Login name ________________ **Name** ______________________

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Midterm
CSE 131B
Winter 2003

Page 1	__________	**(22 points)**
Page 2	__________	**(20 points)**
Page 3	__________	**(20 points)**
Page 4	__________	**(18 points)**
Page 5	__________	**(20 points)**
Subtotal	__________	**(100 points)**
Page 6 **Extra Credit**	__________	**(5 points)**
Total	__________	

1. Fill in the blanks (1 point each); True/False (1 point each); short answer (3 points each).

A(n) _____________________ performs thorough analysis and nontrivial transformations on a program in language L1 into an equivalent program in language L2 as in contrast to a(n) _____________________ which directly performs operations implied by the program.

_____________________ analysis comes before _____________________ analysis in the compilation sequence and both come before _____________________ (which is the major thrust in Project II).

_____________________ analysis deals with verifying correct structure of a program.

_____________________ analysis deals with verifying correct meaning of a program.

A global variable whose storage is defined/allocated in the Data segment can be initialized with any compile time generated/known value. **True** or **False** – Circle the correct answer.

A global variable whose storage is defined/allocated in the Data segment can be initialized with any run time generated/known value. **True** or **False** – Circle the correct answer.

A local variable whose storage is defined/allocated in the Runtime Stack can be initialized with any compile time generated/known value. **True** or **False** – Circle the correct answer.

A local variable whose storage is defined/allocated in the Runtime Stack can be initialized with any run time generated/known value. **True** or **False** – Circle the correct answer.

Which is more compile/run time efficient? ________ **A**. Early binding / static compile time binding
Which is more flexible? ________ **B**. Late binding / dynamic run time binding

Give 2 examples of a dangling reference. (Use code or drawings if you want to help support your answer.)
(6 points)
1.

2.

Give an example of a memory leak. (Use code or drawings if you want to help support your answer.)
(3 points)

2. Show the memory layout of the following struct/record definition taking into consideration the SPARC data type memory alignment restrictions discussed in class. Fill bytes in memory with the appropriate struct/record member/field name. For example, if member/field name `p` takes 4 bytes, you will have 4 `p`'s in the appropriate memory locations. If the member/field is an array, use the name followed by the index number. For example, some number of `p0`'s, `p1`'s, `p2`'s, etc. Place an `X` in any bytes of padding. (10 points)

```
struct foo {
   short  a;
   int    b;
   short  c[3];
   char   d[3];
   double e;
}

struct foo fubar;
```

low memory

fubar:

high memory

What is the `offsetof( struct foo, e )`? (2 point)

What is the `sizeof( struct foo )`? (2 point)

List 2 features in the SPARC architecture (as an example of a RISC architecture) that help decrease the overall cost of making a function call. Be specific. (6 points)

1.

2.

3. What is the lifetime of an object in the Data segment? (3 points)

Can the scope/visibility of a symbol/name bound to an object in the Data segment be anything other than global to the entire source module or global to the entire program (across modules)? Explain. (3 points)

Give an example of a non-converting type cast/conversion (underlying bit pattern does not change). (3 points)

Give an example of a converting type cast/conversion (underlying bit pattern needs to be changed). (3 points)

Give an example of an implicit type coercion (type conversion without an explicit cast). (3 points)

So what is it? Left-Right Rule or Right-Left Rule??? (2 points)

Using this rule (whatever it is!) write the definition of a variable named XXX that is a pointer to an array of 5 pointers to functions that take a pointer to an int as the single parameter and returns a pointer to a struct fubar. (3 points)

4. Project I Semantic Type Checking. Consider the following Oberon code:

```
VAR i : INTEGER;
VAR b : BOOLEAN;
VAR r : REAL;
```

Example 1:

```
i := b + r;
```

How many errors would this statement generate? Describe the error(s) / error message(s) in general terms.
(6 points)

Example 2:

```
i := i + r;
```

How many errors would this statement generate? Describe the error(s) / error message(s) in general terms.
(6 points)

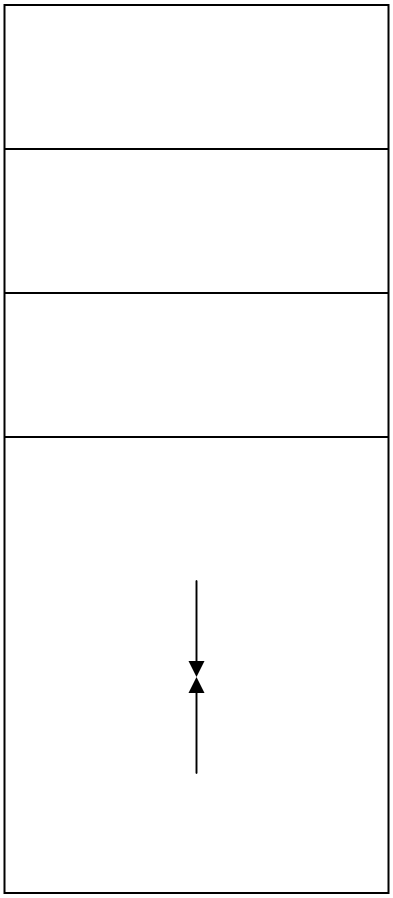
Example 3:

```
VAR x, y : INTEGER;

PROCEDURE P ( a : INTEGER; VAR b : INTEGER );
BEGIN
      ...
END P;

BEGIN
   P( x-y, x+y );
END.
```

How many errors would this code generate? Describe the error(s) / error message(s) in general terms.
(6 points)

5. Fill in the names of the 5 areas of the C Runtime Environment as laid out by most Unix operating systems (and Solaris on SPARC architecture in particular) as discussed in class. Then state what parts of a C program are in each area. (10 points)

low memory



____

____

____

____

____

high memory

What is one of the main distinguishing properties of a definition compared to a declaration? (3 points)

Given the following array definition

```
        /* C */                                  (* Oberon *)
     double a[3][5];                          VAR a : ARRAY 3,5 OF LONGREAL;
```

write the assembly level address calculation expression taking into account scalar arithmetic to access

```
     a[i][j]                                      a[i,j]
```

((a + ______________________________) + ______________________________)

The result is the address of where we can find this array element. (7 points)

Extra Credit (5 points)

What is the value of each of the following expressions?

```
char *a = "1234 Spirit!";           /*  char a[] = "1234 Spirit!";  */

"I love Compilers B!"[7]   _____________

a[5]                       _____________

*a                         _____________

*(a+2)                     _____________

*&a[0]                     _____________

5["This Blows Me Away!"]   _____________
```