Classwork 09 CPE 221 Computer Organization

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(15 points)

Student's Name: _____
(As on Canvas)

Q1. Write an ARM assembly program that initializes the stack pointer SP to the address 0x2000 and pushes two register values R1, and R2 onto the stack and then, pop the values back into R3 and R4.

(2 points)

Solution:

```
MOV  SP, #0x2000
PUSH {R1,R2}
POP  {R3, R4}
```

Q2. In what memory address above the value of R1 and R2 is stored?

(2 points)

Answer

0x 1FF8 — R1

0x 1FFC — R2

Q3. What's the difference between these two code snippets: (4 points)

Snippet 1

```
MOV R1, #2
MOV R2, #3
MOV R3, #4
MOV SP, #0x2000
PUSH {R1, R2, R3}
```

Snippet 2

```
MOV R1, #2
MOV R2, #3
MOV R3, #4
MOV SP, #0x2000
PUSH {R1}
PUSH {R2}
PUSH {R3}
```

Answer: Snippet 1 puts all three register values at once into the stack so the memory looks like

0x1FF4 ⟶ 2 (R1)
0x1FF8 ⟶ 3 (R2)
0x1FFC ⟶ 4 (R3)

while for snippet 2:

0x1FF4 ⟶ 4 (R3)
0x1FF8 ⟶ 3 (R2)
0x1FFC ⟶ 2 (R1)

Q4. (i) Write an ARMv7 program that calls a function my_func and passes two arguments 0x10 and 0x20 using stack. Inside the function, access these two arguments and return their sum. Use R0 for returning the sum. (3 points)

(ii) You must initialize SP with 0x2000 at the beginning of the program. (2 points)

(iii) Also write down the Stack Pointer's value just before the function call, and just before returning from the function call. (2 points)

Solution (i), (ii)

```
MOV   SP, #0x2000

MOV   R0, #0x10
MOV   R1, #0x20
PUSH  {R0, R1}
BL    my_fun

done: B done
```

```
my_func :
        POP {R2, R3}
        ADD R0, R2, R3
        BX  LR
```

(11)

0x 2000 — initially

0x 1FF8 — just before calling the function (after PUSH)

0x2000 — after returning from the function call