National Sun Yat-Sen University ASSEMBLY LANGUAGE AND MICROCOMPUTER

Midterm Exam

1:20-3:20PM Nov 17 2011

Name:		

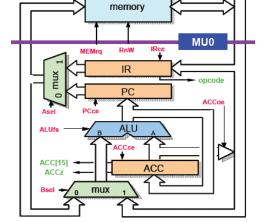
Note: Although there are total 104 points for this exam, the maximum score you can get is 100 points.

1. Fill the following output controls signals used in MU0 to execute JMP and ADD instructions based on the given MU0 data-path. The enable signal like ACCce ,PCce is active high. If RnW equals 1, the memory will be read. (8 pts)

Inputs						Outputs							
	Opcode	!	Ex/ft	t AC	C15	В	sel	PC	ce	ACCoe	MF	EMrq E	x/ft
Instruction	on	Rese	et A	CCz		Asel	AC	Cce	IRce	e AL	Ufs	RnW	
ADD S	0010	0	0	X	X					A+B			1
JMP S	0100	0	X	X	X					B-	+1		0

- 2. For each of the following three equations, write down an ARM instruction to realize its function. (9 pts)
 - (a) r0 = r1/4 r2;

- (b) mem[r1-4]=r2;
- (c) r3=mem[r2+4], r5=mem[r2+8];



- 3. Suppose r1=0xF0000001, r2=0xF0000000 and C=1, N=0, Z=0, V=0, find out the corresponding **r1** value and the conditional code value (**C N Z**) after running each one of the following ARM instructions.
 - (25 pts)
 - (a) MUL r1, r2, r1
- (b) SBCS r1, r2, r1
- (c) MOVS r2, r1, LSL #1
- (d) EOR r1, r1, r2.
- (e) ADDEQ r1, r1, r2.
- 4. For each of the following multiple register store instructions, write a short code to restore these register values by loading the data back from the memory. (10 pts)
 - (a) STMEA r9!, {r0, r5, r1}
 - (b) STMIB r9, {r5, r1, r0}
- 5. Answer for the following short questions: (12 pts)
 - (c) Describe why FIQ exception provides faster response than IRQ. (4 pts)
 - (d) Which registers in ARM are used to be the program counter and link register? (4 pts)
 - (e) Explain what "callee-save" registers mean. (4 pts)

- 6. Find out if the following instruction format is correct or not. If incorrect, point out the problem. (15 pts)
 - (a) STMEB r1!, {r5, r4, r9}
 - (b) ADD r3, r7, #257
 - (c) SUB r12, r3, RRX #2
 - (d) TST r4, r4, #2
 - (e) MOV r3, cpsr
- 7. For the following C-expression: (13 pts)

```
while (r0!=r1)
if (r0>r1) r0=r0-r1;
else r1=r1-r0;
```

- (a) What's the function this code try to implement? (3 pts)
- (b) Write down the corresponding ARM code without using the conditional execution. (But you can still use conditional branches.) (5 pts)
- (c) Write down the corresponding ARM code using the minimum number of instructions. (5 pts)
- 8. Implement the following C-subroutine using ARM assembly language based on the APCS rule. (12 pts)

```
 \begin{array}{c} prob9(int\;a,\,b)\;\{\\ &int\;i;\\ &for\;(i{=}a;\,i{<}b;\,i{+}{+})\\ &printf("\%d\;x\;\%d{=}\%d\;\backslash n",i,\,i,\,ixi);\\ \end{array} \}
```