JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATIONS-2023

B.Tech-V Semester (ECM)

COURSE CODE (CREDITS): 23B11EM512 (3) MAX. MARKS: 25

COURSE NAME: Theory of Computation

COURSE INSTRUCTORS: Dr. Shweta Pandit MAX. TIME: 1 Hour 30 Minutes

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*Note: All questions are compulsory. Marks are indicated against each question in square brackets.*

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**Q1. a)** Diffentiate between DFA, NFA and Null-NFA. Mention the need to study and design DFA, NFA and null NFA. **[2][CO-1][CO-4]**

**b)** Design a MDFA that accepts all strings over the alphabet $\sum = \{a, b\}$ s.t. every string accepted must contain be like, "number of a=0(mode2) || number of b=0(mode 2)". **[2][CO-1][CO-4]**

**Q2. a)** What is minimal DFA and how to get minimal DFA from DFA? Minimize the DFA shown in Fig. 1 below. **[5][CO-1][CO-4]**

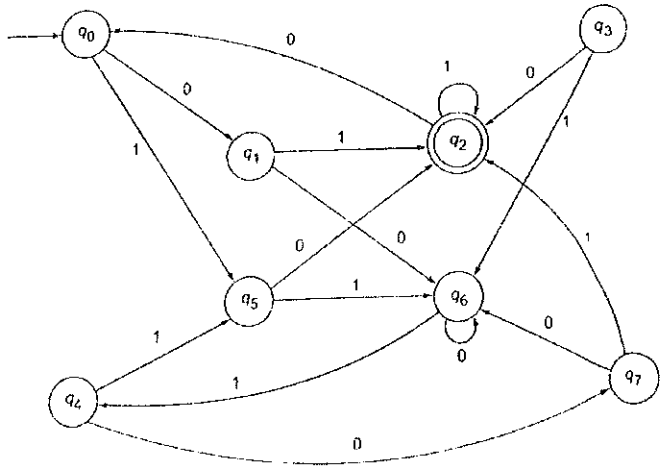


**Fig. 1**

**Q3** Define the acceptance of a string by NFA along with its expressions. Design NFA's over the alphabet $\sum = \{a, b\}$ s.t. every string accepted: **[4][CO-1][CO-4]**

(i) Must start with substring bab.
(ii) Must end with substring bab.
(iii) Must start and end with different symbol.
(iv) Must contain a substring abb.

**Q4 a)** Convert the NFA shown below in Fig. 2 to DFA. **[2][CO-1][CO-4]**

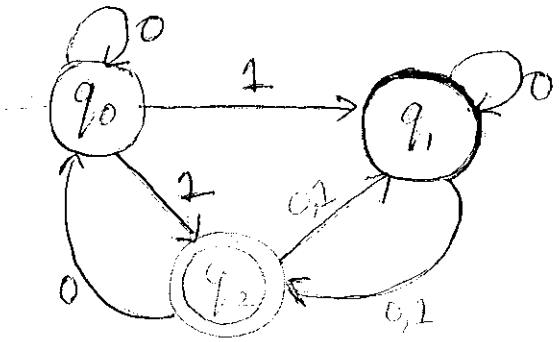


**Fig. 2**

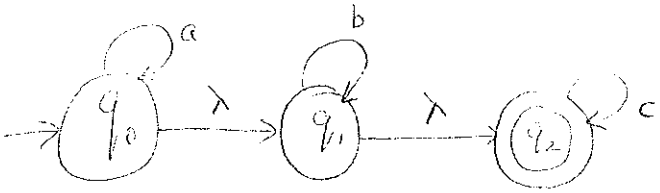


**Fig. 3**

**b)** Convert the $\lambda$-NFA shown in Fig. 3 to NFA. **[2][CO-1] [CO-4]**

**Q5.** Which of the following languages are regular or non-regular languages and why?

**[4][CO-1][CO-4]**

(i) $L = \{a^n b^n \mid 1 \leqslant n \leqslant 2^{|GATE|}\}$

(ii) $L = \{a^m b^n \mid m, n \geqslant 0, m \neq n\}$

(iii) $L = \{a^m b^n \mid m + n = even\}$

(iv) $L = \{a^m b^n \mid m \; is \; divisible \; by \; n\}$

**Q6.** What do you understand by decidability in theory of computation? Show that $A_{NDFA} = \{(B, w) \mid B \; is \; an \; N_{DFA} \; and \; B \; accepts \; w\}$ is decidability. **[4][CO-2]**