Tutorial 4

Question 1: Instruction sets (4)

a) Why is Thumb-2 considered a better instruction set than both Thumb and ARM?

b) Why are we able to use the lsb of the PC for specifying instruction set? (Is it not necessary for pointing to instructions?)

(2 x 2 = 4)

Question 2: Loop timing (4)

a) Assuming we have the following block of code, how many cycles will it take until the label *somewhere_else* is branched to. Calculations please.

```
        MOVS R3, #0
loop:   ADDS R3, R3, #3
        MOVS R4, #0xFF
        CMP R3, R4
        BEQ somewhere_else
        B loop
```

(3)

b) On our processor, how much time does that equate to? (1)

Question 3: Flags (12)

a) Assuming we have data stored in 32 bit registers which we are treating as signed values, what is the result of:

1 147 483 647 + 1 234 567 890 (1)

b) Write down a calculation which would set the V and N flags, but not the C or Z flag. (1)

c) Write down a calculation which would set the V and C flag. (1)

d) Is it possible for an instruction to set both the N and Z flags? Why or why not? (1)

Note: for the following, you do need to be familiar with certain pages of the ARMv6-M Architecture Reference Manual.

Which flags would be set, which would be cleared and which would be left unchanged by:

	Instruction:	Rn	Rm	See page:
e)	ANDS	0x8200 0000	0x7D00 0000	101, 116
f)	ADDS	0x1FFF FFFF	0xE000 0001	110, 35
g)	SUBS	0x8200 0000	0x8200 0000	187
h)	CMP	0	1	129

(4 x 2 = 8)

Question 4: (2)

a) Why is the following set of instructions invalid?

```
LDR R0, =0x0800 1FFF
LDR R0, [R0]
```

b) What is the difference between the following two instructions:

```
LDR R0, foobar
LDR R0, =foobar
```

Question 5: (2)

Write a sequence of instruction which will branch to the instruction labeled *`foo`* if the value in R0 is greater than or equal to the value in R1 when treated as unsigned numbers, and branch to the instruction labeled *`bar`* otherwise.

Bonus: (1)

Write a sequence of instructions set R0 to:
0.26953125 x R1, rounded down to the nearest integer.

Marked out of: 24
Available marks: 25