

Digital Design and Computer Architecture (E85)

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1) Problems

1. For each of the following ARM assembly programs, what value is held in register R0 at the end of execution?

a) AND R0, R0, #0
 ADD R2, R0, #5
 ADD R3, R2, #2
 SUB R0, R3, R2

b) AND R0, R0, #0
 ADD R2, R0, #7
 ADD R3, R2, #1
 ADD R4, R2, R3
 ORR R0, R3, R4

c) AND R0, R0, #0
 SUB R2, R0, #1
 ADD R3, R0, #11
 AND R0, R3, R2

d) AND R1, R1, #0
 SUB R2, R1, #1
 ADD R3, R1, #11
 EOR R0, R3, R2

2. Translate the following C code into ARM assembly. a–c are held in registers R0-R2 and f–j are held in registers R3-R7 in a one-to-one mapping. Do not use the MUL instruction.

a) f = (a + b) | (f - g);
b) j = (c - b) & (f - c);
c) h = (h + i) - (a * 2);
d) a = (h * 8) + (c - g);

3. Show the known contents of memory at the end of execution of the following ARM assembly program.

```
MOV R0, #0
MOV R1, #1234
ADD R2, R0, #5
STR R2, [R1, #0]
ADD R2, R2, R2
STR R2, [R1, #4]
MOV R2, #0
LDR R3, [R1, #4]
LDR R4, [R1]
ORR R2, R3, R4
STR R2, [R1, #4]
```

4. Write a C program to count from one to 50. Use 'i' as the counting variable. Convert that program to ARM assembly with 'i' held in register R4.

4) Time

Please indicate how many hours you spent on this problem set. This will not affect your grade (unless you omit it completely), but will be helpful for calibrating the workload for next semester's class.