Homework #5 *due November 22 , 2016, Tuesday*

(1) Let M be the *PDA* defined by $Q = \{q, q_0, q_1, q_2\}$, $\Sigma = \{a,b\}$, $\Gamma = \{a\}$, $F := \{q, q_1\}$.

$\delta(q_0, a, Z_0) = \{(q, Z_0)\}$

$\delta(q, a, Z_0) = \{(q, aZ_0)\}$

$\delta(q, a, a) = \{(q, aa)\}$

$\delta(q, b, a) = \{(q_1, e)\}$

$\delta(q_1, b, a) = \{(q_1, e)\}$

$\delta(q_1, b, Z_0) = \{(q_2, e)\}$

a) Describe the language accepted by ***M***.

b) Trace all computations of the strings ***aab, abb, aba*** in ***M***.

c) Show that ***aaabb, aaab*** $\in L(M)$.

(2) Construct *PDA*s that accept each of the following languages.

a) $\{a^i b^j \mid 0 \le i \le j\}$

b) $\{a^i c^j b^i \mid i,j \ge 0\}$

d) $\{a^i b^j c^k \mid i+k = j\}$

e) $\{a^i b^j \mid 0 \le i \le j \le 2i\}$

f) $\{a^{i+j} b^i c^j \mid i,j > 0\}$

(3) $L = \{w \in \{a, b\}^* \mid$ *at least one prefix of **w** contains strictly more **b**'s than **a**'s.*$\}$.

For example, ***baa, abb, abbbaa*** are in ***L***, but ***aab, aabbab*** are not in ***L***.

a) Construct a PDA that accepts ***L*** by final state.

b) Construct a PDA that accepts ***L*** by empty stack.

(4) From the main text ***Exercises 6.1.1 (b),(c), 6.2.6, 6.3.2***