Solutions: Tutorial 1

Question 1:
a) Both take input, do processing and provide output. Both are built up of the fundamental components of volatile storage, non-volatile storage and a CPU.
b) Interpret USB commands from the computer and convert those to Serial Wire Debug (SWD) commands which can control the STM32F051C6
c) Fetch the address of the first instruction to execute from the reset vector (0x0800 0004) and load it into the PC.
d) 2. Each instruction is 16-bit (2 bytes) wide, so the PC must be inc'd by 2 to get to the next instruction.

Question 2:
a) Both the output of the assembler and linker are binary machine code files. However, the output of the assembler (object code) only has relative addresses whereas the output of the linker has absolute addresses defined.
b) OpenOCD program acts as an interface to the ST-Link. It establishes the USB connection to the ST-Link and passes messages between the ST-Link and another program which connects to OpenOCD over a network port.

Question 3:
a) ADDS R5, R7, R6
Adds the contents of R7 and R6 and stores the result in R5. The APSR flags are updated depending on the result of the addition.
b) MOV R0, R15
This takes the contents of R15 and copies it into R0. It does not update the APSR flags.
c) MOVS R0, R0
This takes the contents of R0 and moves it into R0. This doesn't actually change R0 However, it does update the contents of the APSR depending on what the contents of R0 happens to be.

Question 4:
a) 0x2000001A <= 0xD2, 0x2000001B <= 0x0x04
b) 0x0800 0042 + (42 * 2) = 0x0800 0096
c) Not possible. Instruction are two bytes long. All data access must be aligned, therefor for the CPU to be able to fetch an instruction, the effective address of the instruction must be a multiple of 2.

Question 5:
a) The CPU has no concept of where the end of our program is. Without us putting the unconditional branch at the end, the PC would be incremented to an address which we did not define data at. This garbage data would be fetched and executed which would produce unpredictable results.
b) Subtracting R4 from R4 must produce a result of 0, independent of whatever value is in R4.
Hence, the Z flag will be set.
BEQ is taken when Z=1, hence the branch will be taken.

Bonus:
0x0F