CONCORDIA UNIVERSITY

Electrical & Computer Engineering

COEN 311: Midterm, October 25, 2018 (2:45 – 4:00pm)

Notes: - ONLY calculators allowed (closed book!)
- Hand in question paper with answer booklet, or no marks will be given!
- Do all FOUR problems

Problem 1 (10 marks)

What is the content of the registers involved and the **memory locations** affected after execution of the following two instructions:

```
move.w   (a1), d2

move.w   d2, (a2)
```

a1	0000 4000	$4000	12D3 A0BC
a2	0000 4004	$4004	8432 1006
d2	5678 CDAB		

Problem 2 (30 marks – 5+20+5)

For the following assembly language instruction

```
move  $16(a2), d0
```

a) What is the corresponding machine language instruction?

b) Provide its micro-instructions (fetch, decode, and execute cycles).

c) Assuming register transfers cost 1 clock cycle (cc), decoding costs 1 cc, arithmetic operations cost 2 cc and memory accesses cost 10 cc, compute the total execution time for the above instruction.

Problem 3 (30 marks)

Write the complete assembly program starting from ORG to END for the following pseudo-code:

```
begin

result := 100
i := 1

while  i <= 10 do
    result := result – i
    i := i + 1
end while
```

Problem 4 (30 marks)

Suppose that the content of the memory is defined below

```
000000:   9040 3040 3228 0034 3428 0036 9643 3628
000010:   003C B440 6700 000E C7C1 3028 003C 9440
000020:   9040 60EE 3143 0038 4843 3143 003A 3028
000030:   003E 4E40 0005 0003
00003C:   0001 0003
```

Complete the assembly language code from the address $000012 onwards.

```
                    ORG $0000
000000              SUB D0,D0
000002              MOVE D0,A0
000004              MOVE X(A0),D1
000008              MOVE Y(A0),D2
00000C               SUB D3,D3
00000E              MOVE ONE(A0),D3
000012
………
000024   DONE        MOVE D3,R(A0)
000028               SWAP D3
00002A               MOVE D3,R+2(A0)
00002E              MOVE THREE(A0),D0
000032               TRAP #0
000034    X          DC 5
000036    Y          DC 3
000038    R          DS 2
00003C   ONE         DC 1
00003E  THREE        DC 3
                     END
```

Add	1101	dDn$_3$	001000	sDn$_3$
	1101	dAn$_3$	011000	sDn$_3$
Subtract	1001	dDn$_3$	001000	sDn$_3$
Multiply	1100	dDn$_3$	111000	sDn$_3$
Divide	1000	dDn$_3$	111000	sDn$_3$
Compare	1011	dDn$_3$	001000	sDn$_3$
Swap	0100100001000			dDn$_3$
Move (register to register)	0011	dDn$_3$	000000	sDn$_3$
	0011	dAn$_3$	001000	sDn$_3$
	0011	dDn$_3$	000001	sAn$_3$
	0011	dAn$_3$	001001	sAn$_3$
Move (register to memory)	0011	An$_3$	101001	sAn$_3$
	Displacement$_{16}$			
	0011	An$_3$	101000	sDn$_3$
	Displacement$_{16}$			
Move (memory to register)	0011	dAn$_3$	001101	sAn$_3$
	Displacement$_{16}$			
	0011	dDn$_3$	000101	An$_3$
	Displacement$_{16}$			
Move (memory to memory)	0011	An$_3$	101101	An$_3$
	s-Displacement$_{16}$			
	d-Displacement$_{16}$			
Branch (unconditional)	01100000	Displacement$_8$		
Branch on equal	01100111	Displacement$_8$		
Branch on greater	01101110	Displacement$_8$		
Branch on less	01101101	Displacement$_8$		
Stop, dump	010011100100			0000