Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/MCA/SEM-5/MCA-E-504A/2009-10

2009

COMPILER DESIGN

Time Allotted : 3 Hours | Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) Which is not a phase of compiler ?

a) Syntax analysis b) Lexical analysis

c) Error handling d) Code optimization.

ii) Which sting satisfies the regular expression
(1) *(000) * (0) * ?

a) 1100 b) 0001

c) 1000 d) 010000.

iii) L1 is regular, L2 is regular, then L1 U L2 is

a) Regular b) Context-free

c) Context-sensitive d) None of these.

iv) Peephole optimization is used in

a) Lexical analysis

b) Syntax analysis

c) Semantic analysis

d) Code optimization.

v) If G is S $\varnothing$ aS / bS / a / b, then L (G) is

a) $\{ a, b \}^*$ b) $\{ a, b \}^+$

c) $\{ a, b, S \}$ d) none of these.

vi) Cross-compiler is a compiler

a) which is written in a language which is different from the source language

b) that generates object code for its host machine

c) which is written in a language that is same as the source language

d) that runs on one machine but produces object code for another machine.

vii) YACC builds up

a) SLR parsing table

b) canonical LR parsing table

c) LALR parsing table

d) none of these.

viii) An annotated parsing tree is

a) a parse tree with attribute values shown at parse tree nodes

b) a parse tree with values of only some attributes shown at parse tree nodes

c) a parse tree without attribute values shown at parse tree nodes

d) a parse tree with grammar symbols shown at parse tree nodes.

ix) Consider the statement "fi (x > = 10)", where 'if' has been misspelled. The error is detected by the compiler in the phase

a) Lexical analysis b) Syntax analysis

c) Semantic analysis d) Syntactic analysis.

x) A dangling reference is a

a) pointer pointing to storage which is freed

b) pointer pointing to nothing

c) pointer pointing to storage which is still in use

d) pointer pointing to uninitialized storage.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Explain DFA and NFA with suitable example. 5

3. a) What do you mean by left recursion ?

   b) Eliminate the left-recursion from the following grammar :

   S ∅ A

   A ∅ Ad | Ae | aB | aC

   B ∅ bBC | f

   C ∅ g. 2 + 3

4. When is a grammar called ambiguous ? Explain with an example. 5

5. Generate 3-address code for the following program segment :

   $x = a[i][j] + 1$;

   $a[i][j] = b[i][k]^* = c[k][j] =$

   $a[i][j] + = b[i][j]$. 5

6. Illustrate the concept of the followings with respest to code optimization :

   a) Global common sub-expression elimination

   b) Copy propagation

   c) Dead code elimination. 2 + 2 + 1

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Consider the following grammar :

E ∅ E + T | T

T ∅ TF | F

F ∅ F * | a | b

Construct the SLR parsing table for this grammar.

b) Consider the following grammar :

S ∅ CC

C ∅ cC | *d*

Construct the conical collection of LR (1) items for grammar. 8 + 7

8. a) Draw the DAG for the expression

$a + a^{*} (b - c) + (b - c)^{*} d$

b) What is syntax tree ?

c) Write the three address code for the following :

```
for(i=1;i<10;i++)
if(a<10)
    a=a+b;
else
    a=a–b;
```

d) What are the rules to compute FIRST and FOLLOW ?

3 + 2 + 5 + 5

9. Briefly explain each of the following with example : 5 × 3

   a) Constant folding

   b) Common sub-expression elimination

   c) Dead code elimination

   d) Loop unrolling

   e) Code motion.

10 a) What is an activation record ? When and why are those records used ? List different fields of an activation records and state the purpose of those fields.

   b) What do you understand by terminal table and literal table ?

   c) What is predictive parsing ? (2 + 2 + 5) + (2 + 2) + 2

11. a) Distinguish between quadruples, triples and indirect triples for the expression

   $$a \simeq b * - C + b * - C .$$

   b) Translate the arithmatic expression

   $a * - (b + c / d)$ into

   i) Syntax tree

   ii) Postfix notation

   iii) 3-address code

   c) Generate machine code for the following instruction :

   $$X = a / - (b * c) - d .$$

   Assume 3 register are available. 5 + 5 + 5

12. a) Show with example the difference between

i) call-by-value

ii) call-by-referece

iii) call-by-name.

b) Give an exampe of non-reducible flow-graph.

c) Construct the flow-graph and optimize the code

for ($i = 1; i \leq n ; i ++$)

for ($j = 1; j \leq n ; j ++$)

$c [i] [j] = a [i] [j] + b [i] [j]$. 6 + 2 + 7