Points missed: _____   Student's Name: _____

Total score: _____/100 points

East Tennessee State University -- Department of Computer and Information Sciences
CSCI 2150 – Computer Organization
Final Exam for Fall Semester, 2001
Instructor: David Tarnoff

Section 002

Read this before starting!

- The total possible score for this test is 100 points.
- This test is closed book and closed notes
- **All** answers **must** be placed in blanks provided. Failure to do so will result in no credit for answer.
- **1 point** will be deducted per answer for missing or incorrect units when required. **No** assumptions will be made for hexadecimal versus decimal, so you should always include the base in your answer.
- If you perform work on the back of a page in this test, indicate that you have done so in case the need arises for partial credit to be determined.
- *Calculators are not allowed.* Use the tables below for any conversions you may need. Leaving numeric equations is fine too.

Binary	Hex		Binary	Hex		Power of 2	Equals
0000	0		1000	8		2^3	8
0001	1		1001	9		2^4	16
0010	2		1010	A		2^5	32
0011	3		1011	B		2^6	64
0100	4		1100	C		2^7	128
0101	5		1101	D		2^8	256
0110	6		1110	E		2^9	512
0111	7		1111	F		2^{10}	1K

"Fine print"

```
INC - Increment
     Usage:  INC     dest
     Modifies flags: AF OF PF SF ZF
     Description:  Adds one to destination unsigned binary operand.


Jxx - Jump Instructions Table
```

Mnemonic	Meaning	Jump Condition
JA	Jump if Above	CF=0 and ZF=0
JAE	Jump if Above or Equal	CF=0
JE	Jump if Equal	ZF=1
JG	Jump if Greater (signed)	ZF=0 and SF=OF
JGE	Jump if Greater or Equal (signed)	SF=OF
JL	Jump if Less (signed)	SF != OF
JLE	Jump if Less or Equal (signed)	ZF=1 or SF != OF
JMP	Unconditional Jump	unconditional
JNA	Jump if Not Above	CF=1 or ZF=1
JNB	Jump if Not Below	CF=0
JNE	Jump if Not Equal	ZF=0
JNG	Jump if Not Greater (signed)	ZF=1 or SF != OF
JNL	Jump if Not Less (signed)	SF=OF
JZ	Jump if Zero	ZF=1

```
MOV - Move Byte or Word
     Usage:  MOV     dest,src
     Modifies flags: None
     Description: Copies byte or word from the source operand to the destination
     operand.  If the destination is SS interrupts are disabled except on early
     buggy 808x CPUs.  Some CPUs disable interrupts if the destination is any of
     the segment registers


POP - Pop Word off Stack
     Usage:  POP     dest
     Modifies flags: None
     Description: Transfers word at the current stack top (SS:SP) to the
     destination then increments SP by two to point to the new stack top.  CS is
     not a valid destination.


PUSH - Push Word onto Stack
     Usage:  PUSH    src
     Modifies flags: None
     Description: Decrements SP by the size of the operand (two or four, byte
     values are sign extended) and transfers one word from source to the stack
     top (SS:SP).


SAL/SHL - Shift Arithmetic Left / Shift Logical Left
     Usage:  SAL     dest,count              SHL     dest,count
     Modifies flags: CF OF PF SF ZF (AF undefined)

     Shifts the destination left by "count" bits with zeroes shifted in on right.
     The Carry Flag contains the last bit shifted out.


SAR - Shift Arithmetic Right
     Usage:  SAR     dest,count
     Modifies flags: CF OF PF SF ZF (AF undefined)

      Shifts the destination right by "count" bits with the current sign bit
      replicated in the leftmost bit.  The Carry Flag contains the last bit
      shifted out.
```

1.) If I wanted to clear bit positions 0, 1, 2, and 5 of an 8-bit value, what bitwise operation and corresponding bit mask would I use?

Operation: _____(1 point)   Mask: _____(2 points)

2.) Mathematically, a left-shift by three bit positions is equivalent to what? (2 points)

3.) Assuming BX contains the value 1001h and the table to the right represents the contents of a short portion of memory, indicate what value AL contains after each of the following MOV instructions. (2 points each)

Address	Value
DS:1000	23h
DS:1001	5Fh
DS:1002	10h
DS:1003	ACh
DS:1004	5Bh
DS:1005	BCh

    MOV   AL, [BX]   AL =

    MOV   AL, [1002h]   AL =

    MOV   AL, [BX+2]   AL =

4.) Of the following jump instructions, indicate which ones will jump to the address LOOP, which ones will simply execute the next address (i.e., not jump), and which ones you don't have enough information to tell.

Instruction		Current Flags	Jump to LOOP	Not jump to LOOP	Cannot be determined	
JNE	LOOP	SF=0, ZF=1, CF=0	❏	❏	❏	(2 points)
JMP	LOOP	SF=1, ZF=0	❏	❏	❏	(2 points)
JG	LOOP	SF=0, ZF=0, CF=0	❏	❏	❏	(2 points)
JLE	LOOP	SF=0, ZF=1, OF=1	❏	❏	❏	(2 points)

5.) Assume AX=1234h, BX=FEDCh, and CX=0000h. After the following code is executed, what would AX, BX, and CX contain? (3 points)

Place your answers in space below:

```
PUSH AX
PUSH BX
PUSH CX
POP CX
POP AX
POP BX
```

                    AX =

                    BX =

                    CX =

6.) Assume that *before* each of the following instructions, AX=90FFh. What will ZF, SF, and CF equal *after* executing the instruction? ***IMPORTANT: Note that these instructions are not executed in a sequence as the problems we did in class were.*** Leave the flag blank if it is not affected by the instruction.

Instruction	Zero Flag	Sign Flag	Carry Flag	
INC AX				(3 points)
INC AL				(3 points)
SAL AX,3				(3 points)
SAR AX,1				(3 points)

7.)   What is the purpose of the ALU in a microprocessor? (3 points)

8.)   What is the purpose of the segment/pointer pair CS:IP? (3 points)

9.)   What is the purpose of the segment/pointer pair SS:SP? (3 points)

10.)   Name the two benefits of the segment/pointer addressing system of the 8088. (4 points)

11.)   If a processor takes 3 cycles to execute any instruction (fetch, decode, execute), how many cycles would a pipelined processor save over a non-pipelined processor to execute 15 instructions? (5 points)

12).   Circle **all** of the following 8088 registers that are 8-bit registers. (4 points)

a. AX   b. SP   c. BL   d. DS
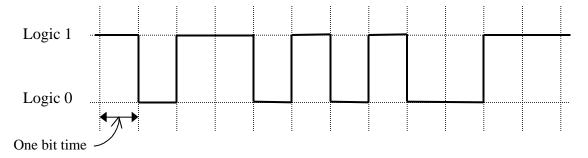e. CH   f. IP   g. DI   h. DL

13.)   What physical address does the segment/pointer combination 2000:01A3 represent? (4 points)

14.)   On an 80x86 processor with 20 address lines, how big is the processor's memory space? (3 points)

15.)   On an 80x86 processor with 20 address lines, what is the maximum number of I/O ports? (3 points)

16.)   Which of the following 80x86 assembly commands is used to write data to an I/O port? (2 points)

a.)   MOV   b.)   OUT   c.)   PORT   d.)   SEND   e.) None of these

17.) What assembly language command on an 80x86 processor is used to read data from memory? (3 points)

18.) On an 80x86 processor, which of the following lines is pulsed low during a read from memory? (3 points)

 a) ^MRDC b) ^IORC c) ^MWTC d) ^IOWC e) None of these

19.) How are comments identified in an assembly language program? (3 points)

20.) List an advantage we discussed in class of interrupts. (3 points)

21.) Define the term **hot-swappable**. (3 points)

Questions 22 and 23 are based on the following RS232 signal sent with 8 data bits and odd parity.

Logic 1

Logic 0

One bit time

22.) What is the binary value being transmitted in this signal? (4 points)

23.) True or false: The parity bit is correct. (3 points)

24.) Classify each of the following characteristics as RS232 serial (R), USB (U), Firewire(F), GPIB (G), or SCSI (S). (2 points each)

 _____ Serial point-to-point communications
 _____ Developed by Apple for the transmission of video and audio
 _____ Primarily used for scientific instrumentation
 _____ Can have at most 63 peripheral devices connected on a single network
 _____ Uses two possible data connection speeds on a single network