Middle East Technical University | Department of Computer Engineering

# CENG 280

Formal Languages and Abstract Machines

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Homework 5

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## Answer for Q1

a. The language consisting of strings that include $0^n1^n$, and $1^m0^m$ for $m \geq 0, n \geq 0$.

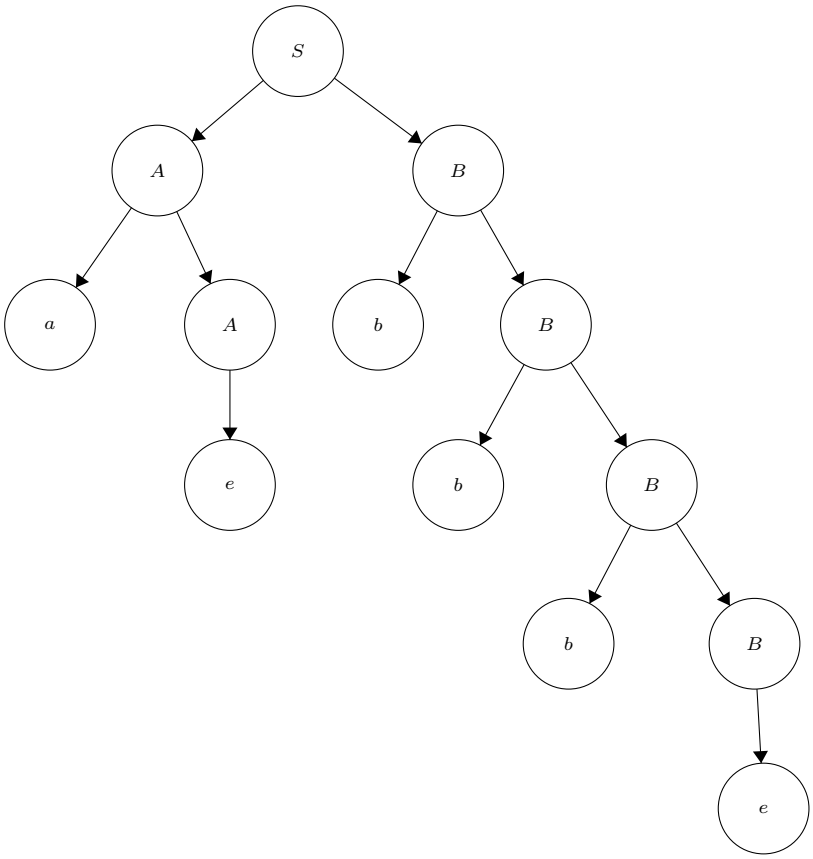
b. Yes, it is ambiguous because there are two derivations to create the empty string:
$S \to A \to e$
$S \to B \to e$

## Answer for Q2

a. There are two derivations to create "ab".
$S \to AB \to aAbB \to abB \to ab$
$S \to AB \to aB \to ab$
Therefore, $G_2$ is ambiguous.

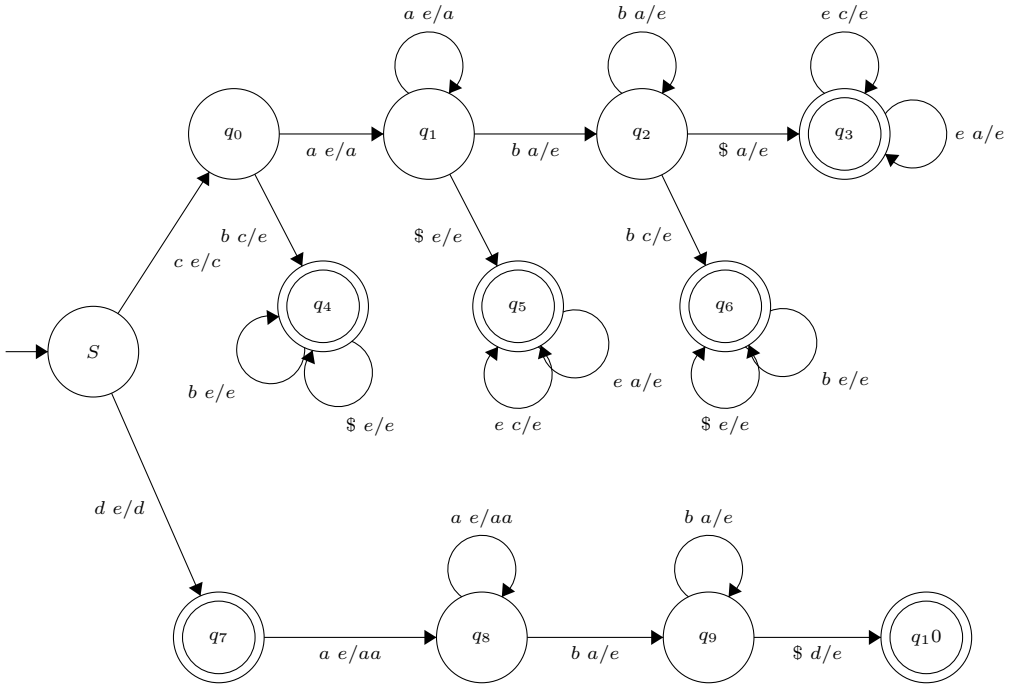
b. If we remove 'a' from relation A and 'b' from relation B, the ambiguity is eliminated. Everything else should remain the same.
So the updated R is:
$S \to AB$
$A \to aA|e$
$B \to bB|e$
Everything else remains the same.

c. $S \to AB \to aAB \to aB \to abB \to abbB \to abbb$
It is the parse three:

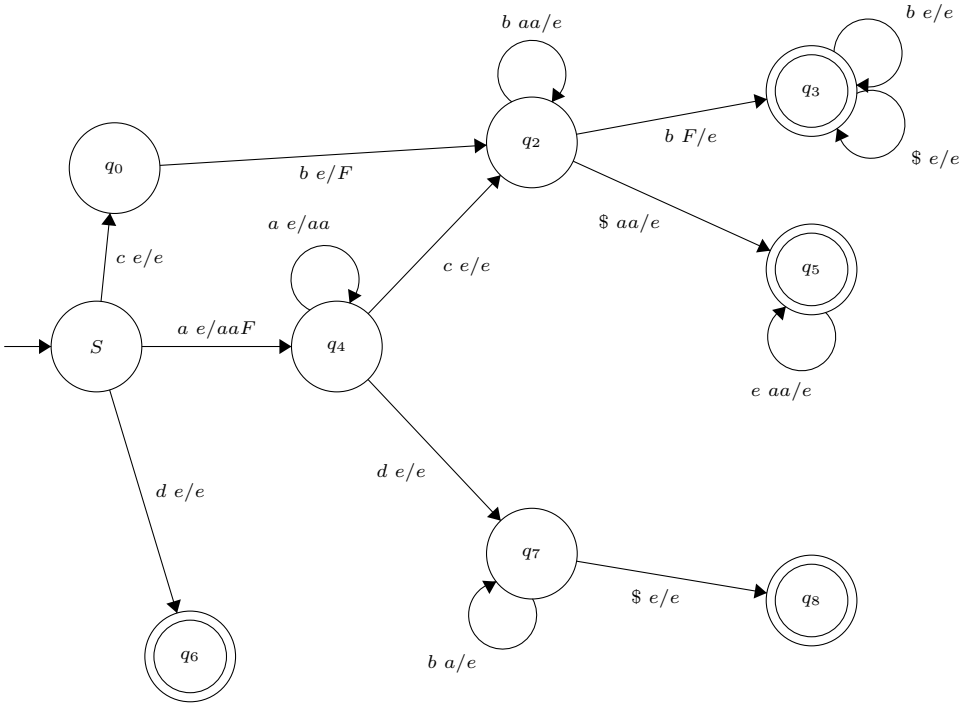



# Answer for Q3

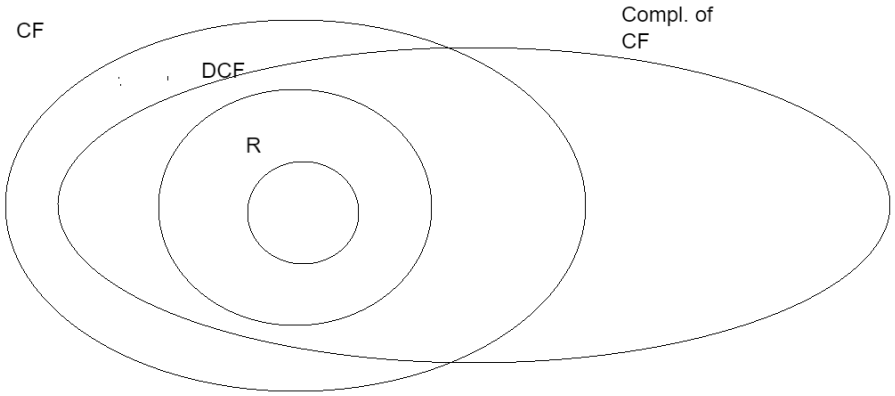
a)
The following two are Deterministic Push Down Automata(DPDA) for the languages $L_1$ and $L_2$, and there is "$" symbol at the end of the all strings from that languages. Since there is not any compatible transitions, i.e., there is no case in which two transitions are possible, and we can create DPDA's for that languages, they are deterministic context-free languages. i)


a e/a
b a/e
e c/e
q0
q1
q2
q3
a e/a
b a/e
$ a/e
e a/e
b c/e
c e/c
$ e/e
b c/e
q4
q5
q6
S
b e/e
$ e/e
e a/e
e c/e
$ e/e
b e/e
d e/d
a e/aa
b a/e
q7
q8
q9
q10
a e/aa
b a/e
$ d/e

ii)


b aa/e
b e/e
q3
q2
q0
b F/e
$ e/e
b e/F
$ aa/e
a e/aa
c e/e
q5
c e/e
S
a e/aaF
q4
e aa/e
d e/e
d e/e
q7
$ e/e
q8
q6
b a/e

b)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