B. Tech.
(Sem. VI) Examination, 2007
Compiler Construction

Time : 3 Hours] [Total Marks : 100

Note : Attempt all questions.

1. Attempt any four parts of the following : $5 \times 4 = 20$
   
   (a) Discuss how YACC can be used to generate a parser. Also, explain the format of its input specification file.
   
   (b) Prove that regular sets are closed under intersection. Present a method for constructing a DFA with an intersection of two regular sets.
   
   (c) Construct a finite automata that will accept those strings of a binary number that are divisible by three.
   
   (d) Find the DFA recognizing the language described by the regular expression.

   $a|abb|a^*b^+$
   
   (e) Find the reduced grammar that is equivalent to the CFG given below:

   $S \rightarrow aC | SB$
   $A \rightarrow bSCa$
   $B \rightarrow aSB | bBC$
   $C \rightarrow aBC | ad$

[Contd...]

(f) What is the language accepted by the finite automata whose transition diagram is given below: (Fig. 1).

![Finite Automaton Diagram]

Fig. 1

2 Attempt any two parts of the following: 10x2=20

(a) Construct the LALR parsing table for the following grammar:

\[ S \rightarrow AA \]
\[ A \rightarrow aA | b \]

(b) Construct a predictive parsing table for the following grammar where \( S \) is a start symbol and \# is the end marker.

\[ S \rightarrow S\# \]
\[ S \rightarrow aABC \]
\[ A \rightarrow a | bbD \]
\[ B \rightarrow a | \epsilon \]
\[ C \rightarrow b | \epsilon \]
\[ D \rightarrow c | \epsilon \]
(c) Consider the grammar and test whether the grammar is LL(1) or not.

\[ S \rightarrow |AB| \in \]
\[ A \rightarrow |AC|OC \]
\[ B \rightarrow OS \]
\[ C \rightarrow 1 \]

3 Attempt any two parts of the following: 10x2=20
(a) Generate three address code for the following code:
switch \( a + b \)
{  
  case 1 : \( x = x + 1 \)  
  case 2 : \( y = y + 2 \)  
  case 3 : \( z = z + 3 \)  
  default : \( c = c - 1 \)  
}

(b) Construct an SLR(1) parsing table for the following grammar:
\[ S \rightarrow A ) \]
\[ A \rightarrow A, P \) (P, P \]
\[ P \rightarrow \{ \text{num, num} \} \]

(c) Transform the following NFA into an optimal/minimal state DFA:

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>( \in )</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A</td>
<td>C</td>
<td>B</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td>D</td>
<td>C</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>A, C</td>
<td>D</td>
</tr>
<tr>
<td>D</td>
<td>D</td>
<td>A</td>
<td>-</td>
</tr>
</tbody>
</table>

V-1038] 3 [Contd...
4 Attempt any two parts of the following: \(10 \times 2 = 20\)
   (a) Write the syntax directed translation to go along with the LR parser for the following:
        \[ S \rightarrow AE \]
        \[ A \rightarrow DS \text{ while} \]
        \[ D \rightarrow \text{do} \]
   (b) For the grammar having productions:
        \[ A \rightarrow (A) \mid \varepsilon \]
        Compute FIRST and FOLLOW set of \(A\).
   (c) A relation \(R\) on the set of integers defined as:
        \[ R = \{(a, b) \mid a - b \text{ is even integer}\} \]
        Show that \(R\) is equivalence.

5 Attempt any two parts of the following: \(10 \times 2 = 20\)
   (a) Give three-address code for the following code fragment:
        \begin{align*}
        \text{if } & a < b \text{ then} \\
        \text{while } & c > d \text{ do} \\
        \text{while } & e <= f \\
        \text{else} & \\
        \text{do} & \\
        p &= p + q \\
        \text{while } & e <= f \\
        \end{align*}
   (b) Construct an LALR(1) parsing table for the following grammar:
        \[ D \rightarrow L : T \]
        \[ L \rightarrow L, id \mid id \]
        \[ T \rightarrow \text{integer} \]
   (c) Write a short note on code optimization.