Spring 2020

SABANCI UNIVERSITY

Faculty of Engineering and Natural Sciences

CS 302 Automata Theory

16.5.2020

Duration: 150 minutes

Final Examination (REMOTE)

Question 1 (*25* points)

*(a) (15 pts) Construct an NFA or a DFA **A** that accepts the language **L** of all strings in (0+1)* in which : the symbol **0** does **not** occur **consecutively more than two times.***

*(b) (10 pts) Compute a minimal state DFA **B** that accepts the language **L** described in part (a)*

Glossary: consecutively → ard arda

Question 2 (*25* points)

(a) (10 pts) A gambling machine works as follows: everytime the event '1' occurs you win 1 TL and every time the event '0' occurs you lose 1 TL. Can you design a NFA that will automatically ring a bell if and when your net income from gambling exceeds 0 TL? If so design it, if not prove your claim.

*(b) (15 pts) Given the gambling machine in part (a) can you design a **PDA** that will automatically ring a bell whenever your income exceeds 0 TL? If so design a deterministic **PDA** (**DPDA**) that will solve the problem.*

Question 3 (*25 points*)

*A CFG **G** = ({E,T,F,I} , {+,*, (,) , x,y,z} , **R**, **E**) where the productions **R** are as follows :*

$E \rightarrow E + T \mid T$; $T \rightarrow T^*F \mid F$; $F \rightarrow I \mid (E) \mid I(E)$; $I \rightarrow x \mid y \mid z$

*(a) (15pts) Compute the **Chomsky Normal Form** (CNF) for **G***

*(b) (10 pts) Compute the **Greibach Normal Form** (GNF) for **G***

*(note that what is required is the precise definition of the **GNF** and **not** necessarily the form used for top down parsing in class in which the first elements of the productions of a non-terminal variable are distinct!)*

Question 4 (*25* points)

*(a) (10 pts) Construct a TM **M** using graphical or tabular notation that performs the computation (s, # w) |--* $_M$ (h, # u) where s is the initial state, **h** the halt state, w∈ {0,1}* and u is obtained from w by interchanging the 0's and 1's in w .*

*(b) (15pts) Construct a 2-tape TM **M** that **decides** the language **L** of **palindromes, i.e.***

$L := (\omega \in \Sigma^* \mid \omega = \omega^R)$, *where ω^R stands for ω reversed . Assume that the initial configuration of the 2-tape TM **M** is (s, # w, #).*