Solutions: Tutorial 4 (25)

Question 1: (15)
a) -512 to 511 2 marks

b) Z = 0,	N = 1,	C = 0,	V = 0 10 marks
c) Z = 1,	N = 0,	C = 1, V = 0	
d) Z = 0	N = 1,	C = 0,	V = 0
e) Z = 0	N = 0	C = 1	V = 0
f) Z = 1,	N = 0,	C = 1,	V = 1

g) Fetches the single byte at the effective address supplied to the instruction. It then sign extends the byte to fill up a word in the target register. Sign extending is done by copying the msb (bit 7) of the loaded byte into into all bits from bit 31 down to bit 8. 2 marks
h) There is no difference in value; they are equal. 1 mark

Question 2: (5)
a) Either something which accesses an unimplemented memory address or something which performs an unaligned data access will do. 2 marks
b) Stop execution, push a few registers to the stack, fetch the data in the associated exception vector, load that data into the PC, continue execution from there. 2 marks
c) This gives us some defined behaviour when a hard fault occurs, rather than just getting the CPU into lockup. Also, we could potentially put some code in the handler which indicates to the user that the fault has occurred. 1 mark

Question 3: (5)
a) Loading an element from the somewhere in the stack into a register without popping it from the stack. It may be useful either because you don't yet want to remove that element (you want it there for later use) or because a traditional pop only give you the top element but a peek can give you any element.   2 marks
b) A subroutine is called with the BL <label> instruction. This takes a normal branch to the instruction labeled <label> but it also saves the address of the instruction which follows the BL instruction into the link register (R14). This is known as the return address. Then, when the subroutine has completed and needs to return the return address can be moved into the PC with the BX LR instruction. This allows the subroutine to return back to wherever it was called from. 3 marks

Question 4: (2)
a) We require (8e6/5) = 1 600 000 iterations when the value is 255. Hence, iterations = 1.6e6/255 = 6 275 2 marks