COEN 020 Name: _____ Fall 2017

Quiz #6
Monday, October 30th

1. [5 pts ea] Each of the following multiplies the integer in R0 by a constant. Identify the constant.

   a. `RSB R0,R0,R0,LSL 5` — **31**

   b. `SUB R0,R0,R0,LSL 3` — **-7**

2. [5 pts ea] Suppose you need to divide an unsigned 8-bit integer variable x by the decimal constant 11_{10}, but there is no divide instruction.

   a. If you use reciprocal multiplication, what constant should you multiply times x? — **23**

   b. Give a sequence of ARM instructions that uses reciprocal multiplication to compute $y = x/11$.

```
LDRB   R0,x
LDR    R1,=23
MUL    R0,R0,R1
LSR    R0,R0,8
STRB   R0,y
```

3. [5 pts ea] Give a single instruction that creates the indicated multiple of R0 using no multiply instruction.

   a. $R0 \leftarrow 9 \times R0$ — `ADD R0,R0,R0,LSL 3`

   b. $R0 \leftarrow 7 \times R0$ — `RSB R0,R0,R0,LSL 3`

4. [5 pts] Give a single instruction that copies either 0 or -1 into R1 as follows:

$$R1 = \begin{matrix} 0 & if\ R0 \geq 0, or \\ -1 & if\ R0 < 0 \end{matrix}$$

   `ASR R1,R0,31`

5. [5 pts] Give a single instruction that copies the following value into R2:

$$R2 = \begin{matrix} 0 & if\ R0 \geq 0, or \\ R1 & if\ R0 < 0 \end{matrix}$$

   `AND R2,R1,R0,ASR 31`

6. [5 pts] Give a C expression that computes $x\ mod\ 8$.

```
X & 7
```

7. [5 pts] What integer constant must be added to an odd negative number before shifting it right arithmetically by 1 bit position to effectively divide by 2?

   +1