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

Fall 2009 - Prof. Ian Allen   Maximum Time: 110 minutes   Total Marks: 81

> ➢   Put final answers **on this question sheet**, where <u>underlined</u> space is given.
> ➢   Enter the **long answers** and **rough work** in the **examination booklet**(s).
> ➢   The use of calculators, notes, or other external aids are ***not*** permitted on this test.
> ➢   You must hand-in these question sheets with your completed test booklet(s).

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1. Convert the following decimal values into 16-bit word, 2's Complement encoded values in hexadecimal:
(3)
   a) **683 =** _____   b) **−684 =** _____

2. Perform the indicated 12-bit hexadecimal arithmetic. Show the result value and indicate by check marks the correct "ON" states of the **Z**ero, **C**arry, **S**ign, and **O**verflow flags after the arithmetic:

   a.   **8AB + ACD = _____**   **Z___   C___   S___   O___**

   b.   **800 + 800 = _____**   **Z___   C___   S___   O___**

   c.   **7EF + 6AB = _____**   **Z___   C___   S___   O___**

   d.   **011 + 0FE = _____**   **Z___   C___   S___   O___**

(8)

3. Perform the following 32-bit hex bitwise operation:
(2)   **000FFF00** AND **1234ABCD =** _____

4. Encode as hexadecimal bytes the following two lines using standard MS-DOS ASCII file encoding:
   Aa Bb Cc
   43 21

(4)
    = _____

5. How many different bit patterns are possible for 15 bits? **=** _____ patterns
(1)

6. If the last two steps of the LMC Instruction Cycle were done in reverse order, which instructions would behave differently?
(2)   **=** _____

7. Name all the LMC executable instructions that are *not* relocatable. (A list of LMC executable instructions and pseudo-instructions is on the last page of this test.)

(4)   = _____

8. What is the major difference in function between a **JUMP** instruction and a **CALL** instruction?

(1)   = _____

9. What is the minimum number of binary bits needed to represent 32,793 items? = _____
(1)

10. The IEEE 754 32-bit single-precision floating-point number **DEADBEEFh** is negative. Give the
hexadecimal for the same value, only positive:
(1)   = _____ hex

11. In your exam book, name and describe briefly the three steps in the Computer Instruction Cycle.
(6)

The next few questions apply to the following DEBUG 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 F0 01 8B F8 B9 A2 07-90 BE 7E 39 FF F0 46 8B   %.........~9..F.
0000:03B0   D8 B1 04 D3 EB 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
```

12. What is the hexadecimal value of the byte at address **03DE**? = _____ hex
(1)
13. What is the hex address of the first byte containing an ASCII letter "**F**" = _____ hex
(1)
14. Give the address in **decimal** of the last (ending) byte of this dump screen: = _____ decimal
(2)
15. Decode to **decimal** the two-byte 2's complement integer at address **03AC** = _____ decimal
(Note: This dump is from a mainframe computer, not an Intel computer.)
(2)

16. Relocate the following subroutine to load at mailbox **20**. Write the new code on the lines provided:

Loc	Code	Label	Mnem	Operand	New Loc - New Code - Reason for change
00	000	RETRN	DAT	?	_____
01	206	DOUBLE	STO	VAR	_____
02	306		ADD	VAR	_____
03	801		SKZ		_____
04	600		OUT		_____
05	900		JMP	RETRN	_____
06	206	VAR	DAT	206	_____

(7)

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)	(pseudo)
CALL	LDA	STO	ADD	SUB	IN	OUT	HLT	SKN	SKZ	SKP	SKNZ	JMP	DAT	ORG

Answer all the following questions by number in the examination booklet.

17. Translate the following machine level code for the LMC into labels, assembler mnemonic codes, and operands. Use the standard 5/6-column format used in class: *Location, Code, Labels, Mnemonics, Arguments/Operands, Comments.* Assume the code is loaded into mailboxes starting at mailbox **00**. Distinguish between Instructions and Data. (*Remember: Put your answers in the answer booklet.*)

(6)   **500 311 800 410 600 500 800 310 600 700 500 600**

18. For the code provided in the preceding question, given input values of **555** then **111**, what value(s) (if any) would be output by this LMC program? (*Remember: Put your answers in the answer booklet.*)
(4)

19. Translate the following pseudo code into standard 5/6-column LMC assembler mnemonic form (using labels) *without optimizing*. Translate the LMC mnemonics to LMC machine codes (numbers) assuming the code is to be loaded by a linker to start at mailbox **00.** Use the standard 5/6-column assembler format with labels for operands. Use labels, not mailbox numbers, for operands.

```
Y = 1
input X
while ( X > Y ) {
     input Z
     subtract Z from X
}
if ( Z <= X ) {
     output Z
     add Y to Z
}
output Z
stop
```

LMC Flag/Lights Condition Table
(for coding "SKIP" conditional statements)

	A < B	A == B	A > B
A — B	N NZ	Z P	P NZ
B — A	P NZ	Z P	N NZ

Your final answer should have the the standard 5/6-column format used in class:
        Location, Code, Labels, Mnemonics, Arguments/Operands, Comments.
Do not optimize your code; do a direct, statement-by-statement translation to LMC assembler.
(10)
All answers on this page should be written in your answer booklet. Number your answers.