Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/MCA/SEM-5/MCAE-504A/2011-12

2011
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 any *ten* of the following : $10 \times 1 = 10$

   i) Lex is a
      a) high level language
      b) phase of compiler
      c) lexical analyzer generator
      d) none of these.

   ii) If $L = L_1 L_2$ and $L_1 = \{ aa, bb \}$, $L_2 = \{ aa, ab \}$ then the value of L is
      a) $\{ aa, bb, aa, ab \}$
      b) $\{ aaaa, aaab, bbaa, bbab \}$
      c) $\{ (aa)^2, ab^3 \}$
      d) none of these.

iii) Which one is graphical representation of syntax ?

a) DAG b) Syntax tree

c) None of these d) Both (a) and (b).

iv) Which one is used to keep track of live procedure activations ?

a) Control stack b) Symbol table

c) Both (a) and (b) d) None of these.

v) If G is S $\rightarrow$ *a*S / *b*S / *a* / *b*, then L (G) is

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

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

vi) Context free grammar is accepted by

a) Turing Machine b) Finite Automata

c) Push Down Automata d) none of these.

vii) Divide by zero error in C language is handled by

a) Lexical analysis b) Syntax analysis

c) Semantic analysis d) Code optimization.

viii) Shift reduce parsing uses

a) Array b) Stack

c) Queue d) none of these.

ix) Most powerful parser is

a) Top down Parser b) SLR

c) LALR d) Canonical LR.

x) Shift reduce parsing technique is not used in

a) Top down Parsing b) SLR Parsing

c) All Bottom up Parsing d) only LALR Parsing.

xi) Activation record of a procedure has

a) 6 fields b) 7 fields

c) 8 fields d) 9 fields.

xii) In flow graph, each node represents

a) a basic block

b) a single instruction

c) only a for loop

d) both for and while loops.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. a) What is heap allocation ?

b) What is activation record ?

3. Consider the following basic block containing 4 statements :

i) $d = b + c$

ii) $e = a + b$

iii) $b = b * c$

iv) $a = e-d.$

Assume that only a and b are live on exit from this block. For each statement, compute the liveness and next use information for the variable used.

4. Show with example the difference between inherited and synthesized attributes.

5. In LR parser, what are being indicated by two letters 'L' & 'R' ? What are the different LR parsers ? What is the basic difference in the implementation of different LR parsing techniques ? 2 + 2 + 1

6. a) Give an example of semantic error & explain.

   b) What is quadruple ? Give an example. 2 + 3

GROUP – C

(Long Answer Type Questions)

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

7. a) Define handle.

   b) Explain handle pruning with example.

   c) Define operator grammar.

   d) What is left-factoring ? How can you remove the left-factoring from the grammar ?

   e) How can you prove that a language is not regular using pumping lemma ? 2 + 3 + 1 + (1 + 3) + 5

8. Construct a predictive parsing table for the following grammar after eliminating left recursion :

$E \rightarrow E + T \mid T$

$T \rightarrow T * F \mid F$

$F \rightarrow (E) \mid id$

Check whether id * id + id belongs to this or not.

9. a) A grammar is given below :

$S \rightarrow aS \mid aSbS \mid \epsilon$

Show that the grammar is ambiguous by constructing two parse trees and two leftmost derivations for **aab.**

b) Compute FIRST and FOLLOW of the following grammar :

$E \rightarrow TE'$

$E' \rightarrow + TE' \mid \epsilon$

$T \rightarrow + FT' \mid \epsilon$

$T \rightarrow * FT' \mid \epsilon$

$F \rightarrow (E) \mid id$

10. Write short notes on any *three* of the following : 3 × 5

a) Three address code

b) Peephole optimization

c) Basic block

d) Symbol table.

11. a) Clearly explain activation record with diagram.

b) Explain static and dynamic storage allocation.

c) What do you mean by activation of a procedure ? Explain briefly with a suitable example. 6 + 6 + 3

12. a) Define basic block and flow graph.

b) Write down the process for identifying basic blocks.

c) Consider the following code :

i) i = 1

ii) j = 1

iii) t1 = 10 * i

iv) t2 = t1 + j

v) t3 = 8 * t2

vi) t4 = t3 – 88

vii) a[t4] = 0.0

viii) j = j + 1

ix) if j ≤ 10 goto (3)

x) i = i + 1

xi) if I ≤ 10 goto (2)

xii) i = 1

xiii) t5 = i – 1

xiv) t6 = 88 * t5

xv) a[t6] = 1.0

xvi) i = i + 1

xvii) if i ≤ 10 goto (13)

Find out the basic block and draw the flow graph for the above code. (2 + 2) + 5 + 6