DAT2343 - MidTerm Test 2 **Name:**_____

Winter 2010 - Prof. Ian Allen Maximum Time: 45 minutes Total Marks: 105

- This test is closed-book. You may use a calculator. Point values are in brackets: [10]
- Put final answers **on this question sheet**, where **underlined** space is given.
- Enter, ***with numbers***, the **long answers** and **rough work** in the **examination booklet**(s).
- You must hand-in these question sheets with your completed test booklet(s) and rough work.

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1. [10] Using 12-bit arithmetic: Indicate by check marks the correct "ON" states of the **Z**ero, **C**arry, **S**ign, and **O**verflow flags after the given arithmetic. Indicate by check marks if the 12-bit result is correct for signed two's complement arithmetic (**`OK-SIGN`**) and/or correct for unsigned arithmetic (**`OK-UNSIGN`**). **Leave flags that are OFF blank:**

   a. **`80F + 7F1 = 000`** **`Z___ C___ S___ O___ OK-SIGN___ OK-UNSIGN___`**

   b. **`9B1 + B1A = 4CB`** **`Z___ C___ S___ O___ OK-SIGN___ OK-UNSIGN___`**

   c. **`FFF + FFF = FFE`** **`Z___ C___ S___ O___ OK-SIGN___ OK-UNSIGN___`**

   d. **`794 + 516 = CAA`** **`Z___ C___ S___ O___ OK-SIGN___ OK-UNSIGN___`**

   e. **`800 + 800 = 000`** **`Z___ C___ S___ O___ OK-SIGN___ OK-UNSIGN___`**

2. [2] What is the largest positive number you can store in **16** bits, two's complement? _____

3. [2] What is the minimum number of binary bits needed to represent **32,793** items? _____

4. [2] Express **`0x41`** in eight bits with: (a) Odd Parity _____ (b) Even Parity _____

5. [1] What basic program feature does Virtual Memory enable? _____

   _____

6. [2] What is the major difference in function between a **`JUMP`** instruction and a **`CALL`** instruction?

   _____

7. [2] List all LMC mnemonic instructions that change the LMC flag lights: _____

8. [6] ***In your exam book***, name and describe briefly the three steps of the LMC Instruction Cycle.

9. [2] If the last two steps of the LMC Instruction Cycle were done in reverse order, which instructions would behave differently? _____

The "Little Man Computer" (LMC) uses the following Operation Code Mnemonic table:

0xy	1xy	2xy	3xy	4xy	500	600	700	800	801	802	803	9xy	(pseudo)
CALL	LDA	STO	ADD	SUB	IN	OUT	HLT	SKN	SKZ	SKP	SKNZ	JMP	DAT

10. [20] Assemble the following LMC mnemonic code into LMC numeric code starting in mailbox **00**. Put your answers into the first two columns of this five-column table:

Mailbox	Code	Label, Mnemonic, Argument/Operand		
		WHILE	LDA	TEN
			SUB	COUNT
			SKP	
			JMP	ENDWH
			LDA	SUM
			ADD	COUNT
			ADD	COUNT
			STO	SUM
			LDA	COUNT
			ADD	ONE
			STO	COUNT
			JMP	WHILE
		ENDWH	LDA	SUM
			OUT	
			HLT	
		SUM	DAT	000
		COUNT	DAT	001
		ONE	DAT	001
		TWO	DAT	002
		TEN	DAT	010

11. [2] Summarize in English the behaviour of the above program: _____

_____

12. [2] What is the final value in mailbox 16 when the program ends? _____

13. [2] **COUNT** and **ONE** have the same values, above. Can they be merged into one variable? _____

14. [18] Translate the following machine level code for the LMC into labels, assembler mnemonic codes, and operands. Use the standard 5-column format used in class: ***Mailbox, Code, Label, Mnemonic, Argument/Operand.*** Assume the code is loaded into mailboxes starting at mailbox **00**. Distinguish between Instructions and Data. ***Number and put your answer in the answer booklet.***

```
116 415 217 600 800 600 500 417 217 801
600 417 802 600 700 500 600 700 000 000
```

15. [6] For the code provided in the preceding question, given possible input values of **300** then **800**, what value(s), if any, would be output by this LMC program? _____

The next few questions apply to the following DEBUG hex dump from a mainframe computer:

```
0000:0390  B8 37 1E BA 30 08 3B C4-73 6A 8B C4 2D 45 03 90  .7..0.;.sj..-E..
0000:03A0  25 1A C0 9B F8 B9 A2 07-90 BE 7E 39 FF FA 46 8B  %.........~9..F.
0000:03B0  D8 B1 00 00 0A 8C D9 03-00 53 33 DB 53 F8 FF 01  .........S3.S...
0000:03C0  50 4B 4C 49 54 45 20 43-6F 70 34 2E 20 31 39 38  PKLITE Cop4. 198
0000:03D0  32 20 50 4B 57 41 52 45-20 49 6E 63 2E 20 42 6C  2 PKWARE Inc. Bl
0000:03E0  6C 20 52 69 67 68 74 73-20 52 65 73 65 72 76 65  l Rights Reserve
0000:03F0  64 4E 6F 74 20 65 6E 6F-75 67 68 20 6D 65 6D 6F  dNot enough memo
```

16. [1] Give the **hexadecimal** address of the last (ending) byte of this dump screen: _____ hex

17. [1] What is the **hexadecimal** address of the first byte containing an **ASCII** letter "**E**"? _____ hex

18. [1] What is the **ASCII** character at address **03BA**? _____ (one ASCII character)

19. [1] What is the **ASCII** character at address **0390**? _____ (answer carefully)

20. [1] What is the **UTF-8** character at address **03F1**? _____ (one **UTF8** character)

21. [2] Decode to **decimal** the one-byte 2's complement integer at address **03BE =** _____ decimal

22. [2] Decode to **decimal** the three-byte 2's complement integer at address **03B2 =** _____ decimal

23. [2] Decode to **decimal** the two-byte 2's complement integer at address **03AC =** _____ decimal (Remember: This dump is from a mainframe computer, not an Intel computer.)

24. [2] *If the above dump were from an Intel computer*, give the **hexadecimal** value of the 32-bit integer located starting at address **03A1:** _____ (one 32-bit hex number)

25. [2] With what character(s) does DOS/Windows end lines in text files? _____

26. [1] What happens to the integer value of a word if you shift it left two bits? _____

27. [1] What happens to the integer value of a word if you shift it right one hex digit? _____

28. [1] True/False: The most negative two's complement number has only the sign bit turned on and all the other bits are zeroes: _____

29. [1] True/False: Two's complement **-1** (minus one) is always "all bits on": _____

30. [1] True/False: Decimal 2341.5 x 10**36 fits in IEEE 754 single precision floating point: _____

31. [1] True/False: An Arithmetic Shift Right preserves the sign of a two's complement number: _____

32. [1] What system generated the following UTF-8 text line **`4B 68 6D 74 77 0A`**: _____

33. [1] Define “Temporal Locality”: _____

_____

34. [3] What happens to cause a Page Fault, and how is it resolved? _____

_____

_____

_____

_____

_____

35. Notes to instructor: _____

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