CS/ECE 354 Midterm Examination #2
April 1, 1992

Name: _____Signature:_____

Student ID: _____

Instructor: _____

Section Number (or class time): _____

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

(2) Write all answers on the exam. Credit will not be given for incorrect answers that show no work.

(3) You have 2 hours to complete this exam.

	Maximum	Earned Score
Short Answer	50	
Multiple Choice	12	
Total	62	

General Information

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

(1) (9 points, 3 each) The following hexadecimal values are in IEEE single precision floating point representation. Do the specified floating point operation and give the result in the same format. Show your work.

```
  0x42800000
+ 0x40100000
------------
```

```
  0x42c80000
+ 0x447a0000
------------
```

```
  0x42800000
x 0x40100000
------------
```

(2) (9 points) Show the IEEE floating point representation of A=0.6. Show the IEEE floating point representation of $B=2^{-5}$. Show the same representation for the product of $A \cdot B$. You should round the result to the nearest representable value.

A: _____

B: _____

A·B: _____

(3) (5 points) For arithmetic done in IEEE floating point format, give a positive number x, that when added to 1.0 produces the result x. In other words give an x such that x > 0, and x + 1.0 = x.

(4) (5 points) Consider a two-dimensional array of words that is stored in column-major order. If the row index ranges from 1 to 10 and the column index goes from 5 to 12, what offset (in bytes) from the beginning of the array is the element [5,6] located?

(5) (4 points) Below is the declaration of an array A[1..3,1..7] of characters stored in column major order. Commas separate constants allocated to sequential memory locations.

```
A:   .byte  0x41, 0x54, 0x4f, 0x4f
     .byte  0x54, 0x4e, 0x46, 0x43
     .byte  0x4d, 0x41, 0x25, 0x41
     .byte  0x52, 0x2d, 0x35, 0x4c
     .byte  0x4c, 0x4a, 0x51, 0x53
     .byte  0x55, 0x00, 0x00, 0x00
```

List the characters at the following indices:

A[2,1]	A[1,4]	A[3,2]	A[2,7]	A[2,2]	A[1,1]	A[3,4]	A[1,3]	A[2,6]
_____	_____	_____	_____	_____	_____	_____	_____	_____

(6) (3 points) Given is the following stack:

*	6	/	2	-	20	+	15	19	→	Stack grows in this direction.

This stack represents arithmetic operations on two operands. The stack is used according to the following rules:

1. Pop off three items: two integers and an operation.

2. Do the operation on the two integers. The ordering of the operation is specified by (1st integer popped) OPERATION (2nd integer popped)

3. Push the result of the operation back onto the stack.

4. Repeat steps 1-3 until there is one integer remaining on the stack.

What is the final result for the given stack?

(7) (3 points) The following operations are applied in order to a stack.

push 4
push 5
push 6
pop
push 7
pop
pop

What is the value on the top of the stack?

(8) (4 points) Consider the following MAL code. The MAL instruction `putc` takes a register as its only argument, and prints the ASCII character in the 7 least significant bits of the register.

```
          .data
three:    .byte 0x33

          .text
         la $11, three
         putc $11
```

If the variable `three` is assigned address `0x65123451`, what is printed out by the `putc` instruction?

(9) (4 points)

```
          .data
aa:       .word   5
bb:       .word   0:3
cc:       .word   33
dd:       .word   15

          .text
         la $12, aa
         lw $12, 12($12)
```

What value is stored in register 12 after the execution of this code?

(10) (4 points) If the MAL instruction

```
la    $9, variable
```

is synthesized with the two instructions,

```
lui   $9, 0x0100
ori   $9, $9, 0x0064
```

what is the address assigned to `variable`?

Multiple Choice. Circle the correct answer.

(11) (4 points) The logical operator XOR can be rewritten with a sequence of AND's, OR's and NOT's. Which of the following SAL code sequences produces the same result for x as `xor x, y, z`?

a)
```
not w, y
not x, z
and x, w, x
and w, y, z
or  x, x, w
```

b)
```
and x, y, z
not w, x
or  x, x, w
```

c)
```
and x, y, z
not x, x
or  w, y, z
and x, x, w
```

d)
```
or  w, y, z
not x, w
```

(12) (4 points) What is the value contained in register 0 after the execution of the following code?

```
li  $3, 7
li  $4, 4
sub $0, $3, $4
```

a) 11
b) 3
c) -3
d) 0
e) none of the above.

(13) (4 points) Both 10.0 and 1.0 can be represented exactly in single precision IEEE floating point. If 1.0 is divided by 10.0, which of the following values is the error in the result?

a) 0.01
b) 0.0625
c) 1.49 x 10 ^ -9
d) 3.75 x 10 ^ -34
e) There is no error