Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/MCA/SEM-5/MCAE-504A/2012-13

2012

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 *five* of the following : $5 \times 2 = 10$

i) If G is $S \rightarrow aS / bS / a / b$, then L(G) is :

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

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

ii) Context free grammar is accepted by :

a) Turing Machine b) Finite Automata

c) Push Down Automata d) None of these.

iii) A symbol table is a :

a) Compilation phase b) Error handler

c) Data structure d) None of these.

iv) Bottom up parsing is a right choice to handle a larger class of grammar.

a) True b) False

c) Not always d) Irrelevant.

v) The difference between DAG and Syntax tree lies in the fact that :

a) A node in a Syntax tree for a common sub expression has more than one parent

b) A node in a DAG for a common sub expression has more than one parent

c) A node in a Syntax tree for a common sub expression may have more than one parent.

vi) What is not the phase of a compiler ?

a) Syntax analyzer   b) Code generator

c) Code optimizer   d) Code linker.

vii) What is the first phase of a compiler ?

a) Code generator   b) Code optimizer

c) Lexical analyzer   d) Syntax analyzer.

GROUP – B

(Short Answer Type Questions)

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

2. Generate 3 address code for the following program segment

```
sum = 0;
for (j = 1; j<=10;j++)
sum=sum+a[j]+b[j];
```

3. a) What do you mean Left recursion ?

b) Eliminate the left recursion from the following grammar:

S → (L) / a

L → L, S / S   2 + 3

4. Compare different implementation of 3 – address code. 5

5. a) What is DAG ?

   b) Draw the DAG for the following expression

      $a + (b*d) + c* (b*d) + e + a/(b*d)$

6. Find out FIRST and FOLLOW for the following grammar :

   $E \rightarrow E + T / T$

   $T \rightarrow TF / F$

   $F \rightarrow F * / a$

GROUP – C

(Long Answer Type Questions)

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

7. a) A grammar is given below :

      $S \rightarrow aS \ |aSbS| \in$

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

   b) Consider the following grammar :

      $S \rightarrow CC$

      $C \rightarrow cC|d$

      Construct the canonical collection of LR(1) items for this 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 = 15

i) Constant Folding

ii) Common sub expression elimination

iii) Dead code elimination

iv) Loop unrolling

v) Code motion.

10. Write short notes on the following (any *three*) : 3 × 5 = 15

a) Three address code

b) Peephole optimization

c) Basic Block

d) Symbol table.

11. a) Discuss the procedure to convert a regular expression to corresponding NFA with figure, and hence convert the following regular expression to NFA :

(a|b)*(ab)*aabb

b) Eliminate the left recursion of the following productions:

bexpr-> bexpr **or** bterm|bterm

bterm-> bterm **and** bfactor|bfactor

bfactor -> **not** bfactor|(bexpr)|**true**|**false**

and hence find out the FIRST and FOLLOW of the above productions. 6 + 9