Marmara University
CSE 3064– Formal Lang. & Automata Th. **Name:** _____
Final Exam, June 29, 2020 **Signature:** _____

Question:	1	2	3	4	5	Total
Points:	20	20	20	20	20	100
Score:						

On my honor, I have neither given nor received any unauthorized assistance on this homework. I understand that if I cheat than I will get zero grade from this online homework and I am going to be furher subject to disciplinary action by the regulations of Marmara University.

Name: _____

Signature: _____

Notes:

- Read, accept and sign the text written inside the frame above. If you cannot print this homework document, provide handwritten solutions on blank A4 sheets. In this case, write the statement inside the frame and today's date to the first solution sheet, and sign the sheet. Homework solutions without a valid signature will not be accepted.
- Write your student ID, first name and surname on top of each solution page.
- During the homework study, you may use textbooks, course slides and lecture notes.
- During the homework study, Internet access except during the homework download and submission periods is NOT allowed. You may use your computers and smart phones in offline mode.
- This homework consists of 5 questions in 2 pages.
- Please write your answers clearly and neatly to the provided spaces.
- Show all your work.
- If you make any assumptions in the solutions, please state them clearly.
- Scan all the solution pages to a single PDF file named as "FirstName_LastName.pdf" and upload the pdf file to https://ues.marmara.edu.tr/ before 13:00 on the same day.
- Unreadable homeworks will not be graded and get zero grade. Please check your pdf file before submission for readability.

1. (20 pts) Construct an NFA recognizing the language of the following regular expression:

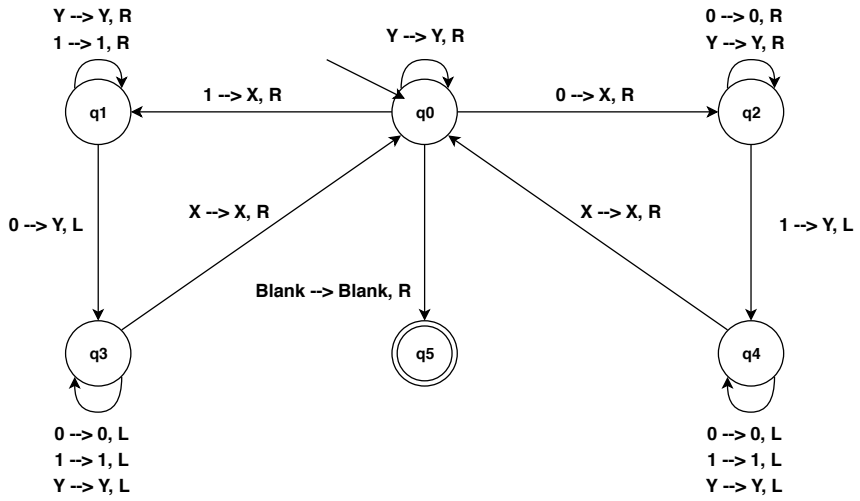
$$(01)^*(1^* \cup 0000)^*(0101 \cup \epsilon)$$

2. (20 pts) Given the following language:

$$L = \{a^x b^y c^z d^t \mid x, y, z, t \geq 0 \text{ and } x + 2y - 3z = t\}$$

Construct a push-down automata for L.

3. Given the following Turing machine,



where the input alphabet is $\Sigma = \{0, 1\}$, the tape alphabet is $\Gamma = \{0, 1, X, Y, Blank\}$ and $Blank$ denotes the blank (empty tape) symbol.

(a) (10 pts) Determine whether the following strings are accepted by this Turing machine: $w_1 =$ "1001", $w_2 =$ "01011", $w_3 =$ "10001".

(b) (10 pts) What is the language recognized by this Turing machine?

4. (20 pts) Prove or disprove that the following language is a Context-Free Language:

$$L = \{a^x b^y c^z \mid x, y, z \geq 0 \text{ and } x > 2y > 3z\}$$

Note that you have to give a formal proof or disproof.

5. (20 pts) Consider the problem of determining whether a regular expression R_1 generate the reverse of the language generated by a regular expression R_2 or not. Prove or disprove that this problem is decidable. You have to give a formal proof or disproof. Note that you may use any proof introduced in the class without proving it again.