Department of Electrical and Computer Engineering
Concordia University

COEN 421/6341 – Embedded Systems Design

Assignment #1
Submission: Moodle

1. **[10pts]** In your own words, discuss main common characteristics found in embedded computing systems.
2. **[15pts]** Briefly explain, in your own words, some of the challenges faced when designing embedded computing systems.
3. **[15pts]** Assuming a six-bit system, how would the NZCV flags be set after these operations?
    a. -7+(-29)
    b. 31+11

4. **[15pts]** ARM implements load/store architecture instead of the accumulator or stack-based architecture. Discuss the process for executing arithmetic instructions in the load/store architecture.
5. **[20pts]** A *mov* assembly instruction copies the value of the source register to the destination register. What is the value of the destination register r1 after the following instruction completes?

Memory Address	Assembly Instruction
...	...
0x08000166	MOV r1, pc
...	...

6. **[25pts]** Consider the execution of the program loaded in memory according to the data presented in the below table. Discuss what is the content of the used registers after the program execution is finished.

Memory Region	Memory Address	Binary Instruction	Assembly Instruction	Comments
Data Memory	0x20000000	0x0001	DCW 0x0001	
	0x20000002	0x0000	DCW 0x0000	; 0x00000001
	0x20000004	0x0002	DCW 0x0002	
	0x20000006	0x0000	DCW 0x0000	; 0x00000002
	0x20000008	0x0000	DCW 0x0000	
	0x2000000A	0x0000	DCW 0x0000	; 0x00000000
	...	...	...	
Instruction Memory	0x08000160	0x4903	LDR r1, [pc,#12]	; @0x08000170
	0x08000162	0x680A	LDR r2, [r1]	; r2 = a
	0x08000164	0x4B03	LDR r3, [pc,#12]	; @0x08000174
	0x08000166	0x681C	LDR r4, [r3]	; r4 = b
	0x08000168	0x1915	ADDS r5, r2, r4	; r5 = a + b
	0x0800016A	0x4E03	LDR r6, [pc,#12]	; @0x08000178
	0x0800016C	0x6035	STR r5, [r6]	; save c
	0x0800016E	0xE7FE	B 0x0800016E	; stop
	0x08000170	0x0000	DCW 0x0000	
	0x08000172	0x2000	DCW 0x2000	; 0x20000000
	0x08000174	0x0004	DCW 0x0004	
	0x08000176	0x2000	DCW 0x2000	; 0x20000004
	0x08000178	0x0008	DCW 0x0008	
	0x0800017A	0x2000	DCW 0x2000	; 0x20000008
	...	...	...	