

# MTL783: Theory of Computation Minor Exam

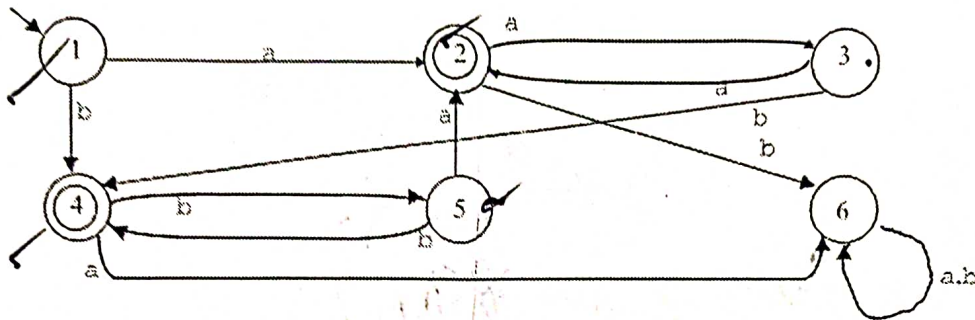
Writing Time: 1:45 hours

Total Marks: 25

Q1. Draw a deterministic machine that accepts the language:  $\{a^i b^j c^k\}$  such that either  $i < 5$  or  $j = k$ .

[5]

Q2. (i) Construct the minimum state automata equivalent to the following transition diagram:



(ii) Find the regular expression corresponding to the minimum DFA using Arden's lemma.

[2+2=4]

Q3. Consider the language  $\{a^j b^k c^m : j + k + m > 0, j, k, m \geq 0 \text{ and } m = k - j\}$

- Show that it obeys Pumping Lemma for CFG
- Draw a Deterministic PDA to accept the language.
- Write the CFG to generate this language.

[1+2+2=5]

Q4. Consider the grammar  $G$  with  $V = \{S, A, B\}, T = \{a, b\}$  such that the starting symbol is  $S$ , and the production rules are:

$$S \rightarrow aB | bA, A \rightarrow a | bAA | aS, B \rightarrow b | bS | aBB$$

- Write the above grammar in CNF.
- Use CYK algorithm to check whether the string 01001 belongs to  $L(G)$ .

[2+4=6]

Q5. (i) Write the grammar for accepting the language  $\{a^m b^k | 2k \leq m \leq 3k + 1\}$ .

(ii) Draw the Leftmost and Rightmost derivation trees for the above grammar for accepting the string  $a^7 b^2$ .

[2+3=5]