PR 7 TBFO

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Nama : Raden Francisco Trianto Bratadiningrat
NIM : 13522091

6.1.1

Exercise 6.1.1: Suppose the PDA $P = (\{q, p\}, \{0, 1\}, \{Z_0, X\}, \delta, q, Z_0, \{p\})$ has the following transition function:

Start State

1. $\delta(q, 0, Z_0) = \{(q, XZ_0)\}$.
2. $\delta(q, 0, X) = \{(q, XX)\}$.
3. $\delta(q, 1, X) = \{(q, X)\}$.
4. $\delta(q, \epsilon, X) = \{(p, \epsilon)\}$.
5. $\delta(p, \epsilon, X) = \{(p, \epsilon)\}$.
6. $\delta(p, 1, X) = \{(p, XX)\}$.
7. $\delta(p, 1, Z_0) = \{(p, \epsilon)\}$.

Starting from the initial ID (q, w, Z_0), show all the reachable ID's when the input w is:

* a) 01.

$(q, 01, Z_0) \vdash (q, 1, XZ_0) \vdash (p, 1, Z_0) \vdash (p, \epsilon, \epsilon)$

b) 0011.

$(q, 0011, Z_0) \vdash (q, 011, XZ_0) \vdash (q, 11, XXZ_0) \vdash (q, 1, XXZ_0) \vdash (p, 1, XZ_0)$
$\vdash (p, 1, Z_0) \vdash (p, \epsilon, \epsilon)$

c) 010.

$(q, 010, Z_0) \vdash (q, 10, XZ_0) \vdash (q, 0, XZ_0) \vdash (q, \epsilon, XXZ_0) \vdash (p, \epsilon, XZ_0) \vdash (p, \epsilon, Z_0)$

6.2.1

Exercise 6.2.1: Design a PDA to accept each of the following languages. You may accept either by final state or by empty stack, whichever is more convenient.

* a) $\{0^n1^n \mid n \geq 1\}$.

PDA : $(\{q, p\}, \{0, 1\}, \{X, Z_0\}, \delta, q, Z_0\})$

$\delta(q, 0, Z_0) = \{(q, XZ_0)\}$

$\delta(q, 0, X) = \{(q, X)\}$

$\delta(q, 1, X) = \{(p, \epsilon)\}$

$\delta(p, 1, X) = \{(p, \epsilon)\}$

b) The set of all strings of 0's and 1's such that no prefix has more 1's than 0's.

PDA : $(\{q,p\},\{0,1\},\{A,B,Z_0\},\delta,q,Z_0\})$

$\delta(q,0,Z_0)=\{(q,AZ_0)\}$

$\delta(q,1,Z_0)=\{(q,BZ_0)\}$

$\delta(q,0,A)=\{(q,AA)\}$

$\delta(q,1,B)=\{(q,BB)\}$

$\delta(q,1,A)=\{(q,\varepsilon)\}$

$\delta(q,\varepsilon,Z_0)=\{(p,Z_0)\}$

c) The set of all strings of 0's and 1's with an equal number of 0's and 1's.

PDA : $(\{q,p\},\{0,1\},\{X,Y,Z_0\},\delta,q,Z_0\})$

$\delta(q,0,Z_0)=\{(q,XZ_0)\}$

$\delta(q,0,X)=\{(q,XX)\}$

$\delta(q,0,Y)=\{(q,\varepsilon)\}$

$\delta(q,1,Z_0)=\{(q,YZ_0)\}$

$\delta(q,1,X)=\{(q,\varepsilon)\}$

$\delta(q,1,Y)=\{(q,YY)\}$

$\delta(q,\varepsilon,Z_0)=\{(p,\varepsilon)\}$

$\boxed{6.2.5}$

Exercise 6.2.5: PDA $P=(\{q_0,q_1,q_2,q_3,f\},\{a,b\},\{Z_0,A,B\},\delta,q_0,Z_0,\{f\})$ has the following rules defining δ:

$\delta(q_0,a,Z_0)=(q_1,AAZ_0)$	$\delta(q_0,b,Z_0)=(q_2,BZ_0)$	$\delta(q_0,\epsilon,Z_0)=(f,\epsilon)$
$\delta(q_1,a,A)=(q_1,AAA)$	$\delta(q_1,b,A)=(q_1,\epsilon)$	$\delta(q_1,\epsilon,Z_0)=(q_0,Z_0)$
$\delta(q_2,a,B)=(q_3,\epsilon)$	$\delta(q_2,b,B)=(q_2,BB)$	$\delta(q_2,\epsilon,Z_0)=(q_0,Z_0)$
$\delta(q_3,\epsilon,B)=(q_2,\epsilon)$	$\delta(q_3,\epsilon,Z_0)=(q_1,AZ_0)$	

Note that, since each of the sets above has only one choice of move, we have omitted the set brackets from each of the rules.

* a) Give an execution trace (sequence of ID's) showing that string bab is in $L(P)$.

$(q_0,bab,Z_0)\vdash(q_2,ab,BZ_0)\vdash(q_3,b,Z_0)\vdash(q_1,b,AZ_0)$

$(q_0, bab, Z_0) \vdash (q_2, ab, BZ_0) \vdash (q_3, b, Z_0) \vdash (q_1, b, AZ_0)$
$\vdash (q_1, \varepsilon, Z_0) \vdash (q_0, \varepsilon, Z_0) \vdash (f, \varepsilon, \varepsilon)$

b) Give an execution trace showing that abb is in $L(P)$.

$(q_0, abb, Z_0) \vdash (q_1, bb, AAZ_0) \vdash (q_1, b, AZ_0) \vdash (q_1, \varepsilon, Z_0)$
$\vdash (q_0, \varepsilon, Z_0) \vdash (f, \varepsilon, \varepsilon)$

c) Give the contents of the stack after P has read b^7a^4 from its input.

$(q_0, b^7a^4, Z_0) \vdash (q_2, b^6a^4, BZ_0) \vdash (q_2, b^5a^4, BBZ_0) \vdash \dots \vdash (q_2, a^4, B^7Z_0)$
$\vdash (q_3, a^3, B^6Z_0)$

Stack
B
B
B
B
B
B
Z_0

Hasil setelah membaca b^7a^4

! d) Informally describe $L(P)$.

L(P) adalah bahasa yang diterima PDA yaitu semua string dengan jumlah "b" dua kali lebih dari jumlah "a".

$\boxed{6.2.6}$

Exercise 6.2.6: Consider the PDA P from Exercise 6.1.1.

a) Convert P to another PDA P_1 that accepts by empty stack the same language that P accepts by final state; i.e., $N(P_1) = L(P)$.

L(P) = semua string yang diawali dengan 0 dan diakhiri dengan 1

PDA P1 : $(\{q, p\}, \{0, 1\}, \{X, Z_0\}, \delta, q, Z_0\})$

$\delta(q, 0, Z_0) = \{(q, XZ_0)\}$

$\delta(q, 0, X) = \{(q, X)\}$

$\delta(q, 0, X) = \{(q, X)\}$

$\delta(q, 1, X) = \{(p, \varepsilon)\}$

$\delta(p, 1, Z_0) = \{(p, Z_0)\}$

$\delta(p, 0, Z_0) = \{(q, XZ_0)\}$

$\delta(p, \varepsilon, Z_0) = \{(p, \varepsilon)\}$

b) Find a PDA P_2 such that $L(P_2) = N(P)$; i.e., P_2 accepts by final state what P accepts by empty stack.

PDA P2 : $(\{q, p\}, \{0, 1\}, \{Z_0\}, \delta, q, Z_0\})$

$\delta(q, 0, Z_0) = (q, Z_0)$

$\delta(q, 1, Z_0) = (p, Z_0)$

$\delta(p, 0, Z_0) = (q, Z_0)$

$\delta(p, 1, Z_0) = (p, Z_0)$

$\delta(p, \varepsilon, Z_0) = (p, \varepsilon)$