Total No. of Questions : 8]

SEAT No. :

P1873

[Total No. of Pages : 3

[4859]-1063

B.E. (Information Technology)

MODERN COMPILERS

(2012 Pattern) (Elective - I) (End Sem) (Semester - I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Assume suitable data, if necessary.***

Q1) a) Define callee-save and caller-save registers. How do the use of registers save time for programming languages? **[6]**

b) Draw control-flow graph for the given code. Find the live ranges of a, b, c. **[6]**

```
a = 0
L1 : b = a + 1
c = c + b
a = b*2
if a <N goto L1
return c
```

c) Explain the terms Mutatorand incremental garbage collection. Explain Tricolor Marking along with its algorithm. **[8]**

OR

Q2) a) When we say that a "variable escapes"? For each variable a, b, c, d in the given program, find whether itescape and why? **[6]**

```
int f(int a, int*b)
{       int c[3], d;
        d = a + 1;
        b = g (c, & b);
        return c[1] + b;
}
```

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b) Write Maximal Munch algorithm for optimal tiling instruction selection and comment on its efficiency. **[6]**

c) Explain copying garbage collection with a neat diagram. Write Cheney's algorithm and comment on its cost. **[8]**

Q3) a) Explain Higher-order functions and Functional programming language in brief. What are three flavors of Functional programming language? **[6]**

b) What is closure? How it can be implemented using Heap-allocation? **[6]**

c) Explain tail position with suitable example. Write the steps to implement tail call. **[6]**

OR

Q4) a) Define inline expansion. Explain the rules for inline expansion. **[6]**

b) Explain call-by-name and call-by-need with respect to lazy evaluation. **[6]**

c) Explain strictness analysis. **[6]**

Q5) a) Explain Inter-procedural data-flow analysis in brief. Describe different functions for flow-insensitive side effect analysis. **[8]**

b) What are possible caches in a system? Describe different approaches for instruction-cache optimization. **[8]**

OR

Q6) a) Define call-graph. Draw call-graph for given code: **[8]**

```
Procedure f()
begin
        call g()
        call h()
End
procedure g()
begin
        call h()
        call i()
end
procedure h()
begin
end
procedure i()
begin
end
```

b) What is inter-procedural optimization? Describe different kinds of inter-procedural optimizations. **[8]**

Q7) a) What are reasons for variable aliases? Explain variable aliases based on type and based on flow. **[8]**

b) What is reaching definitions? Write in and out definitions for reaching definitions. **[8]**

OR

Q8) a) Explain transformations using dataflow analysis using suitable examples. **[8]**

b) Explain explicit and implicit parametric polymorphism with suitable examples. **[4]**

c) Draw IR tree representation and quadruple: a = b[i] + c. **[4]**