

BACHELOR OF ELECTRONICS & TELE-COMMUNICATION ENGG EXAMINATION, 2017
(3rd Year, 2nd Semester)

Systems Software

Time: 3 hours

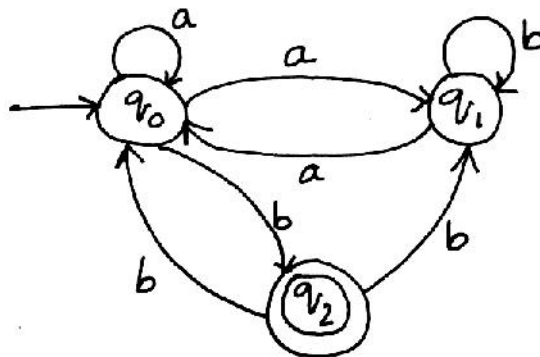
Full Marks: 100

Answer **Question No.1** and any **four** from the rest.

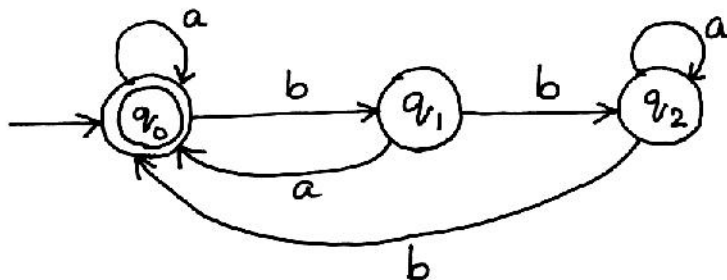
1. (a) Construct a DFA for $\Sigma = \{a, b, c\}$, that accepts any string with **aab** as a substring. Explain each step of its construction. 10

- (b) Draw the flowchart of a pushdown automaton (PDA) that accepts the language $\{0^{2n} 1^n \mid n > 0\}$ and explain. Give two examples, one for acceptance and the other for rejection by the PDA. 10

2. (a) Construct a DFA for the following NFA and hence write a program in C language to simulate the DFA. 10

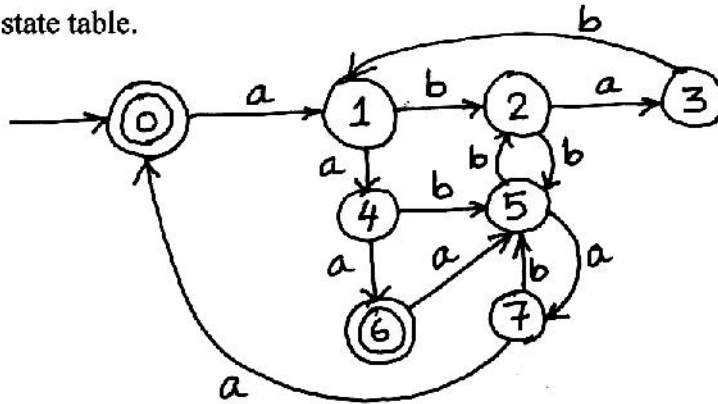


- (b) Derive a regular expression for the following FA. 04



[Turn over

- (c) Minimize the states of the following DFA and show the result in the form of a state table. 06



3. Consider the following grammar

$$S \rightarrow AB$$

$$A \rightarrow Ca \mid \varepsilon$$

$$B \rightarrow BaAC \mid c$$

$$C \rightarrow b \mid \varepsilon$$

- (a) Eliminate left recursion from the above grammar. 4
- (b) Draw the transition diagrams and hence write mutually recursive procedures for the above grammar to implement a non back tracking recursive descent parser. 10
- (c) Parse the string w: **baaab** using the parser that you have constructed. Give the sequence of calls and draw the parse tree accordingly. 6

4. Consider the following grammar G

$$E \rightarrow 5+T \mid 3-T$$

$$T \rightarrow V \mid V*V \mid V+V$$

$$V \rightarrow a \mid b$$

Construct a predictive parsing table for G and hence write a driver routine to design a parser. Show the moves of the parsing of the string $w: 5+a*b$ using the predictive parsing method and obtain the left most derivation for the same. Show the corresponding parse tree also. 14+6

5. (a) Generate 3-address code corresponding to the program fragment given below. Each time a temporary variable is needed, use a new temporary. Do not perform any optimization. 8

```
while(A<C and B>D) do
  if A = 1 then C = C+1
  else
    while A<= D do
      A = A+3
```

- (b) Identify the leaders and hence the basic blocks in the TAC for part (a) above and draw the corresponding flow graph. 6
- (c) Discuss different representations of three address code and compare them. 6
6. (a) Rewrite the basic block given below in single assignment form and then draw the data flow graph (DFG) for that form. Obtain the assembly code from the DFG for a hypothetical machine. 4+4

```
a = q - r;
b = a + t;
a = r + s;
c = t - u;
```

- (b) Draw the life-time graph for the basic block given in part(a) and hence determine the minimum number of registers required to perform the operations. 5
- (c) Explain different loop optimization techniques with suitable examples. 7

7. Write notes on the following:

4 * 5

- (i) Bootstrapping
- (ii) Syntax directed translation
- (iii) Ambiguous grammar
- (iv) Shift reduce parser

End of question