PDA's

Ex.: Find PDA's that accept the following languages:

1. $L_1 = \{ww^R \mid w \in \{a,b\}^+\}$
2. $L_2 = \{a^n b^{2n} \mid n \in N^*\}$
3. $L_3 = \{a^n b^{2n} \mid n \in N\}$
4. $L_4 = \{a^{2n} b^n \mid n \in N^*\}$

Sol.:

2,3 - see the test for Seminar 13

1. M=({q0, q1, q2}, {a,b}, {A, B, Z}, d, q0, Z, {q2}) // Ariana Hategan

d(q0,a,Z) = {(q0, AZ)}
d(q0,b,Z) = {(q0, BZ)}

d(q0,a,A) = {(q0, AA), (q1, epsilon)}
d(q0,a,B) = {(q0, AB)}
d(q0,b,A) = {(q0, BA)}
d(q0,b,B) = {(q0, BB), (q1, epsilon)}

d(q1,a,A) = {(q1, epsilon)}
d(q1,b,B) = {(q1, epsilon)}

d(q1,epsilon,Z) = {(q2, Z)}

(q0,abba,Z) |- (q0, bba, AZ) |- (q0, ba, BAZ) |- (q1, a, AZ) |- (q1, epsilon, Z) |- (q2, epsilon, Z)
=> accepted
(q0,abaa,Z) |- (q0, baa, AZ) |- (q0, aa, BAZ) |- (q0, a, ABAZ) |- (q0, epsilon, AABAZ)
|- (q1, epsilon, BAZ)
=> not accepted

- d(q0, epsilon, Z) = {(q2, Z)} - transition to add in order to also accept the empty sequence ($L'_1 = \{ww^R \mid w \in \{a,b\}^*\}$)

4. M=({q0, q1, q2, q3}, {a,b}, {A, Z}, d, q0, Z, {q3}) // Ariana Hategan

d(q0,a,Z) = {(q1, AZ)}
d(q1,a,A) - {(q0, AZ)}
d(q0,a,A) = {(q1, AA)}
d(q1,a,A) = {(q0, AA)}
d(q0,b,A) = {(q2, epsilon)}
d(q2,b,A) = {(q2, epsilon)}
d(q2,epsilon,Z) = {(q3,Z)}

(q0, aaaabb, Z) |- (q1, aaabb, AZ) |- (q0, aabb, AZ) |- (q1, abb, AAZ) |- (q0, bb, AAZ) |- (q2, b, AZ) |- (q2, epsilon, Z) |- (q3, epsilon, Z) => aaaabb is accepted

Attribute Grammars

Ex.: Give an attribute grammar for evaluating simple arithmetic expressions with id, (,), +, *

Sol.:

S - attributed grammar

E -> E + T	{E1.val = E2.val + T.val}
E -> T	{E..val = T.val}
T - > T * F	{T1.val = T2.val * F.val}
T -> F	{T.val = F.val}
F -> (E)	{F.val = E.val}
F - > id	{F. val = id.val}

Obs.: The green arrows from the syntax tree below indicate how evaluation is performed (bottom-up - value of attribute in parent is computed based on values of attributes in descendants, attributes are synthesized) w = 2 + 3 * 4