PES UNIVERSITY, Bangalore

(Established under Karnataka Act No. 16 of 2013)

Department of Computer Science & Engineering

Automata Formal Languages & Logic

Homework

1. Construct a PDA $L = \{a^i b^j \mid 0 \leq i \leq j\}$
2. Construct a PDA $L = \{a^i b^j c^i \mid i,j \geq 0\}$
3. Construct a PDA $\{a^i b^j c^k \mid i+k = j\}$
4. Construct a PDA $\{a^i b^j \mid i \geq 0\} \cup a^* \cup b^*$
5. Construct a PDA $L = \{a^i b^j \mid 2i = 3j+1\}$
6. Construct a PDA $\{a^i b^j \mid i \neq j\}$
7. Construct a PDA $L = \{a^n b^m \mid m \leq n \leq 2m\}$
8. Construct a PDA $L = \{a^i b^j c^k \mid i,j,k \geq 0 \text{ and } (i \neq j \text{ or } j \neq k)\}$
9. Construct a PDA for $L = \{a^n b^m \mid n, m \geq 0 \text{ and } m \text{ is even}\}$
10. Construct a PDA for $L = \{b_i \# b_{i+1}^R \mid$ bi is the binary representation of some integer i,i≥0, without leading zeros$\}$.
11. Construct a PDA for $L = \{a^m b^n c^p d^q \mid m, n,p,q \geq 0 \text{ and } m+n=p+q\}$
12. Construct a PDA for arithmetic, let $\Sigma = \{int,+,-,(,)\}$ and language ARITH $= \{w \in \Sigma^* \mid$ w is a legal arithmetic expression$\}$.
13. Construct a PDA for the language $L=\{a^n w w^R b^n$ where w is any string in (a+b)*$\}$.
14. Let L be the language $\{w \in \{a, b\}^* \mid$ w has a prefix containing more b's than a's. For example baa, abba, abbaaa $\in$ L, but aab, aabbab $\notin$ L. Construct a PDA that accepts the language.
15. $a^i b^j c^k$ where either i = j (and k is any number) or k is the difference between i and j. Show an accepting sequence of configurations for the input aabbbc. Show how the PDA rejects both aabbbbc and aaaabbbcc.
16. Construct a PDA for simplified XML tags strings .For example <a><a><a><c></c> where a, b and c are the only tag names.
17. Construct a PDA for the language of table tags in HTML {TABLE, TH, TR, TD} .
18. The language of addition with positive or negative numbers, that is, strings over the alphabet {a, b, c, –} of the form:

    (a) $a^n b^m c^k$ where k = n + m and both numbers are positive; for example, aabbcccc.

    (b) $-a^n b^m c^k$ where k = m - n if m n and the first number is negative; for example, -aabbbbcc.

(c) $-a^nb^m-c^k$ where k = n – m if n > m and the first number is negative; for example,

-aaaabb-cc.

(d) $a^n-b^mc^k$ where k = n - m if n m and the second number is negative; for example, aaaa-bbcc.

(e) $a^n-b^m-c^k$ where k = m - n if m > n and the second number is negative; for example,

aa-bbbb-cc.

(f) $-a^n-b^m-c^k$ where k = n + m and both numbers are negative; for example,

-aaa-bbb-cccccc.

Show an accepting sequence of configurations for each of the example strings shown above.

19. PDA P = $(\{q_0,q_1,q_2,q_3,f\},\{a,b\},\{Z,A,B\}, \delta, q_0, Z, \{f\})$ has the following rules defining δ:

$\delta(q_0,a,Z) = (q_1,AAZ)$	$\delta(q_0,b\ Z) = (q_1,BZ)$	$\delta(q_0,\lambda,Z) = (f,\lambda)$
$\delta(q_1,a,A) = (q_1,AAA)$	$\delta(q_1,b,A) = (q_1,\lambda)$	$\delta(q_1,\lambda,Z) = (q_0,Z)$
$\delta(q_2,a,B) = (q_3,\ \lambda\ )$	$\delta(q_2,b,B) = (q_2,BB)$	$\delta(q_2,\lambda,Z) = (q_0,Z)$
$\delta(q_3,\lambda,B) = (q_2,\lambda)$	$\delta(q_3,\lambda,Z) = (q_1,AZ)$	

a. Give an sequence showing that string bab is in L(P)
b. Give a sequence showing that string abb is in L(P).
c. Give the contents of the stack after P has read b^7a^4 from its input.
d. Informally describe L(P).

20. Let M be the PDA defined by

Q = {q0,q1,q2}

Σ = {a, b}

Γ = {a}

F = {q1,q2}

$\delta(q0,a,\lambda) = \{q0,a\}$

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δ (q0, λ , λ) = {q1, λ }

δ (q0,b,a) = {q2, λ }

δ (q1, λ ,a) = {q0, λ }

δ (q2,b,a) = {q2, λ }

δ (q2, λ ,a) = {q2, λ }

a. Describe the language accepted by M.
b. Give the transition diagram of M.
c. Trace all computations of the strings aab, abb, aba in M.
d. Show that aabb, aaab $\in$ L(M)