Points missed: _____ Student's Name: _____

Total score: _____/100 points

East Tennessee State University
Department of Computer and Information Sciences
CSCI 2150 (Tarnoff) – Computer Organization
TEST 3 for Fall Semester, 2003

Section 001

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 space provided. Failure to do so may result in loss of points.
- **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
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7

Binary	Hex
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

Power of 2	Equals
2^3	8
2^4	16
2^5	32
2^6	64
2^7	128
2^8	256
2^9	512
2^{10}	1K
2^{20}	1M
2^{30}	1G

"Fine print"

Academic Misconduct:

Section 5.7 "Academic Misconduct" of the East Tennessee State University Faculty Handbook, June 1, 2001:

"Academic misconduct will be subject to disciplinary action. Any act of dishonesty in academic work constitutes academic misconduct. This includes plagiarism, the changing of falsifying of any academic documents or materials, cheating, and the giving or receiving of unauthorized aid in tests, examinations, or other assigned school work. Penalties for academic misconduct will vary with the seriousness of the offense and may include, but are not limited to: a grade of 'F' on the work in question, a grade of 'F' of the course, reprimand, probation, suspension, and expulsion. For a second academic offense the penalty is permanent expulsion."

DEC - Decrement
Usage: DEC dest
Modifies flags: AF OF PF SF ZF
Description: Unsigned binary subtraction of one from the destination.

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

Jxx - Jump Instructions Table

Mnemonic	Meaning	Jump Condition
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
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 "src" operand to the "dest" operand.

NOT - One's Compliment Negation (Logical NOT)
Usage: NOT dest
Modifies flags: None
Description: Inverts the bits of the dest operand forming the 1s complement.

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.

Answer questions 1 through 9 based on the following settings of the 8086 registers.

AX = 2345h	SP = 0123h	CS = 1000h
BX = 8080h	IP = 1234h	DS = 2000h
CX = 0055h	DI = 2345h	SS = 3000h
DX = 9876h	SI = 3456h	ES = 4000h

1. What is the value in the register DH? (2 points)

2. What is the physical address pointed to by DS:DI? (3 points)

3. True or false: The physical address of the next instruction to be executed by the processor can be calculated from the above data? (2 points)
4. True or false: The physical address of the top of the stack can be calculated from the above data? (2 points)
5. What is the value of SP after the execution of the instruction **`POP AX`**? (2 points)

6. What is the value of SS after the execution of the instruction **`POP AX`**? (2 points)

7. Assume that the instruction **`DEC CH`** is executed. How would the following flags be set? ***Write "N/A" if the flag was not affected.*** (3 points)

   ZF = _____ CF = _____ SF = _____

8. Assume that the instruction **`SAL AH,2`** is executed. How would the following flags be set? ***Write "N/A" if the flag was not affected.*** (3 points)

   ZF = _____ CF = _____ SF = _____

9. Assume that the instruction **`SAR BL,3`** is executed. What would the new value of BL be? (2 points)

10. List the two benefits of segmented addressing. (3 points)

11. List one benefit of using assembly language. (2 points)

12. List one drawback of using assembly language. (2 points)

13. For each of the following registers, identify how many bits they contain. (4 points)

BP = _____ bits IP = _____ bits DI = _____ bits DL = _____ bits

14. What character/symbol is used to indicate the start of a comment in assembly language for the assembler we used in class? (2 points)

15. For each of the assembly language commands below, what is the boolean value for the active low signals ^MRDC, ^MWTC, ^IORC, and ^IOWC. (4 points)

```
mov   ah,[5674h]
in    bh,1234h
mov   [ax],bx
out   4af5h,bh
```

^MRDC	^MWTC	^IORC	^IOWC

16. Assume the register BX contains the value 2000h 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:2000	17h
DS:2001	28h
DS:2002	39h
DS:2003	4Ah
DS:2004	5Bh
DS:2005	6Ch

MOV AL, DS:[BX] AL =

MOV AL, DS:[BX+1] AL =

MOV AX, BX AL =

MOV AX, 2003 AL =

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

18. If a processor takes 3 cycles to execute any instruction (fetch, decode, execute), how many cycles would a pipelined processor take to execute 5 instructions? (3 points)

19. On an 80x86 processor with 32 address lines, what is the maximum number of I/O ports? (2 points)

20. True or false: Interrupt-driven I/O is faster than non-interrupt-driven I/O because the processor does not need to constantly be checking with the device to see if it needs serviced. (2 points)

21. True or false: DMA is faster than non-DMA because the data does not have to be read from the I/O device into the processor then copied to memory. It is simply copied directly from the device to memory. (2 points)

22. 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	
JE	LOOP	SF=0, ZF=1, OF=0	❑	❑	❑	(2 points)
JNB	LOOP	SF=1, ZF=0, CF=0	❑	❑	❑	(2 points)
JMP	LOOP	SF=0, ZF=0, OF=0	❑	❑	❑	(2 points)
JGE	LOOP	ZF=0, SF=0, OF=1	❑	❑	❑	(2 points)

23. Using an original value of 11000011_2 and a mask of 00001111_2, calculate the results of a bitwise AND, a bitwise OR, and a bitwise XOR for these values. (2 points each)

Original value	Bitwise operation	Mask	Result
11000011_2	AND	00001111_2	
11000011_2	OR	00001111_2	
11000011_2	XOR	00001111_2	

24. Assume AX=1000h, BX=2000h, and CX=3000h. After the following code is executed, what would AX, BX, and CX contain? (3 points)

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

Place your answers in space below:

AX =

BX =

CX =

For the next 5 problems, indicate whether the statement describes DRAM or SRAM

25. _____ is the fastest. (2 points)

26. _____ is the cheapest. (2 points)

27. _____ is the uses flip-flops or D-latches to store data. (2 points)

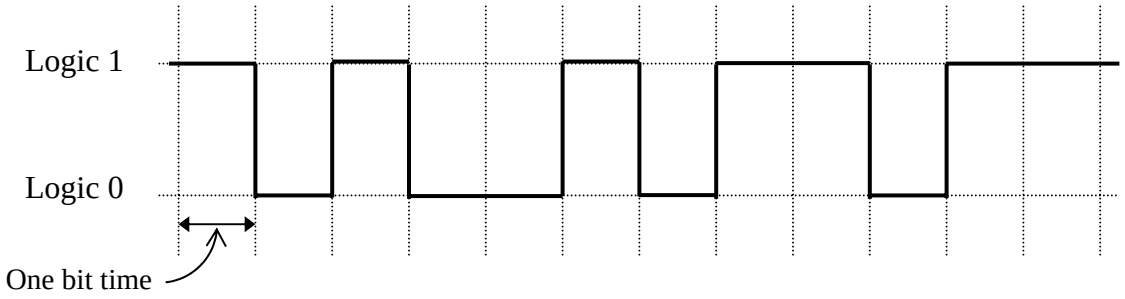
28. _____ is used for main memory. (2 points)

29. _____ is used for cache memory. (2 points)

30. Draw a line between the memory type on the left and its most appropriate characteristic on the right. (1 point each)

EEPROM ○	○ This has a very high initial one-time cost regardless of how many you buy. Very cheap to buy individual chips afterward.
Flash RAM ○	○ Old PC's used to use these for their BIOS. They usually had a sticker to cover up a small window in the top of the chip.
EPROM ○	○ This one is like RAM, but can only be written to or erased in large blocks.
OTPROM ○	○ User programmable, but if there is an error in the code, you cannot erase it, you need to program a new memory.
Custom masked ROM ○	○ This one can be written to by the processor, but has a very slow write time as compared to RAM.

Questions 26 through 27 are based on the following RS232 serial signal sent with 8 data bits.



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

32. Assuming the parity had been set to even, indicate whether an error has occurred. (2 points)

    a.) No error b.) Error c.) Cannot be determined

33. True or false: a parity bit can only detect if an odd number of bit errors has occurred. (2 points)

34. What is the maximum number of devices that can be connected to a single RS232 serial connection? (2 points)