

Homework 3

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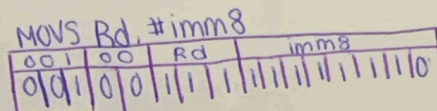
Q1.

8421

1. 0x27FE

0010 0111 1111 1110

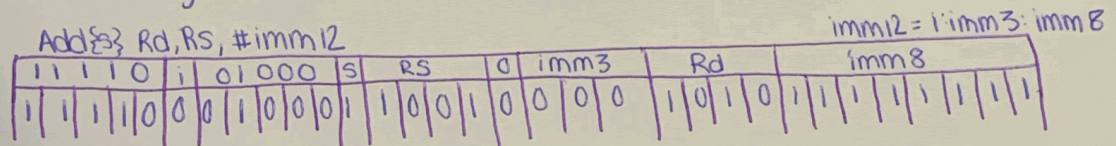
= binary: 0010 0111 1111 1110



2. 0xF1190AFF

1111 0001 0001 1001 0000 1010 1111 1111

= binary: 1111 0001 0001 1001 0000 1010 1111 1111



Q2. Multiplication w/shift instructions

MOV R0, #100

MUL R2, R1, R0

$$100 = 2^6 + 2^5 + 2^2$$

$$= 64 + 32 + 4$$

$$R1 \times 64$$

$$R1 \times 32$$

$$R1 \times 4$$

LSL R3, R1, #6
 LSL R4, R1, #5
 LSL R5, R1, #2
 ADD R2, R3, R4
 ADD R2, R2, R5

Q3.

Address	Contents
0x60000000	DRAM
0x40000000	Peripherals
0x20000008	SRAM
0x20000000	STACK
	...
	R3, [R0], #1
0x00000014	R2, =dst
0x00000012	R1, =src1
0x00000010	R0, =src0
0x0000000C	String "SSC" <- (explanation:CSS)
0x00000008	String "BWU" <- (explanation:UWB)
0x00000004	00000011
0x00000000	20000108

Q4. Source Code + Screen Shots:

```
        ; left  right  value
node1 DCD  0x10C, 0x130, 4
node2 DCD  0x118, 0x124, 2
node3 DCD  0, 0, 1
node4 DCD  0, 0, 3
node5 DCD  0x13C, 0x148, 6
node6 DCD  0, 0, 5
node7 DCD  0, 0, 7
root  DCD  node1
```

```
    LDR    R1, =0x100
    LDR    R0, =0
```

loop

```
    LDR    R2, [R1, #8]
    CMP    R0, R2
    BEQ    found
    BLT    goLeft
    BGT    goRight
```

goLeft

```
    LDR    R3, [R1]
    CMP    R3, #0
    BEQ    notFound
    MOV    R1, R3
    B      loop
```

goRight

```
    LDR    R3, [R1, #4]
    CMP    R3, #0
    BEQ    notFound
    MOV    R1, R3
    B      loop
```

found

```
    MOV    R1, R1
    MOV    PC, LR
```

notFound

```
    MOV    R1, #0
    MOV    PC, LR
```

```
END
```

Test Case 1 :

untitled.S - [Unsaved] - Visual Studio Code

Emulation Running Line Issues 17 0

Execute Reset Step Backwards Step Forwards

```
9 root DCD node1
10
11 LDR R1, #0x100
12 LDR R0, #0
13
14 loop LDR R2, [R1, #8]
15 CMP R0, R2
16
```

View Memory Contents

Start address: 0x100 End address: 0x1100

Word Address	Byte 3	Byte 2	Byte 1	Byte 0	Word Value
0x100	0x0	0x0	0x1	0xC	0x10C
0x104	0x0	0x0	0x1	0x30	0x130
0x108	0x0	0x0	0x0	0x4	0x4
0x10C	0x0	0x0	0x1	0x18	0x118
0x110	0x0	0x0	0x1	0x24	0x124
0x114	0x0	0x0	0x0	0x2	0x2
0x118	0x0	0x0	0x0	0x0	0x0
0x11C	0x0	0x0	0x0	0x0	0x0
0x120	0x0	0x0	0x0	0x1	0x1

Word Value Format Dec Hex Memory Map Key Instructions Data

39 notFound

```
40 MOV R1, #0
41 MOV PC, LR
42
43 END
44
```

R0 0x0 Dec Bin Hex

R1 0x10C Dec Bin Hex

R2 0x2 Dec Bin Hex

R3 0x10C Dec Bin Hex

R4 0x0 Dec Bin Hex

R5 0x0 Dec Bin Hex

R6 0x0 Dec Bin Hex

R7 0x0 Dec Bin Hex

R8 0x0 Dec Bin Hex

R9 0x0 Dec Bin Hex

R10 0x0 Dec Bin Hex

R11 0x0 Dec Bin Hex

R12 0x0 Dec Bin Hex

R13 0xFF000000 Dec Bin Hex

LR 0x0 Dec Bin Hex

PC 0x20 Dec Bin Hex

Clock Cycles Current Instruction: 3 Total: 32658

CSRR Status Bits (NZCV) 1 0 0 0

Test Case 2

untitled.S - [Unsaved] - Visual Studio Code

Emulation Running Line Issues 23 0

Execute Reset Step Backwards Step Forwards

```
1 left right value
2 node1 DCD 0x10C, 0x130, 4
3 node2 DCD 0x118, 0x124, 2
4 node3 DCD 0, 0, 1
5 node4 DCD 0, 0, 3
6 node5 DCD 0x13C, 0x148, 6
7 node6 DCD 0, 0, 5
```

View Memory Contents

Start address: 0x100 End address: 0x1100

Word Address	Byte 3	Byte 2	Byte 1	Byte 0	Word Value
0x100	0x0	0x0	0x1	0xC	0x10C
0x104	0x0	0x0	0x1	0x30	0x130
0x108	0x0	0x0	0x0	0x4	0x4
0x10C	0x0	0x0	0x1	0x18	0x118
0x110	0x0	0x0	0x1	0x24	0x124
0x114	0x0	0x0	0x0	0x2	0x2
0x118	0x0	0x0	0x0	0x0	0x0
0x11C	0x0	0x0	0x0	0x0	0x0
0x120	0x0	0x0	0x0	0x1	0x1

Word Value Format Dec Hex Memory Map Key Instructions Data

```
30 CMP R3, #0
31 BEQ notFound
32 MOV R1, R3
33 B loop
34
35 found
36 MOV R1, R1
```

R0 0x5 Dec Bin Hex

R1 0x13C Dec Bin Hex

R2 0x6 Dec Bin Hex

R3 0x13C Dec Bin Hex

R4 0x0 Dec Bin Hex

R5 0x0 Dec Bin Hex

R6 0x0 Dec Bin Hex

R7 0x0 Dec Bin Hex

R8 0x0 Dec Bin Hex

R9 0x0 Dec Bin Hex

R10 0x0 Dec Bin Hex

R11 0x0 Dec Bin Hex

R12 0x0 Dec Bin Hex

R13 0xFF000000 Dec Bin Hex

LR 0x0 Dec Bin Hex

PC 0x3C Dec Bin Hex

Clock Cycles Current Instruction: 3 Total: 21490

CSRR Status Bits (NZCV) 0 0 1 0

Test Case 3

untitled.S - [Unsaved] - VisUAL

NewOpenSaveSettingsToolsEmulation RunningLine Issues 180ExecuteResetStep BackwardsStep Forwards

Reset to continue editing code

```
1 ; left right value
2 node1 DCD 0x10C,0x130,4
3 node2 DCD 0x118,0x124,2
4 node3 DCD 0,0,1
5 node4 DCD 0,0,3
6 node5 DCD 0x13C,0x148,6
7 node6 DCD 0,0,5
8 node7 DCD 0,0,7
9 root DCD node1
10
11 LDR R1,=0x100
12 LDR R0,=8
13
```

View Memory Contents

Start address: 0x100End address: 0x1100Memory Map

Word Address	Byte 3	Byte 2	Byte 1	Byte 0	Word Value
0x100	0x0	0x0	0x1	0xC	0x10C
0x104	0x0	0x0	0x1	0x30	0x130
0x108	0x0	0x0	0x0	0x4	0x4
0x10C	0x0	0x0	0x1	0x18	0x118
0x110	0x0	0x0	0x1	0x24	0x124
0x114	0x0	0x0	0x0	0x2	0x2
0x118	0x0	0x0	0x0	0x0	0x0
0x11C	0x0	0x0	0x0	0x0	0x0
0x120	0x0	0x0	0x0	0x1	0x1

Word Value FormatDecHexMemory Map KeyInstructionsData

R0	0x8	Dec	Bin	Hex
R1	0x148	Dec	Bin	Hex
R2	0x6	Dec	Bin	Hex
R3	0x148	Dec	Bin	Hex
R4	0x0	Dec	Bin	Hex
R5	0x0	Dec	Bin	Hex
R6	0x0	Dec	Bin	Hex
R7	0x0	Dec	Bin	Hex
R8	0x0	Dec	Bin	Hex
R9	0x0	Dec	Bin	Hex
R10	0x0	Dec	Bin	Hex
R11	0x0	Dec	Bin	Hex
R12	0x0	Dec	Bin	Hex
R13	0xFF000000	Dec	Bin	Hex
LR	0x0	Dec	Bin	Hex
PC	0x54	Dec	Bin	Hex

Clock CyclesCurrent Instruction: 3 Total: 25982

CSPR Status Bits (NZCV)0010

26 MOV R1,R1