Fall 2016

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

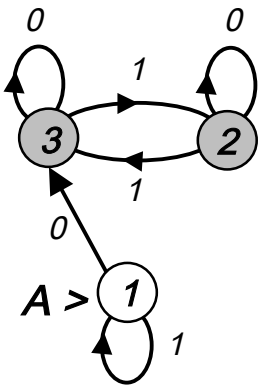
Final Examination

Closed (Book+Notes+All Electronic Devices)

Duration : 150 minutes

Q1	
Q2	
Q3	
Q4	
Q5	
Total	

Question 1 (*20* points)



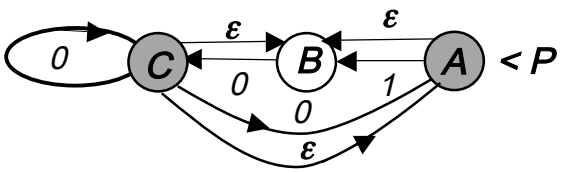
A *DFA* $\boldsymbol{A = (Q_A, \Sigma, \delta_A, q_{0A}, F_A)}$ is given by the figure above where $\boldsymbol{q_{0A} = 1}$ and $\boldsymbol{F_A = \{2,3\}}$.

(a) Express the transition function $\boldsymbol{\delta_A}$ in *tabular* form.

(b) Write down the language $\boldsymbol{L_A}$ accepted by $\boldsymbol{A}$ and its complement $\boldsymbol{L_A{}^c}$ as two *regular expressions*.

(c) Compute a *minimal state machine* that accepts the language $\boldsymbol{L_A}$

Question 2 (*20* points)



Consider the *ε-NFA* ***P*** with ***ε-***transitions given above.

(a) Construct an *NFA* (*without* ***ε-*** transitions) that accepts the same language as ***P*** either in graphical or in tabular form.

(b) Compute an equivalent *DFA* ***X*** to the *ε-NFA* ***P*** using your result in ***(a).***

Question 3 (*20* points)

Consider the *CFG* $G = (\{S, A, B\}, \{0,1\}, R, S)$ where the production set R is given below :

$R : S \rightarrow AB \; ; \; A \rightarrow 0A1 \mid e \; ; \; B \rightarrow 1B0 \mid e$

(a) Compute the *Chomsky Normal Form* $G1 = (V1, T, R1, S)$ for G.

(b) Compute a *PDA* P that accepts the language L_G

(c) State whether your P is a *deterministic PDA (**DPDA**)* or not ?

Question 4 (*20* points)

Consider the following *CFG* $\boldsymbol{G = (\{S, A, B\}, \{0,1\}, R, S)}$ where $\boldsymbol{R}$ is given below

$\boldsymbol{R : S \rightarrow 0S \mid 1A \; ; \; A \rightarrow 1B \mid 1S \mid e \; ; \; B \rightarrow 0B \mid 0S \mid e}$

(a) Is the language $\boldsymbol{L_G}$ a *regular language* ? If so compute an *NFA* that accepts it ; if not explain why not. (Hint : Note that $\boldsymbol{G}$ *is a right linear CFG*)

(b) Sketch a *parse tree* for the string $\boldsymbol{00110 \in L_G}$**.** Based on your parsing diagram discuss whether $\boldsymbol{G}$ is an *ambiguous* or a *non-ambiguous* grammar.

Question 5 (*20* points)

Sketch in *graphical* or *tabular* form :

(a) A Turing Machine ***M*** that performs the computation $(s, \underline{\#}\, 0^n 1^n) \vdash_M (h, \underline{\#}\, 1^n 0^n)$

(b) A Turing Machine ***T*** that *semidecides* the language $L = \{0^n 1^n, n > 0 \text{ integer}\}$

In both cases you are allowed to use ***multitape*** or ***nondeterministic*** *TM*s.