

Department of Electrical Engineering, IIT Delhi
EEL702 System Software: Minor I Examination
 (Closed book/Closed Notes) Time: 1 hour Maximum Marks: 15

“Thou shalt not covet thy neighbour’s answers”

1. **1s | more; more or less** (3 marks)

Consider the DFA, $M = \{Q, \Sigma, \{q_1\}, \delta, F\}$, where all the symbols have their ‘usual’ meanings. $Q = \{q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8\}$, $F = \{q_1, q_3, q_7\}$, and δ is given by the table to the right. Using this information, construct an equivalent minimum-state DFA.

State	a	b
q_1	q_2	q_4
q_2	q_5	q_3
q_3	q_2	q_6
q_4	q_1	q_5
q_5	q_5	q_5
q_6	q_3	q_5
q_7	q_6	q_8
q_8	q_7	q_3

2. **Simplicity in Complexity: Do you see a pattern?** (3 marks)

Consider the following DFA-based algorithm to find all occurrences of pattern $P[1..m]$ in a piece of text $T[1..n]$. Write an expression for the complexity of the given algorithm in terms of n , m , and Σ (where all symbols have their ‘usual’ meanings). Explain your answer.

```

ALGORITHM FSM_matcher
q := 0; compute_δ();
FOR i := 1 TO n DO
  q := δ(q, T[i]);
  IF q == m THEN print shift=i - m;
ALGORITHM compute_δ()
FOR q := 0 TO m DO
  FOREACH a ∈ Σ DO
    k := min(m + 1, q + 2); REPEAT k := k - 1;
    UNTIL P[1..k] is a suffix of P[1..q]a
  
```

3. **फिर एक दफ़ा... DFA** Construct a DFA for the alphabet $\Sigma = \{0, 1\}$ which accepts all strings with 00 as a substring. (3 marks)
4. **Even the Introvert must engage in Regular Expression!** Construct a regular expression for the *complement* of the language accepted by the DFA of the previous question. (3 marks)
5. **One for the Smart A-lex.../* No Comments! */**

What *precisely* does the following lex code print out, given a few lines of text input, terminated by a Control-D? There will be no marks for an imprecise answer. *It is a digital world, you know!* (3 marks)

```

%{
int i, j, k;
%}
%%
\n      { k++; i++; }
[^\t\n]+ { j++; i += yyleng; }
.       { i++; }
%%
int main(void)
{ yylex(); printf("%d\t%d\t%d\n",j,k,i); return 0; }

```