CS/ECE 354 Midterm Examination #1
October 10, 1991
Open Book
No Calculators

Name: _____Signature:_____

Student ID: _____

Instructor: _____

(1) This exam is open book, open notes. NO calculators.

(2) Write all answers on the exam.

This test consists of two parts. Part one contains 11 short answer questions. Part two contains 6 multiple choice questions, Each question has its value indicated.

You have precisely 90 minutes to complete this exam.

	Maximum	Score
Short Answer	50	
Multiple Choice	20	
Total	70	

General Information

A numeric subscript after any number designates the base in which the number is represented. In addition, hexadecimal numbers are indicated by prefixing a character string with `0x`. Octal numbers are indicated by prefixing a character string with `0`.

Short Answer

1. (1 point) Put your name and your instructor's name on each page of the exam.

2. (12 points, 2 each) Use one of the following numbered descriptions to identify what is true about the given SAL instructions.

1.	a valid SAL instruction	___	A.	`add  a1, b1, c1, d1`
2.	too many operands	___	B.	`beq  a1, b1`
3.	not enough operands	___	C.	`b  label3`
4.	not a SAL instruction	___	D.	`mult  15, three, five`
5.	illegal use of an immediate	___	E.	`divide  i1, i2, i3`
		___	F.	`bltz value, 100`

3. (3 points) Give hexadecimal values for the following octal values.

a. 07203_8 _____

b. 044556_8 _____

c. 0123_8 _____

4. (3 points) Give a single SAL conditional branch instruction that would have exactly the same effect as the unconditional branch

```
b    label
```

5. (6 points, 1 each) Fill in the following table by giving an 8-bit representation for the following decimal values.

decimal	sign/magnitude	one's complement	two's complement
-19			
64			

6. (8 points) Give a (VERY!) brief description of what the following SAL code does. An explanation consisting of what the individual instructions do will receive no credit.

```
        .data
msg:    .asciiz  "Enter an integer:  "
msg2:   .asciiz  "The result is:  "
x:      .word
y:      .word 0
z:      .word
i:      .word

        .text
        move     i, 0
loop:   beq      i, 5, next
        puts     msg
        get      x
        add      y, y, x
        add      i, i, 1
        b        loop
next:   div      z, y, i
        puts     msg2
        put      z
        done
```

7. (3 points, 1 each) Convert the following 8-bit integers into 16-bit integers. The representation for each integer is given.

a. (sign magnitude) `10101010` _____

b. (one's complement) `01111111` _____

c. (two's complement) `10000011` _____

8. (3 points) If a computer were to execute the following SAL code sequence, how many instruction fetches, operand loads and operand stores would be performed? Fill in your answer in the box given below.

```
move aa, bb
add  aa, aa, cc
mult dd, aa, 3
div  ee, dd, bb
```

instruction fetch	operand load	operand store

9. (2 points) List all 8-bit 2's complement representations that do not have an 8-bit 2's complement representation for their additive inverse.

10. (4 points) Show the representation of 23_{10} as an 8-bit binary number in

(A) Sign/Magnitude representation.

(B) 1's complement representation.

(C) 2's complement representation.

(D) Biased notation (excess 127).

11. (5 points) A region of memory contains the following data. What is its interpretation as an ASCII string?

```
.byte   0x65, 0x69, 0x67, 0x68, 0x74, 0x79
.byte   45, 0145, 0151, 0147, 0150, 0164, 32,
.byte   100, 111, 108, 108, 97, 114, 115, '!'
```

Answer: _____

Multiple Choice

12. (3 points) What does the following piece of SAL code do? Assume that the values input for both `y` and `z` are positive.

```
        .data
x:      .word
y:      .word
z:      .word
        .text
        get     y
        get     z
        beq     z, 0, lab1
        sub     x, y, z
        bgtz    x, lab1
        put     y
        b       lab2
lab1:   put     z
lab2:   done
```

(A) It prints the value of `z`.

(B) It prints the difference between `y` and `z`.

(C) It prints the maximum of the two numbers `y` and `z`.

(D) It prints the value of `y`.

(E) It prints the minimum of the two numbers `y` and `z`.

13. (4 points) The following unsigned numbers are represented in hexadecimal, octal, binary, and decimal, respectively. Which of the following numbers are all equivalent?

(A) 200_{16} 04000_{8} $0100\,0000\,0000_{2}$ 1024_{10}

(B) 200_{16} 02000_{8} $0100\,0000\,0000_{2}$ 512_{10}

(C) 400_{16} 02000_{8} $0100\,0000\,0000_{2}$ 1024_{10}

(D) 400_{16} 0400_{8} $0100\,0000\,0000_{2}$ 512_{10}

(E) 200_{16} 0400_{8} $0100\,0000\,0000_{2}$ 1024_{10}

14. (4 points) The following unsigned numbers are represented in hexadecimal, octal, binary, and decimal, respectively. Which answer specifies four unique integers?

(A) 37_{16} 045_{8} $0001\,1011_{2}$ 37_{10}

(B) 27_{16} 047_{8} $0100\,0101_{2}$ 37_{10}

(C) 25_{16} 045_{8} $0010\,0101_{2}$ 37_{10}

(D) 27_{16} 045_{8} $0010\,0010_{2}$ 35_{10}

(E) 32_{16} 050_{8} $0011\,0010_{2}$ 45_{10}

15. (3 points) What is the range of integers that can be represented in a 16-bit two's complement number?

(A) -65535 to 65535

(B) -65536 to 65535

(C) -32768 to 32767

(D) -16384 to 16384

(E) -32767 to 32767

16. (3 points) What is the largest number that can be represented by a 7-bit (including sign) sign magnitude number?

(A) -64 (B) 128 (C) 127 (D) 63 (E) 64

17. (3 points) When the following code is executed, what does this SAL program print out?

```
            .data

char1:      .byte   '2'
char2:      .byte   '5'
sum:        .byte   0

            .text

            add     sum, char1, char2
            put     sum

            done
```

(A) 7 (B) 67 (C) 103 (D) C (E) g