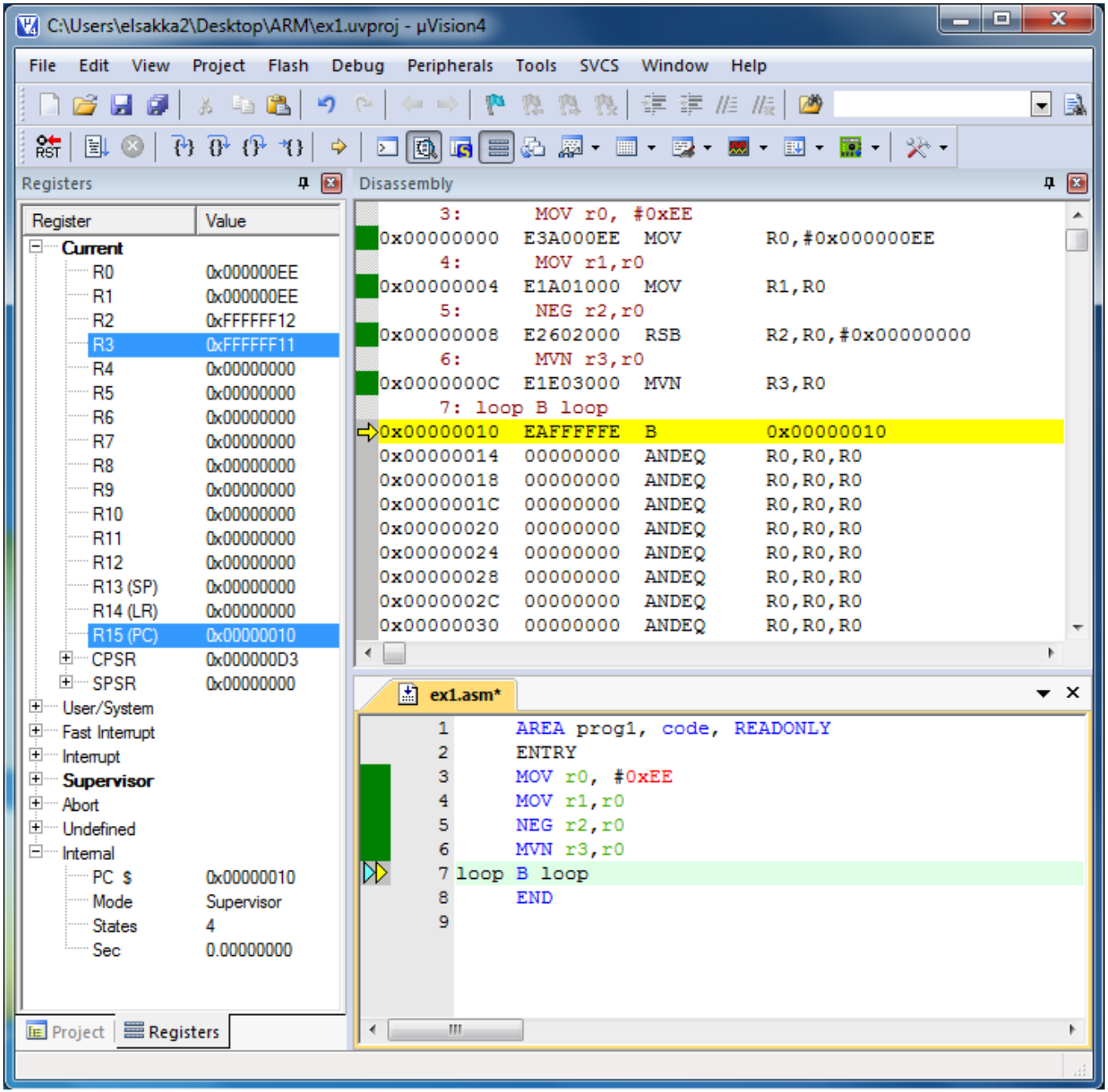

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```
 AREA prog1, code, READONLY
     ENTRY
     MOV r0, #0xEE
     MOV r1,r0
     NEG r2,r0
     MVN r3,r0
loop B loop
     END
```

```
 AREA prog1, code, READONLY
     ENTRY
     MOV r0, #-0xEE
     MOV r1,r0
     NEG r2,r0
     MVN r3,r0
loop B loop
     END     END
```

- What is the effect of this change on the generated code?

ARM pseudo-instructions