R13

Code No: 114AG

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, February -2024

FORMAL LANGUAGES AND AUTOMATA THEORY

(Computer Science and Engineering)

Time: 3 hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

1.a) How to check acceptance of string by finite automata? [2]

b) What are the differences between DFA & NFA? [3]

c) Write the regular expression for the L={w €{0,1}* | w has no pair of consecutive zeros. [2]

d) What is context free language? Give example. [3]

e) Remove Null production from the following grammar

S → ASA | aB | b

A →B

B → b | ∈ [2]

f) What are the components of a Push Down Automata? [3]

g) When do you say that a Turing Machine accepts a string? [2]

h) What is Turing machine halting problem? [3]

i) Write about Universal TM. [2]

j) Give example problems of type NP-Complete. [3]

PART - B

(50 Marks)

2.a) What is Automata? Explain classification of Automata.

b) Design a DFA for language every 00 is immediately followed by 1 over {0, 1}*. [5+5]

OR

3.a) Construct DFA for the given NFA.

	Next state	
	0	1
→ q0	q0,q1	q0
q1	q2	q1
q2	q3	q3
(q3)	-	q2

b) Construct Mealy machine corresponding to Moore machine.

States (Q)	Next States		Output
	I/P=0	I/P=1	
→q1	q1	q2	0
q2	q1	q3	0
q3	q1	q3	1

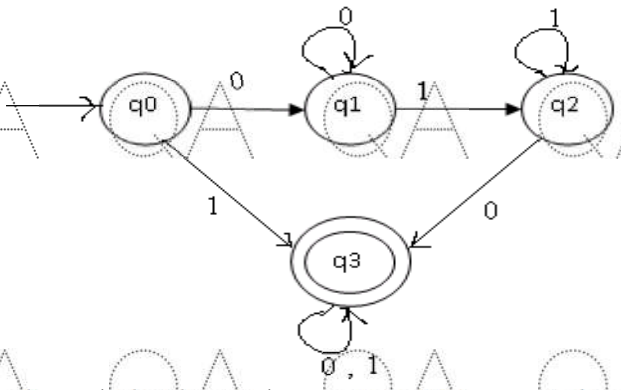
[5+5]

4.a) Construct an equivalent FA for the given regular expression (0+1)*(00+11)(0+1)*.

b) Explain the Pumping Lemma for regular sets. Show that L={$\mathbf{a^P}$| **p is a prime**}is not regular. [5+5]

OR

5.a) Construct the regular grammar for the following FA.



b) Explain about derivation and parse trees? Construct the string 11001010 from the Leftmost and Rightmost derivation.
S→1B/0A
A→1/1S/0AA
B→0/0S/1BB. [5+5]

6.a) Simplify the following context free grammar. (Here, Λ stands for epsilon (ϵ)).
S→TU|V
T→aTb|Λ
U→cU| Λ
V→aVc|W
W→bW| Λ.

b) Convert the following grammar into Greibach normal form.
S→AA/a
A→SS/b. [5+5]

OR

7.a) What is deterministic Push Down Automata? Draw and explain a deterministic PDA for accepting $\{ a^n b^n \mid n>1\}$.

b) Construct a CFG equivalent to the following PDA.
PDA={(p, q), (0, 1), δ, p, q, (Z, X)}, where p is initial state, q is final state.
δ is defined as
δ(p,0,Z)=(p,XZ)
δ(p,0,X)=(p,XX)
δ(p,1,X)=(q,ϵ)
δ(p,1,X)=(p,ϵ)
δ(p,ϵ,Z)=(p,ϵ). [5+5]

8.a) Explain the general structure of multi tape and non-deterministic Turing machines and Show that these are equivalent to basic Turing machines.

b) Construct a Turing machine which multiplies two unary numbers. [5+5]

OR

9.a) Write about Churches hypothesis and Computable function in Turing Machines with an example.

b) Describe the recursively enumerable languages. [5+5]

10.a) Discuss in brief about Turing reducibility.

b) Discuss the concept of decidability and undecidability of the context of formal languages. [5+5]

OR

11.a) What is satisfiability problem? How Cook's theorem helps in deciding the NP completeness of problem.

b) What is NP Problem? Explain with Travelling Sales person problem. [5+5]

---ooOoo---