

Homework Assignment 4

(Due 2:10pm, Dec. 6, scan (or take a photo) and upload it in Canvas)

You should use the following instructions only.

- Instructions
 - ADD, SUB, AND, ORR, EOR, MOV, **MUL**
 - CMP, BGE/BLT/BGT/BLE/BEQ/BNE
 - B, BL, BX
 - LDR, STR, PUSH, POP

1. (100 points) Write an assembly code for the “for loop” in the following C code.

```
int* x = new int[10];
int* y = new int[20];
...
for ( int k = 0 ; k < 5 ; k++ ) {
    x[2*k] = y[4*k];
}
```

R15 (PC)	...	0x0414	...
R14 (LR)	0x0410	0x0410	x
R13 (SP)	0x0404	0x040C	...
R12	...	0x0408	y
	RF	0x0404	0x0410
		0x0400	0x0408
		0x03FC	...
		0x03F8	...

Main memory

- R0-R12 are freely available.
- You can use any of R0-R12 for “int k” (i.e., you don’t need to use the stack for k).

```
MOV R0, #0
loop:
CMP R0, #5
BGE loop_end
LDR R1, [SP, #4]
MUL R2, R0, #4
MUL R2, R2, #4
ADD R2, R1, R2
LDR R2, [R2]
LDR R1, [SP, #12]
MUL R3, R0, #2
MUL R3, R3, #4
ADD R3, R1, R3
STR R2, [R3]
ADD R0, R0, #1
B loop
loop_end:
```

2. (100 points) Write an assembly code for the “nested for loop” (in the rectangle) in the following C code.

```
int** x = new* int[10];
int* y = new int[100];
for ( int k = 0 ; k < 10 ; k++ ) {
    x[k] = new int[10];
}
...

```

```
for ( int k = 0 ; k < 10 ; k++ ) {
    for ( int m = 0 ; m < 10 ; m++ ) {
        x[k][m] = y[10*k+m];
    }
}
```

R15 (PC)	...
R14 (LR)	0x4010
R13 (SP)	0x4000
R12	...

RF

0x4014	...
0x4010	0x4000
0x400C	...
0x4008	x
0x4004	...
0x4000	y
0x03FC	...
0x03F8	...

Main memory

- R0-R12 are freely available.
- You can use any of R0-R12 for “int k” and “int m” (you don’t need to use the stack for them).

```
MOV R0, #0
loop1:
CMP R0, #10
BGE loop1_end
MOV R1, #0
loop2:
CMP R1, #10
BGE loop2_end
LDR R2, [SP]
MUL R3, R0, #10
ADD R3, R3, R1
MUL R3, R3, #4
LDR R2, [R3]

LDR R3, [SP, #8]
MUL R4, R0, #4
ADD R4, R3, R4
LDR R3, [R4]

MUL R4, R1, #4
ADD R4, R3, R4
STR R2, [R4]
ADD R1, R1, #1
B loop2
loop2_end:
ADD R0, R0, #1
B loop1
loop1_end:
```