Tutorial 1

Question 1: Memory
What is special about the memory address:
a) 0x20000000
b) 0x08000000
c) 0x08000004
d) 0x20001FFF

e) What is the address of the last byte of RAM?

5x1 = 5

Question 2: Processing Instructions
a) Explain the function of the program counter (PC).

Write an instruction to:
b) add the contents of R0 and R8 and store the result in R0
c) Perform a logical OR of the data in R0 with the data in R1 and store the result in R1

3x1 = 3

Question 3: Load/Store Example
Assume we have the following code:

```
LDR R0, A
LDR R1, B
@ your instructions go here

A: .word 0x08000000
B: .word 0x20000000
```

Write a sequence of instruction which when placed at the specified location will cause the word located at the start of Flash to be copied to the start of RAM.

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Question 4: Instruction encoding
See Chapter A6.7 of the ARM-v6m architecture reference manual.
Assuming we want instructions to be located in memory as follows:

Address	Instruction
0x080000AA	ANDS R2, R2, R1
0x080000AC	MOVS R7, #0xF0

What data is placed at the addresses 0x080000AA through 0x080000AD? Specify each of the four bytes individually.

4x1 = 4

Question: Toolchain
a) What is the job performed by the assembler?
b) What is the job performed by the linker?
c) What does the **-Ttext** flag supplied to the linker do?
c) Explain the function of OpenOCD.
d) What does the compiler directive **.word** do?
e) What does the **-o** option supplied to the assembler do?

6x1 = 6

Bonus:
Why is the reset vector defined as _start **+ 1**?
(it's the **"+1**" which you need to explain)

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Marked out of: 20
Available marks: 22