BLM3064 – Final – 2021

Soru 3) input = abccc

G: $S \to AB \mid BC$
$A \to BA \mid CC \mid a$
$B \to CA \mid b$
$C \to AB \mid c$

	a	b	c	c	c
⑤	{S}				
④	{B}	–			
③	{A}	{A}	{B}		
②	{S,C}	{S}	{A}	{A}	
①	{A}	{B}	{C}	{C}	{C}

X_{15}
X_{14} X_{25}
X_{13} X_{24} X_{35}
X_{12} X_{23} X_{34} X_{45}
X_{11} X_{22} X_{33} X_{44} X_{55}

① $A \to a$, $B \to b$, $C \to c$; $X_{11} = \{A\}$, $X_{22} = \{B\}$, $X_{33} = \{C\}$, $X_{44} = \{C\}$, $X_{45} = \{C\}$

② $X_{12} = X_{11} \cdot X_{22} = \{A\} \cdot \{B\} = \{AB\} \Rightarrow S \to AB;\ C \to AB$
$= \{S, C\}$

$X_{23} = X_{22} X_{33} = \{BC\} \Rightarrow S \to BC$
$= \{S\}$

$X_{34} = X_{33} X_{44} = \{CC\} \Rightarrow A \to CC$
$= \{A\}$

$X_{45} = X_{44} X_{55} = \{CC\} \Rightarrow A \to CC$
$= \{A\}$

③ $X_{13} = X_{11} X_{23} + X_{12} X_{33} = \{AS\} + \{S, C\} \cdot \{C\}$
$= \{AS, SC, CC\} \Rightarrow$ only $A \to CC$
$= \{A\}$

$X_{24} = X_{22} X_{34} + X_{23} X_{44}$
$= \{BA, SC\} \Rightarrow A \to BA$
$= \{A\}$

$X_{35} = X_{33} X_{45} + X_{34} X_{55}$
$= \{CA, AC\} \Rightarrow B \to CA$
$= \{B\}$

④ $X_{14} = X_{11} X_{24} + X_{12} X_{34} + X_{13} X_{44}$
$= \{AA, SA, CA, AC\} \Rightarrow B \to CA$,
$= \{B\}$

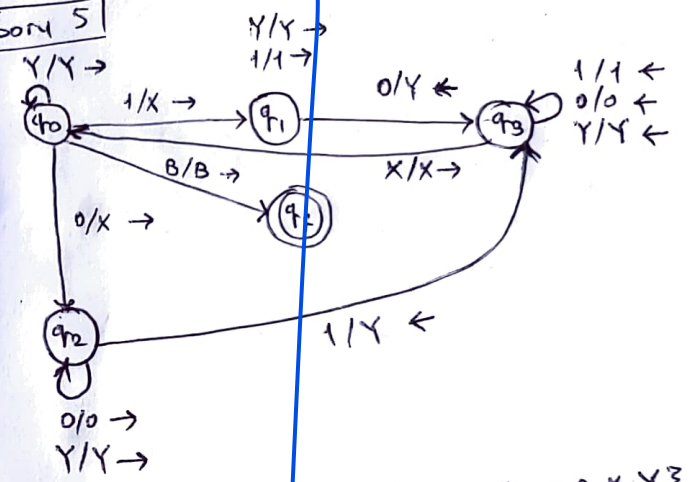
$X_{25} = X_{22} X_{35} + X_{23} X_{45} + X_{24} X_{55}$
$= \{BB, SA, AC\}$
$\Rightarrow \emptyset$

⑤ $X_{15} = X_{11} \cdot X_{25} + X_{12} X_{35} + X_{13} X_{45} + X_{14} X_{55}$
$= \{A \cdot \emptyset, SB, CB, AA, BC\}$
$\Rightarrow S \to BC$
$= \{S\}$

⑤'inci katmanda, yani X_{15}'te "S" sembolü mevcut olduğu için ($S \in X_{15}$);

abccc ∈ L(G)

Soru 5



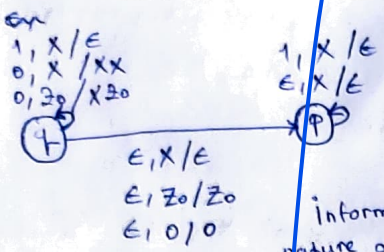
M = ({q_0, q_1, q_2, q_3, q_f}, {0,1}, {0,1,B,X,Y}, δ, q_0, B, {q_f})

input = 010011

q_0 010011 B ⊢ X q_2 10011 ⊢ q_3 XY 0011
⊢ X q_0 Y 0011 ⊢ XY q_0 0011 ⊢ XY X q_2 011
⊢ XYX 0 q_2 11 ⊢ XYX q_3 0Y1
⊢ XY q_3 X 0Y1 ⊢ XYX q_0 0Y1
⊢ XYXX q_2 Y1 ⊢ XYXXY q_2 1
⊢ XYXX q_3 YY ⊢ XYX q_3 XYY
⊢ XYXX q_0 YY ⊢ XYXX Y q_0 Y B
⊢ XYXXYY q_0 B ⊢ XYXXYY B q_f

TM eşit sayıda 0 ve 1'leri olan Recursively Enumerable dilleri kabul ediyor.

Soru 1



input = 00111

information regarding the nature of the automaton is not given. We don't know whether this is a final state or null/emptying automaton. We'll assume it's null PDA.

(q0, 00111, Z0)
↓ (ε) → (p, 00111, Z0) → (halt)
(q, 0111, XZ0)
↓ → (p, 0111, Z0) → (halt)
(q, 111, XXZ0)
↓ → (p, 111, XZ0) → (p, 11, Z0) → halt
(q, 11, XZ0)
↓ → (p, 11, Z0) → (halt)
(q, 1, Z0)
↓ → (p, 1, Z0) → (halt)
(halt)

right side

if this was a Final state PDA, then everything to the right side would be correct, not halt.

Soru 4

a)

1: Elimination ε-productions

S → AB | BAB | ADL | B | BB | DL
A → a | aa | E
B → A | ABB | AF | b | BB | F
D → d | BB | AF | F
F → E | EK

2: Eliminating ~~unit Productions (X→Y, Y→Z)~~ useless symbols.

S → AB | BAB | ADL | B | BB | DL
A → a | aa | ~~E~~
B → A | ABB | AF | b | BB
D → d | BB | AF

→ ADL ve DL de aynı şekilde

* kitaba göre 'AF' ler de silinmeli, çünkü 'F' useless bir sembol olduğu için. Ama hocamız bu şekilde gözmüştü.

3: Eliminating unit productions

B → a | aa | AF | b | BB
S → AB | BAB | ADL | a | aa | AF | b | BB | DL
A → a | aa
D → d | BB | AF

b) CNF : ~~X~~ X → YZ , Y → a .

Sıkıntılı non-terminal/variable'ler.

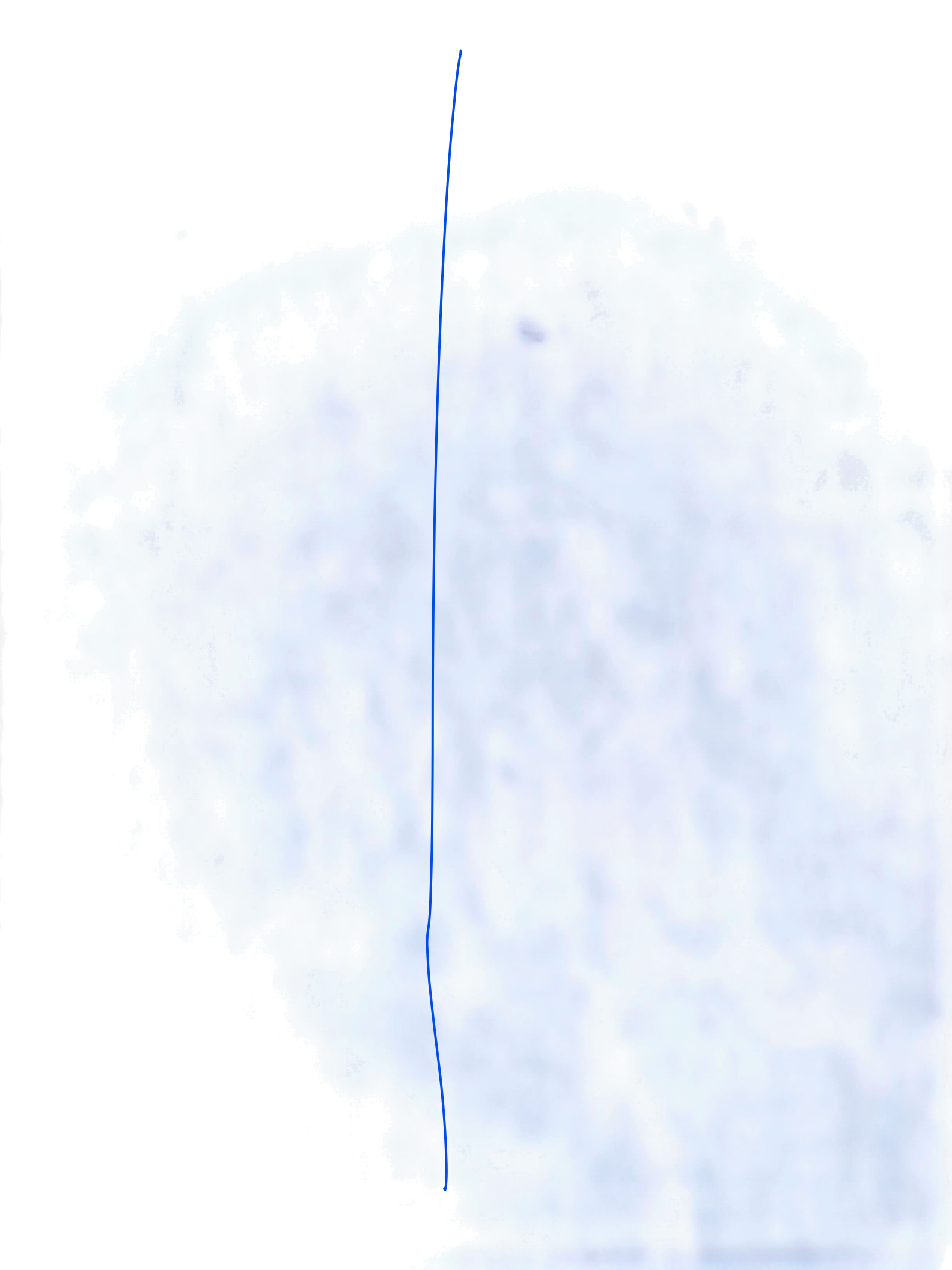
S → BAB | ADL ; K → BA , Z → AD

Sıkıntılı terminal'ler.

B → a , S → a , A → a ; T → a

=>

S → AB | KB | ZL | a | TT | AF | b | BB | DL
B → a | TT | AF | b | BB
A → a | TT
D → d | BB | AF



SLAM364 - BÜT

① 1) eliminating ε-productions :

S → ABB | AA | AD | BB | A | D

A → a | aa | CE

B → A | ABD | AF | b | BD | F

D → d | AB | A | B

F → EA | F | E

2) eliminating useless prsymbols

S → ABB | AA | AD | A | D

A → a | aa | ~~CE~~

B → A | ABD | AF | b | BD | F

D → d | AB | A | B

F → EA | F

3) eliminating unit productions.

B → a | aa | ~~CE~~ | ABD | AF | b | BD | EA | F

D → d | AB | a | aa | ABD | AF | b | BD | EA | F

F → EA | F

A → a | aa

S → ABB | AA | AB | a | aa | d | AB | ~~CE~~ | ABD | AF | b | BD | EA | F

CNF : X → YZ , Z → Z

Sıkıntılı terminaller:

B → aa , D → aa , A → aa , S → aa

⇒ T → a

Sıkıntılı non-terminaller:

B → ABD , D → ABD , S → ABD | ABB

⇒ X → ~~BD~~ AB

⇒ S → XB | AA | AB | a | TT | d | AB | XD | AF | b | BD | EA | F

A → a | TT

B → a | TT | XD | AF | b | BD | EA | F

D → d | AB | a | TT | XD | AF | b | BD | EA | F

F → EA | F

② input = bbaac

S → AC | BB

A → BC | BB | a

B → CC | b

C → AC | C

X_{15}				
X_{14}	X_{25}			
X_{13}	X_{24}	X_{35}		
X_{12}	X_{23}	X_{34}	X_{45}	
X_{11}	X_{22}	X_{33}	X_{44}	X_{55}

{S, C}				
-	{A}			
-	-	{S, C}		
{S, A}	-	-	{S, C}	
{B}	{B}	{A}	{A}	{C}

b b a a c

$X_{12} = X_{11} X_{22} = \{BB\} \Rightarrow S \to BB,\ A \to BB$

$= \{S, A\}$

$X_{23} = X_{22} X_{33} = \{BA\} \Rightarrow \emptyset$

$X_{34} = X_{33} X_{44} = \{AA\} \Rightarrow \emptyset$

$X_{45} = X_{44} X_{55} = \{AC\} \Rightarrow S \to AC,\ C \to AC$

$= \{S, C\}$

$X_{13} = X_{11} X_{23} + X_{12} X_{33} = \{S, A\} \cdot \{A\}$

$= \{SA, AA\} \Rightarrow \emptyset$

$X_{24} = X_{22} X_{34} + X_{23} X_{44} = \emptyset$

$X_{35} = X_{33} X_{45} + X_{34} X_{55} = \{AS, AC\} \Rightarrow$

$\Rightarrow S \to AC,\ C \to AC \Rightarrow X_{35} = \{S, C\}$

$X_{14} = X_{11} X_{24} + X_{12} X_{34} + X_{13} X_{44}$

$= \emptyset$

$X_{25} = X_{22} X_{35} + X_{23} X_{45} + X_{24} X_{55}$

$= \{BS, BC\} \Rightarrow A \to BC \Rightarrow X_{25} = \{A\}$

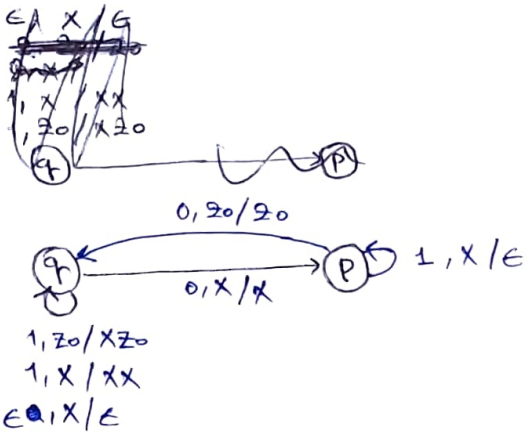
$X_{15} = X_{11} X_{25} + X_{12} X_{35} + X_{13} X_{45} + X_{14} X_{55}$

$= \{BA, SS, SC, AS, AC\}$

$\Rightarrow S \to AC,\ C \to AC \Rightarrow X_{15} = \{S, C\}$

Since 'S' is in X_{15}, "bbaac" $\in L(G)$.

(3)



input : 11 0 11

$(q_1, 11011, Z_0)$

$\downarrow$

$(q_1, 1011, XZ_0)$

$\xrightarrow{\epsilon} (q_1, 1011, Z_0) \to (q_1, 011, XZ_0) \to (p, 11, XZ_0) \to (p, 1, Z_0)$ (halt)

$\xrightarrow{\epsilon} (q_1, 011, Z_0)$ (halt)

$(q_1, 011, XXZ_0)$

$\xrightarrow{\epsilon} (q_1, 011, XZ_0) \to (p, 11, XZ_0)$

$\to (p, 1, Z_0)$ (halt)

$(p, 11, XXZ_0)$

$\xrightarrow{\epsilon} (q_1, 11, XZ_0)$

$\xrightarrow{\epsilon} (q_1, 11, Z_0) \to (q_1, 1, XZ_0) \to (q_1, \epsilon, XZ_0)$ (halt)

$\to (q_1, \epsilon, Z_0)$ (halt)

$(p, 1, XZ_0)$

$\xrightarrow{\epsilon} (q_1, 1, XXZ_0) \to (q_1, 1, XZ_0) \to (q_1, \epsilon, XXZ_0)$

$\xrightarrow{*} (q_1, \epsilon, Z_0)$ (halt)

$(q_1, 1, Z_0)$

$\downarrow$

(q_1, ϵ, XZ_0)

$\downarrow$

(q_1, ϵ, Z_0) (halt)

$(q_1, 1, XXZ_0)$

$\downarrow$

$(q_1, \epsilon, XXXZ_0)$

$\downarrow$

(q_1, ϵ, XXZ_0)

$\downarrow$

(q_1, ϵ, XZ_0) (halt)

$\downarrow$

(q_1, ϵ, Z_0) (halt)

$(q_1, 1, XZ_0)$

$\xrightarrow{\epsilon} (q_1, 1, Z_0)$

$\downarrow$

$(q_1, \epsilon, XZ_0) \to (q_1, \epsilon, XXZ_0)$

$\xrightarrow{*} (q_1, \epsilon, Z_0)$ (halt)

(q_1, ϵ, XXZ_0)

$\xrightarrow{*} (q_1, \epsilon, Z_0)$

(halt)

(q_1, ϵ, Z_0)

If p is a final state and our PDA is a final state PDA, then PDA accepts "11011".

(4)

$M = (\{q_0, q_1, q_2, q_3, q_4\}, \{0, 1\}, \{0, 1, X, Y, B\}, \delta, q_0, B, \{q_4\})$

input : 00011 = 00011B

	0	1	X	Y	B
q_0	(q_1, X, R)	–	–	(q_3, Y, R)	–
q_1	$(q_1, 0, R)$	(q_2, Y, L)	–	(q_1, Y, R)	–
q_2	$(q_2, 0, L)$	–	(q_0, X, R)	(q_2, Y, L)	–
q_3	–	–	–	–	(q_4, B, R)
q_4	–	–	–	–	–

$\Rightarrow q_0 00011 \vdash X q_1 0011 \vdash X0 q_1 011$

$\vdash X00 q_1 11 \vdash X0 q_2 0Y1 \vdash X q_2 00Y1$

$\vdash q_2 X00Y1 \vdash X q_0 00Y1 \vdash XX q_1 0Y1$

$\vdash XX0 q_1 Y1 \vdash XX0Y q_1 1 \vdash XX0 q_2 YY$

$\vdash XX q_2 0YY \vdash X q_2 X0YY \vdash XX q_0 0YY$

$\vdash XXX q_1 YY \vdash XXXY q_1 Y$

$\vdash XXXYY q_1 B$ (halts)

Kabul etmedi.

TM'in dili = $\{0^n 1^n ; n \geq 1\}$