DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF TECHNOLOGY
B.TECH - Semester – VII(CE)
SUBJECT: (CE 703) Compiler Construction

Examination	: External Examination	Seat No.	: CE 84
Date	: 28/11/2019	Day	: Thursday
Time	: 3 Hrs. (11.30 to 2.30pm)	Max. Marks	: 60

INSTRUCTIONS:
1. Figures to the right indicate maximum marks for that question.
2. The symbols used carry their usual meanings.
3. Assume suitable data, if required & mention them clearly.
4. Draw neat sketches wherever necessary.

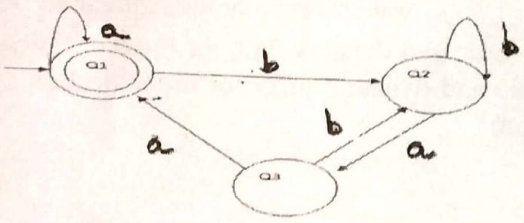
SECTION-I

Q.1 Do as Directed **[10]**

a) Define Three Address Code with suitable example 02

b) Identify the number of tokens in the following C statement: 02
printf ("I = %d, &I = %X", I , &I);

c) Construct a Regular Expression from the given Finite Automata by Algebraic Method using Arden's Theorem. 02



d) What is the maximum number of reduce moves that can be taken by a bottom-up parser for a grammar with no null and no unit production to parse a string with n tokens ? 02

e) (1) Which parsers are specialized form of LR parsers that lie in between SLR parsers and CLR parsers in terms of power of parsing the grammars ? 02
(2) In which parsing technique both shift-reduce and reduce-reduce conflicts occurs ?

Q.2 Attempt Any Two **[10]**

a) Write a short note on: P-CODE For PASCAL 05

b) Consider the following grammar. 05
S → aAbc | BCf
A → C | null
B → Cd | c
C → df | null
a) Is the given grammar LL(1) ?
b) Find FIRST and FOLLOW sets.
c) Construct the parsing table

c) Generate Triple and Quadruple Tables for the given algebraic expression 05
A + B * C - D + E / F

Q.3 Answer the following **[10]**

a) Show that the following grammar is **NOT** LALR(1). 06

S→ Aa | bAc | Bc | bBa
A→ d
B→ d

b) Write a Lex program that converts binary number into decimal number. 04

OR

Q.3 Answer the following **[10]**

a) Construct canonical LR parser for the below given grammar 06

S→ L = R
S → R
L→ *R
L→ id
R→ L

b) Construct a Recursive Descent Parser for below given grammar 04

E→ T + E | T- E | T
T → a

SECTION - II

Q.4 Do as Directed **[10]**

a) Differentiate local and global copy propagation. Write equations of in (i) and out (i). 02

b) Fill in the blank and justify with example: S-Attributed Syntax Directed Definitions can be evaluated using _____ tree traversal of the Annotated/Decorated Parse Tree. 02

c) How can you compute static and dynamic link for the Activation Records on the Run Time Stack? Show static and dynamic links for the allocation of Activation Records for the following program. 02

```
program RTST;
   procedure P;
     procedure Q;
       begin R; end
     procedure R;
       begin Q; end
   begin R; end
begin P; end
```

d) Write 3-Address code for the following C code and create control flow graph. 02

```
if(a<b && c<d)
   X=Y+M*N;
else
   X=Y+Z;
End
```

e) Write an algorithm to find nodes in the natural loop of the control flow graph from the given input back edge. 02

Q.5 Attempt Any Two **[10]**

a) A robot is to be moved to a unit step in a direction specified as a command given to it. The robot moves in the direction North, South, East, West on receiving N, S, E, W commands respectively. The current position of the robot is initialized to (0,0) Cartesian coordinates on receiving command Start. **Write production rules for producing sequence of commands and semantic rules for knowing position of a robot after receiving a sequence of commands.** Draw annotated parse tree for 05

following sequence:

Start, N, N, E, S, E, N

b) Give detailed run-time stack of the dynamic memory allocation for the following code fragment: 05

```
Begin
Write (Factorial(4));
    Integer Procedure Factorial(integer N)
      If(N<3) return N; else return N*Factorial(N-1);
End
```

c) For following set of instruction 05

(i) Find leaders, design basic blocks and based on that draw a control flow graph

(ii) Find predecessor, successor and dominator for every basic blocks.

1) m=i-1	11) t4= c[m]	21) x = x + 1
2) j = n	12) if t4 < j goto 9	22) goto (5)
3) t1 = 4 * n	13) if i<j goto 23	23) t10= 4 * i
4) m = x[j]	14)t5 = 4 * i	24) t11= x +3
5) i=i+1	15) x=a[t5]	25) t12= 4 * n
6) t1=4 * i	16) t6 = 4 * i	26) t13 = a[t12]
7) t2 = x [t1]	17)t7 = 4 * j	27)t14 = 4 * t11
8) if t2 > i goto 5	18)t8 = a[t7]	28)a[t14]= t11
9) j=j-1	19)t9=4*j	29)t15 = 4 * n
10) t3= 4 * j	20)a[t9]=x	30) a[t15]=x

Q.6 Answer the following **[10]**

a) Write LEX and YACC programs for Computing Integer and floating point Arithmetic Expressions involving (+,-,*,/,%,^) using unambiguous Grammar similar to conventional Expression Grammar. Clearly show the steps of compilation and run of programs. 05

b) What is Symbol table? What are the columns of it? Explain different ways to organize the symbol table data structure and compare them. 05

OR

Q.6 Answer the following **[10]**

a) Define: EVAL(i), KILL(i) where 'i' is some Basic Block. Write Data flow equations for IN(i) and OUT(i). Write algorithm to compute IN(i) and OUT(i) using iterative method which continues until convergence. Explain how will you use output of the algorithm for doing Global Common Sub-Expression Elimination? 06

b) Write syntax directed definition to generate 3-Address code from the following Grammar. Draw decorated parse tree for the input string X=Y+Z*(W+M) and generate 3-Address code. 04

S→id=E

E→E+T/T

T→T*F/F

F→(E)/NUMBER