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April 25, 2022
CS 321 Assignment 6

Section 6.1 (Question 1):

Current Grammar:
S → aS | bBb | aaA | A
A → aaA | Aa
B → Bb | bba | λ

Remove λ-Productions:
S → aS | bBb | aaA | A | bb
A → aaA | Aa
B → Bb | bba | b

Remove Unit-Productions:
S → aS | bBb | aaA | Aa | bb
A → aaA | Aa
B → Bb | bba | b

Remove Useless-Productions:
S → aS | bBb | bb
B → Bb | bba | b

Final Grammar:
S → aS | bBb | bb
B → Bb | bba | b

Section 6.1 (Question 2):

Current Grammar:
S → aAbC | aaA | bbS
A → bbC | bb
B → Ab | ba | λ
C → abC | C | λ

Remove Useless-Productions:
S → aAbC | aaA | bbS
A → bbC | bb
C → abC | C | λ

Remove λ-Productions:
S → aAbC | aaA | bbS | aAb
A → bbC | bb
C → abC | ab

Remove Unit-Productions:
S → aAbC | aaA | bbS | aAb
A → bbC | bb
C → abC | ab

Final Grammar:
S → aAbC | aaA | bbS | aAb
A → bbC | bb
C → abC | ab

Section 6.2 (Question 3):

Convert to Chomsky Normal Form:
If P → a and Q → b then…
S → PS | QBQ | QQ
B → BQ | QQP | b

If R → QB and S → QQ then…
S → PS | RQ | QQ
B → BQ | SP | b

Chomsky Normal Form:
S → PS | RQ | QQ
B → BQ | SP | b
P → a
Q → b
R → QB
S → QQ

Section 6.2 (Question 4):

Convert to Greibach Normal Form:
If X → a and Y → b then…
S → aAYC | aXA | bYS | aAY
A → bYC | bY
C → aYC | aY

Greibach Normal Form:
S → aAYC | aXA | bYS | aAY
A → bYC | bY
C → aYC | aY
X → a
Y → b

Section 7.1 (Question 5):
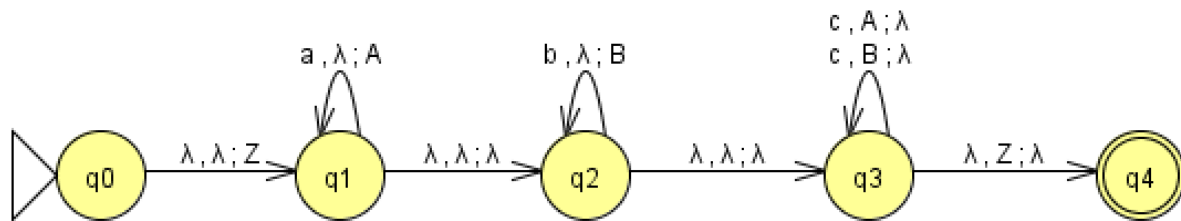
States: {q0, q1, q2, q3, q4}
Input Alphabet: {a, b}
Initial State: q0
Final States: q4
Start Stack Symbol: Z
Stack Alphabet: {A, B, Z}
Transitions:
      δ (q0, λ, λ) = {(q1, Z)}
      δ (q1, a, λ) = {(q1, A)}
      δ (q1, λ, λ) = {(q2, λ)}
      δ (q2, b, λ) = {(q2, B)}
      δ (q2, λ, λ) = {(q3, λ)}
      δ (q3, c, A) = {(q3, λ)}
      δ (q3, c, B) = {(q3, λ)}
      δ (q3, λ, Z) = {(q4, λ)}

Section 7.1 (Question 6):
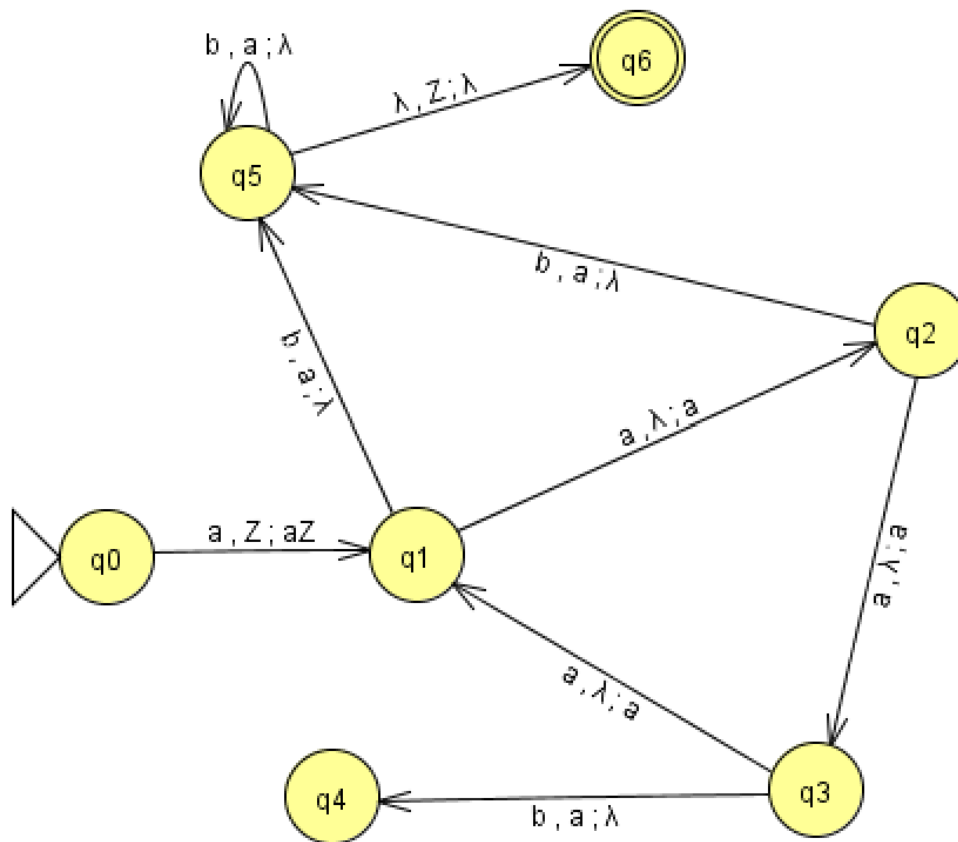
States: {q0, q1, q2, q3, q4, q5, q6}
Input Alphabet: {a, b}
Initial State: q0
Final States: q6
Start Stack Symbol: Z
Stack Alphabet: {a, Z}
Transitions:

       δ (q0, a, Z) = {(q1, aZ)}
       δ (q1, a, λ) = {(q2, a)}
       δ (q1, b, a) = {(q5, λ)}
       δ (q2, b, a) = {(q5, λ)}
       δ (q2, a, λ) = {(q3, a)}
       δ (q3, a, λ) = {(q1, a)}
       δ (q3, b, a) = {(q4, λ)}
       δ (q5, b, a) = {(q5, λ)}
       δ (q5, λ, Z) = {(q6, λ)}