

Midterm1 – Practice test

Discrete Structures 2

Spring 2019

Instructions:

- Please verify that your paper contains **8 pages** including this cover and **1 blank page**.
- Don't forget to write down your **NID on top of each page** of this test.
- This exam is **closed book**. No notes or other materials are permitted.
- To receive full credit, you must show your work clearly with **enough details if mentioned**, but not too much that you run out of time.
- Calculators are not allowed.

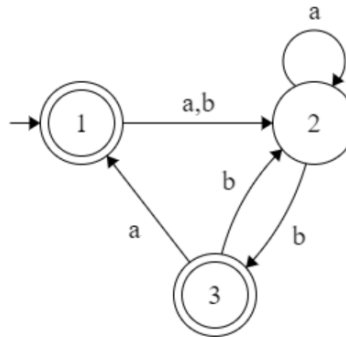
Question	points	Score
1	20	
2	10	
3	8	
4	10	
5	12	
6	8	
Total	100	

Section 1: (20 points) True or False?

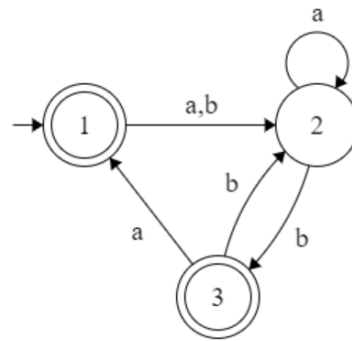
Q1-a	If a language is described by a regular expression, then it is regular.	T	F
Q1-b	If regular expression $R=a$ for some $a \in \Sigma$. Then $L(R)=\{a, \varepsilon\}$	T	F
Q1-c	$0^*10^* = \{w w \text{ contains a single } 1\}$	T	F
Q1-d	$(0 \cup \varepsilon)^* = 0^* \cup 1^*$	T	F
Q1-e	Let $N1 = (Q1, \Sigma, \delta1, q1, F1)$ recognize $A1$, $N2 = (Q2, \Sigma, \delta2, q2, F2)$ recognize $A2$, and $N = (Q, \Sigma, \delta, q0, F)$ recognizes $A1 \cup A2$. Then $Q = \{q0\} \cup Q1 \cup Q2$.	T	F
Q1-f	Predicate is a function whose range is $\{\text{TRUE}, \text{FALSE}\}$.	T	F
Q1-g	A Tree is a connected graph without simple cycles.	T	F
Q1-h	A Graph is a collection of points and lines connecting some pairs of points	T	F
Q1-i	A Directed graph is a collection of points and arrows connecting some pairs of points.	T	F
Q1-k	Function $f: N \rightarrow N$ where $f(x) = 2x + 1$ is onto.	T	F

Section 2:

Q2: (15 points) Find regular expression for the language accepted by the following automata. (Show the steps.)



Q3: (20 points) convert the following finite automata to DFA.



Q4: (10 points) Draw the state diagram of a DFA for the following language. (Assume $\Sigma = \{a,b\}$).

$\{w \mid w \text{ does not contain the substring } baba \}$

Q5: (15 points) Convert the regular expression $(a \cup b^+)a^+b^+$ to NFA. (show the steps.)

Q6: (20 points) Use the pumping lemma to show that the following language is not regular.

$$A_3 = \{a^{2^n} \mid n \geq 0\} \text{ (Here, } a^{2^n} \text{ means a string of } 2^n \text{ a's.)}$$