CISC 458* Programming Language Processors
J.R. Cordy - April 1998

Quiz #4

Time: 20 minutes

Instructions: Total 10 marks. Closed Book.
                   Answer all questions in the space provided on this sheet.

1. (3 marks) Consider the following declaration.

```
var R:
    record
        i: array [2..5] of integer
        c: char
        r: array [0..3] of real
        b: boolean
    end
```

Assume that there is no reordering of fields and that the type **integer** requires two bytes aligned on a two byte boundary, type **real** requires four bytes aligned on a two byte boundary, and **char** and **boolean** each require one byte aligned on a one byte (i.e. any) boundary.

Using the storage allocation algorithm discussed in class, what is the size and alignment of record R?

   (i) size

   (ii) alignment

2. (2 marks) Assuming that the base address of the record R of question 1 above is represented in register R5, what is the data descriptor for the field `R.b` of the record in question 1 ?

3. (2 marks) What kind of optimization is each of the following code changes <u>mainly</u> an example of ?

(i) For the statement :

```
a := a + c
```

<u>Original code</u>   <u>Optimized code</u>
```
move    address(a),R1              add    c,a
move    a,R2
move    c,R3
add     R3,R2
move    R2,@R1
```

Kind of optimization: _____

(ii) For the statement :

```
a := a * 2
```

<u>Original code</u>   <u>Optimized code</u>
```
move    address(a),R1              move   a,R1
move    a,R2                       add    R1,R1
move    literal(2),R3             move   R1,a
mult    R3,R2
move    R2,@R1
```

Kind of optimization: _____

4. (3 marks) You are about to implement an optimizing compiler for the new programming language Mocha, which has recursion but does not allow nesting of procedures, on a RISC machine with 24 general purpose registers and a built-in memory stack. How would you choose to implement each of the following parts of the run time model ?

(i) Run stack (RS)

(ii) Expression stack (ES)

(iii) Display