BANKURA UNIVERSITY

B.Sc (HONS) FIFTH SEMESTER EXAMINATIONS, 2021-22

Subject: Computer Science **Course ID: 51512**

Course Title: Theory of Computation

Full Marks: 40 **Time: 2 Hrs**

The figures in the margin indicate full marks

Answer all the questions.

UNIT I

1. Answer any five of the following questions: (5x2=10)
   a) Write two differences between nfa and dfa.
   b) Define regular expression? Give example.
   c) Find all strings of length 5 or less in the regular set represented by $(ab+a)^*(aa+b)$
   d) State pumping lemma of regular languages.
   e) Define simple grammar. Give example.
   f) What is context free language? Give example.
   g) Define Turing Machine.
   h) Draw an nfa for $L=a^*b^*$

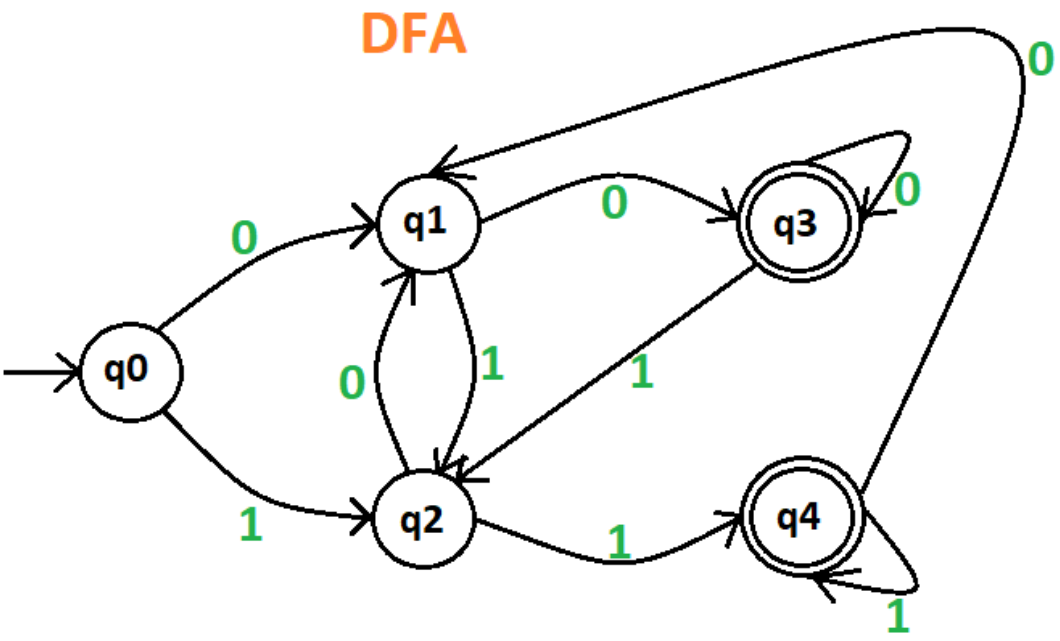
UNIT II

2. Answer any Four of the following questions: (5x4=20)
   a) Find regular expression for the following languages
      I. Set of all strings of {0, 1} not ended with 01.
      II. L=vwv such that |v|=2 and v,w $\mathcal{E}$ {a, b}*
      III. Write differences between accepter and transducer. 1.5x2+2=5
   b) Draw dfa for the following languages:
      I. L = (ab+ba)*bb
      II. Strings of {0, 1} ended with 01. 2.5x2=5
   c) Design a pda for $L=\{ a^nb^{2n}\ n: n>0 \}$. Explain functioning of it with instantaneous description. 4+1=5
   d) Write context free grammars for $L_1=\{ a^nb^mc^n : n>0, m>0 \}$ & $L_2=\{ a^nb^n : n>0\}$ 2.5x2=5
   e) Design a Turing machine for $L=\{ a^nb^nc^n: n>0 \}$.
   f) Prove that $L=\{a^p: p \text{ is a prime}\}$ is not regular. State pigeonhole principle. 4+1=5

UNIT III

3. Answer any one of the following questions: (10x1=10)

a) Find a regular expression for the following dfa.



Prove the following theorem by method of induction

$1+2+3+.....+n = n(n+1)/2$ 6+4=10

b) Use pumping lemma for context free languages to prove that following languages are not context free.

I. $L=\{ a^n b^n c^n : n>0 \}$.

II. $L=\{a^n b^m \mid n=m^2\}$ 5+5=10