Spring 2021

SABANCI UNIVERSITY
Faculty of Engineering and Natural Sciences
CS 302 Automata Theory

Remote Final Examination

Closed (Book+Notes+All Electronic Devices)

Duration : 150 minutes

Q1	
Q2	
Q3	
Q4	
Total	

Question 1 (*25* points)

A language $L \subseteq \{1\}^*$ *has the property that the number of* **1***'s in each of its strings is either an* ***even number*** *(***0** *is an even number) ; OR is divisible by* **3***.*

(a) *(10 pts) Construct an NFA* ***A*** *that accepts* ***L****.*

(b) *(8 pts) Construct a minimal state DFA* ***B*** *that accepts* ***L****.*

(c) *(7 pts) Write down a* ***regular expression E*** *for* ***L****.*

Question 2 (*25* points)

Consider the 3 languages :

$L_1 = (\omega \in \{a,b,c\}^* \mid a^s b^t c^r \; ; \; s = t = r \geq 0)$; $L_2 = (\omega \in \{a,b,c\}^* \mid a^s b^t c^r \; ; \; s > t \geq 0 \; ; \; r \geq 0)$;

$L_3 = (\omega \in \{a,b,c\}^* \mid a^s b^t c^r \; ; \; s+t+r$ *is an even number)*

For each case state whether the language in question is ***regular****? is* ***context-free*** *but not* ***regular****? is not* ***context-free****. For each case* ***prove your conclusion*** *by constructing either an NFA; a CFG (or a PDA) or by using the relevant version of the pumping lemma.*

Question 3 (*25 points)*

Consider the language $L = (\omega \in \{a,b,c\}^* \mid a^s b^t c^r \; ; \; s \geq t \geq 0 \; ; \; t+r =$ ***even*** *number;* $t,r \geq 0)$

Is ***L*** *a CFL? If so either construct a PDA* ***P*** *that accepts* ***L*** *or a CFG* ***G*** *that generates* ***L*** *whichever you find more convenient. If not prove your claim.*

Question 4 *(25 points)*

Consider the language $L = (\omega \in \{0,1\}^* \mid \omega = u.v \; ; \; u,v \in \{0,1\}^* \; ;$ ***v*** *is obtained from* ***u*** *by interchanging the* ***0***'s *and* ***1***'s *in* ***u)***

Construct a possibly ***2-tape*** *and* ***non-deterministic*** *TM* ***M*** *that decides* ***L****.*