National University of Computer and Emerging Sciences 027

Islamabad Campus

Theory of Automata (CS3005)

Sessional-I Exam

Course Instructor(s):
Dr. Tajwar Mehmood, Ms. Maryam Shahbaz and Ms. Bushra Fatima

Section(s): BSCS-5th (A,B,C,D,E,F,G)

Total Time (Hrs): 1
Total Marks: 52
Total Questions: 5

Date: Sep 24, 2025

Umar

Student Signature

Roll No **Course Section**

Do not write below this line.

Attempt all the questions.

Solve all questions on Question paper, you can show extra working on extra Sheet

CLOS

[CLO 1: Identify formal language classes and prove language membership properties.]

[[CLO 2: Differentiate and manipulate formal descriptions of languages, automata and grammars with focus on non-regular, regular, context-free languages using automata (DFA, NFA, PDA) and Turing Machines.]

[CLO 2]

Q1: Describe (in English) the languages associated with the following regular Expressions **[2 marks]** 2

A. (0+1)(0+1)*00

S is a language with alphabets $\Sigma = \{0,1\}$. ~~that~~ The words of S start with either '0' or '1' and end with '00'.

[CLO1]

Q2: Provide a recursive definition of language **[10 marks]** 3

A. Recursive definition of all strings of the form 0^i1^j, where { i>=2j , I,j>=0 }

Language Defined :

Step 1 :
Let ^, 00, 0 belong to L, ~~where i>=2j and j>=0~~

Step 2:
If x belongs to L and y belongs to L and is 1, then $x^i y^j$ also belongs to L where i>=2j, j>=0

Step 3:
All the string not defined by the above 2 steps donot belong to L

[CLO 2]

Q3: Write an RE for the following languages **[20 marks]**

A. Does not contain **01** , L ∈ {0,1}*

R.E = 1*0*

10

B. Language in which every **a** is followed by **bb**, L ∈ {a,b}*

R.E = b* (abb)*

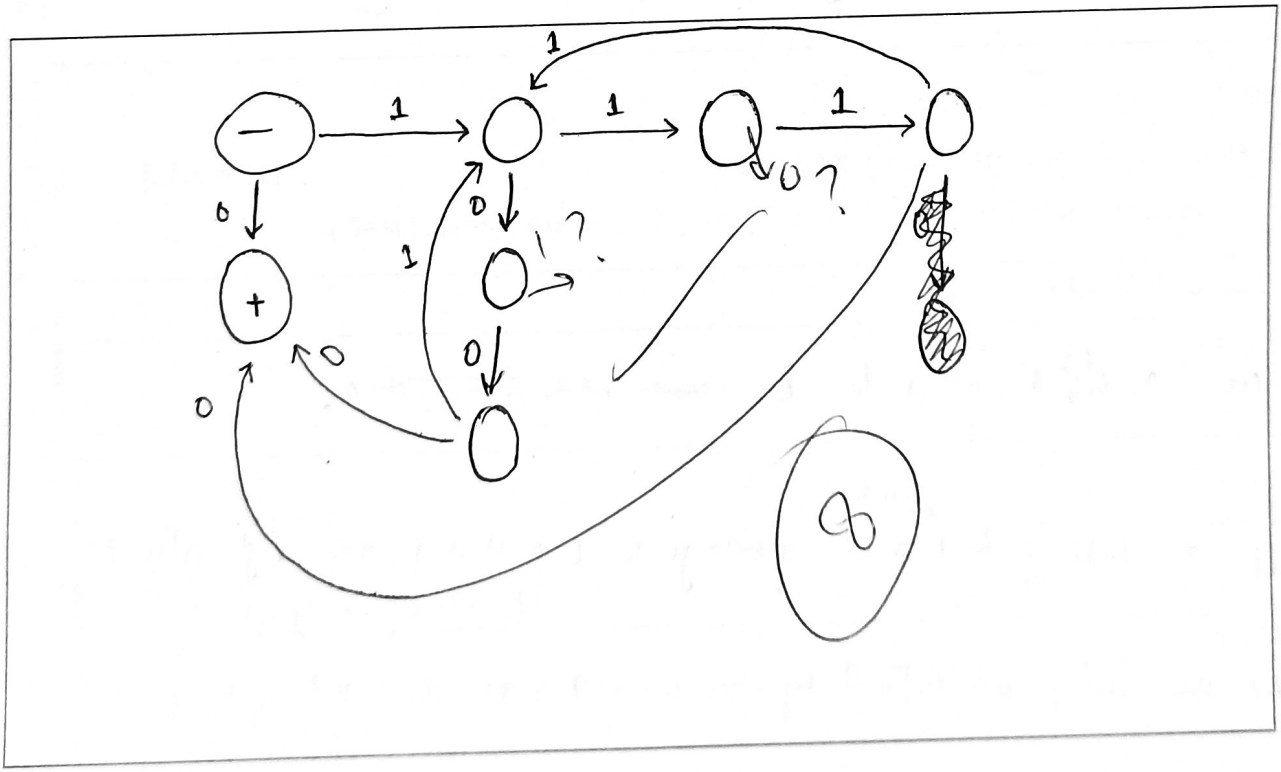
abbbbbabbb?

6

[CLO 2]

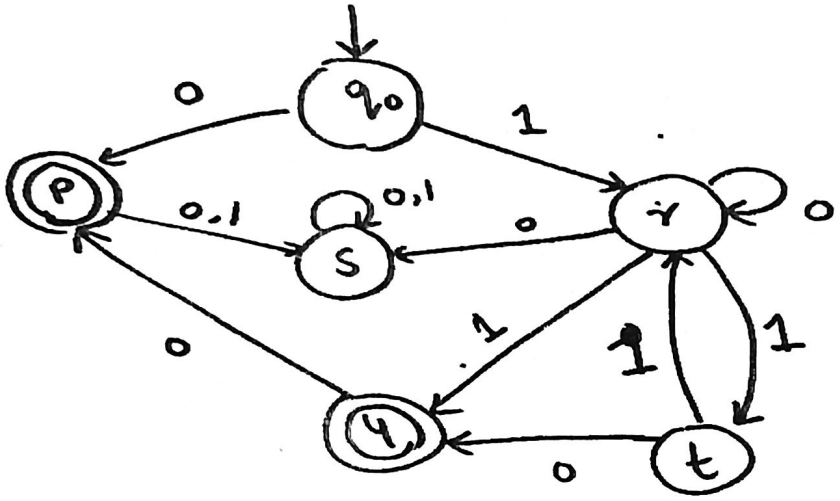
Q4: Design an FA for the following languages. L ∈ {0,1}* **[10 marks]**

B. (111+100)*0



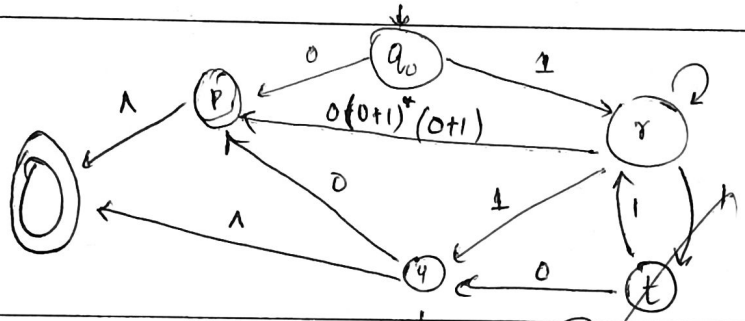
Q3: Convert given TG to RE

[10 marks]

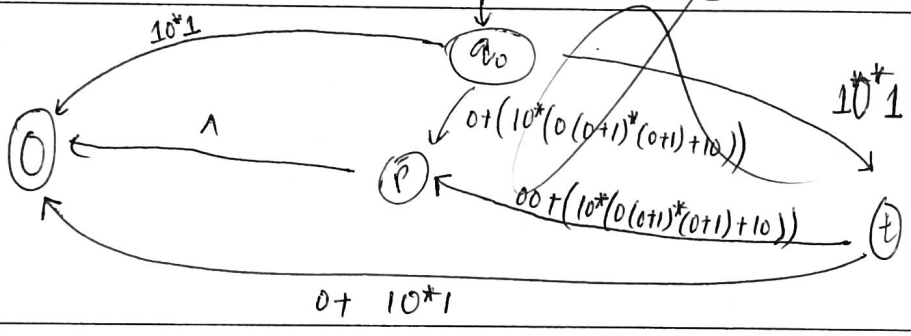


Comprehensive rough work on sheet

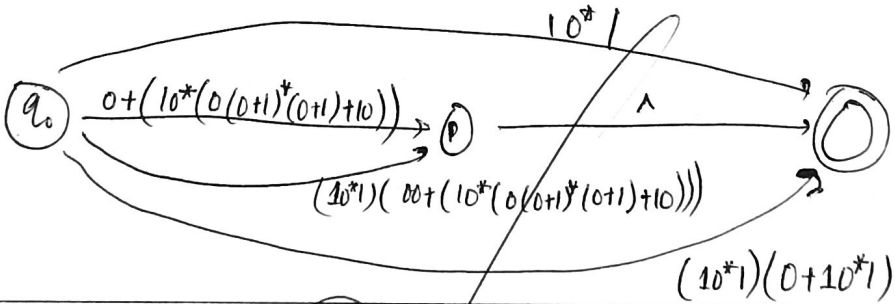
Step 1:



Step 2:



Step 3:



3

Final Answer :

$$(10^*1)+\left(0+(10^*(0(0+1)^*(0+1))+10)\right)+\left((10^*1)(00+(10^*(0(0+1)^*(0+1)+10)))\right)+\left((10^*1)(0+10^*1)\right)$$