CS375 WK7

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August 22, 2011

Figure 1: Q01: FA

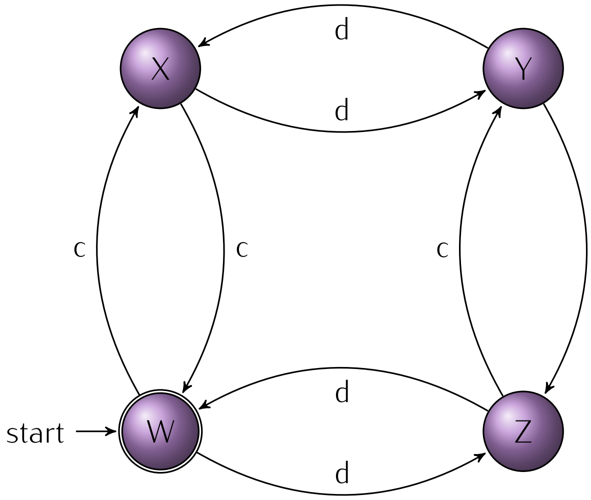


Figure 2: Q01: PDA

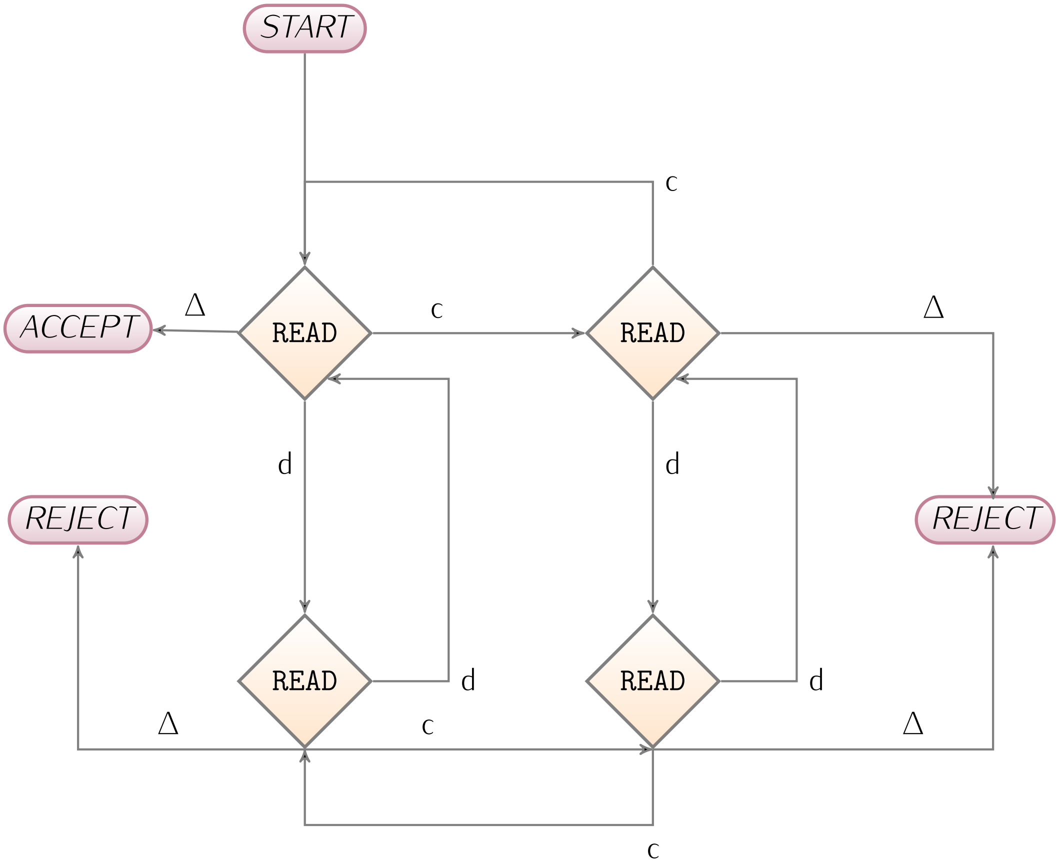


Figure 3: Q02: FA

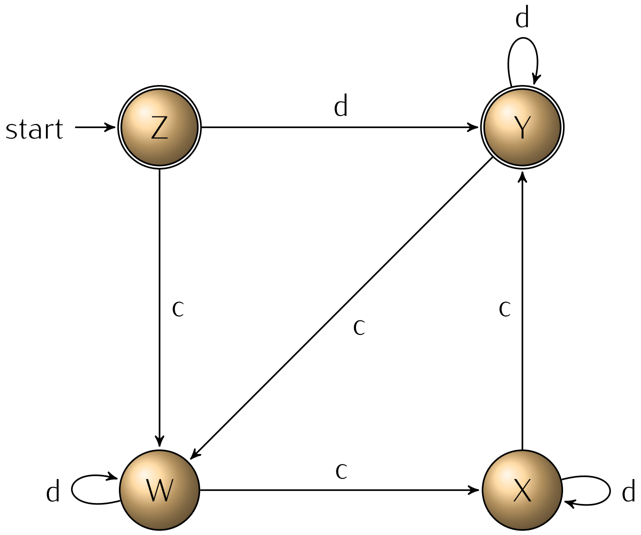


Figure 4: Q02: PDA

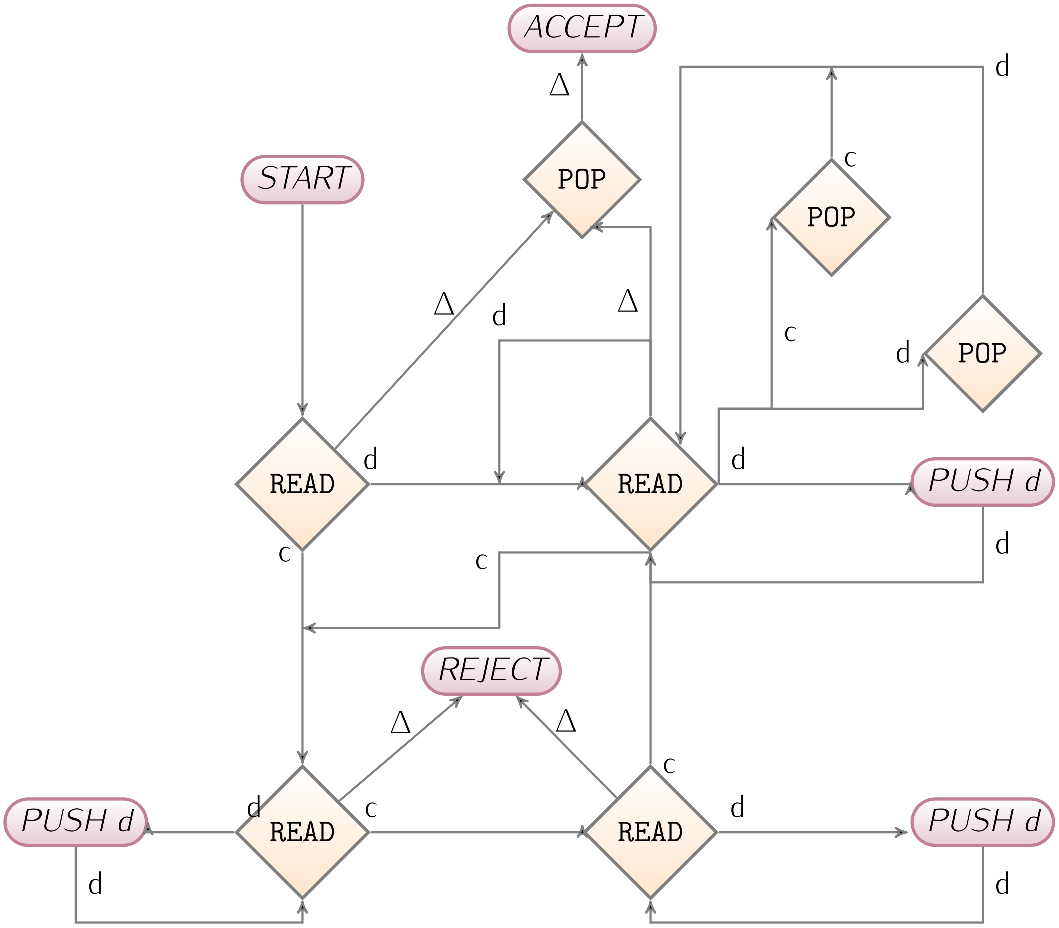


Figure 5: Q03a: Conversion Form

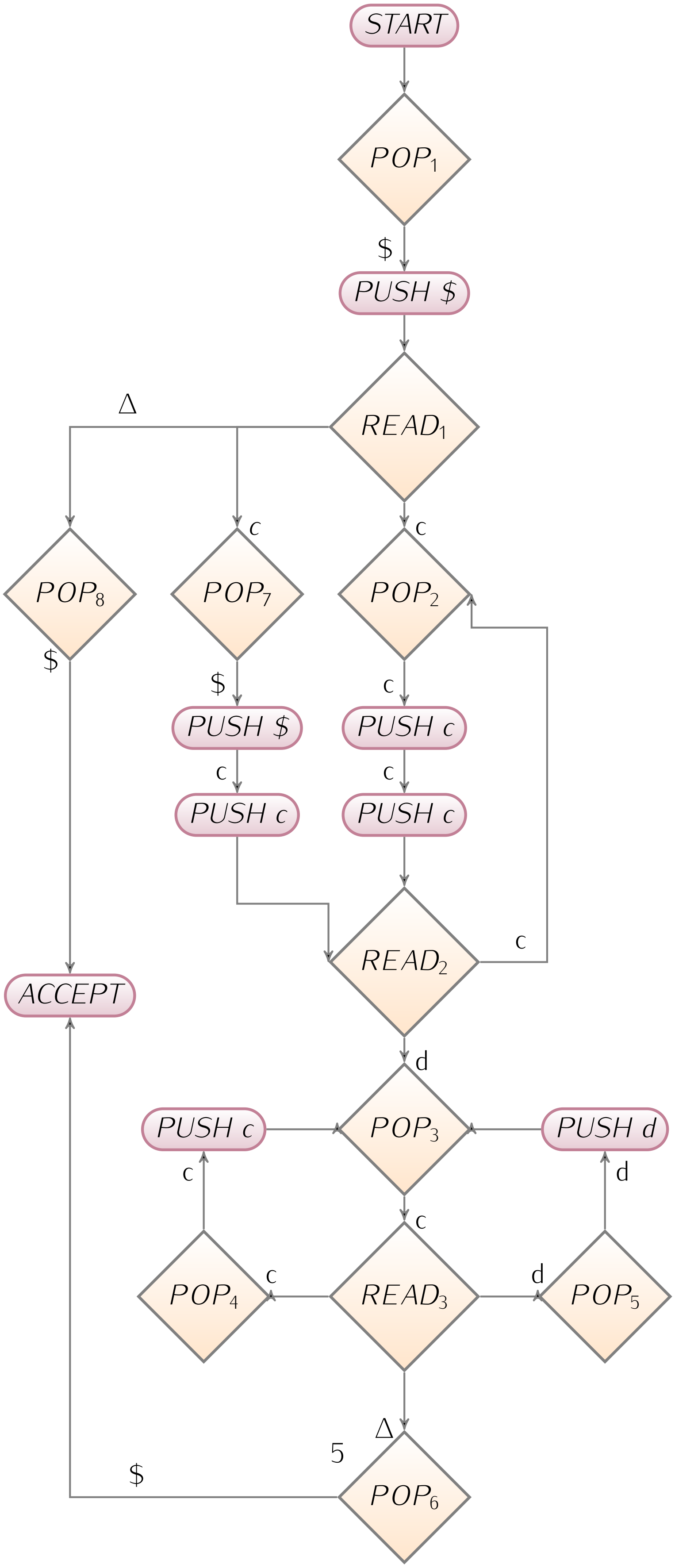


Figure 6: Q03.a Summary Table

FROM Where	To Where	READ What	POP What	PUSH What	ROW Number
START	$READ_1$	Λ	$\$$	$\$$	1
$READ_1$	ACCEPT	Λ	$\$$	–	2
$READ_1$	$READ_2$	c	$\$$	c$\$$	3
$READ_1$	$READ_2$	c	c	cc	4
$READ_2$	$READ_2$	c	c	cc	5
$READ_2$	$READ_3$	d	c	–	6
$READ_3$	$READ_3$	c	cc	c	7
$READ_3$	$READ_3$	d	dc	d	7
$READ_3$	$ACCEPT$	Λ	$\$$	–	8

Figure 7: Q03.a Productions

Rule 1: $S \rightarrow Net(START, ACCEPT, \$)$

Rule 2:

Net($READ_1$,ACCEPT,$\$$)$\rightarrow$ Row_2

Net($READ_2$,$READ_3$,$\$$)$\rightarrow$ Row_6

Net($READ_3$,ACCEPT,$\$$)$\rightarrow$ Row_8

Rule 3:

$Row_1 \rightarrow \Lambda$

$Row_2 \rightarrow \Lambda$

$Row_3 \rightarrow c$

$Row_4 \rightarrow c$

$Row_5 \rightarrow c$

$Row_6 \rightarrow d$

$Row_7 \rightarrow c$

$Row_8 \rightarrow c$

Figure 8: Q03.b

STATE	STACK	TAPE
Start	Δ	cccddd
$Read_1$	Δ	cccddd
Push	cΔ	cccddd
$Read_2$	cΔ	cccddd
Push	ccΔ	cccddd
$Read_2$	ccΔ	cccddd
Push	cccΔ	cccddd
$Read_2$	cccΔ	cccddd
Pop	ccΔ	cccddd
$Read_3$	ccΔ	cccddd
Pop	cΔ	cccddd
$Read_3$	cΔ	cccddd
Pop	Δ	cccddd
$Read_3$	Δ	cccddd
Pop	Δ	cccddd
Accept	Δ	cccddd

Figure 9: Q03.c

STATE	STACK	TAPE
Start	Δ	cccdcd
$Read_1$	Δ	cccdcd
Push	cΔ	cccdcd
$Read_2$	cΔ	cccdcd
Push	ccΔ	cccdcd
$Read_2$	ccΔ	cccdcd
Push	cccΔ	cccdcd
$Read_2$	cccΔ	cccdcd
Pop	ccΔ	cccdcd
$Read_3$	ccΔ	cccdcd
Pop	cΔ	cccdcd
$Read_3$	cΔ	cccdcd
Pop	Δ	cccdcd
$Read_3$	Δ	cccdcd
Pop	Δ	cccdcd
Accept	Δ	cccdcd

Figure 10: Q03.d

STATE	STACK	TAPE
Start	Δ	**cccdcc**
$Read_1$	Δ	c**ccdcc**
Push	cΔ	c**ccdcc**
$Read_2$	cΔ	cc**cdcc**
Push	ccΔ	cc**cdcc**
$Read_2$	ccΔ	ccc**dcc**
Push	cccΔ	ccc**dcc**
$Read_2$	cccΔ	cccd**cc**
Pop	ccΔ	cccd**cc**
$Read_3$	ccΔ	cccdc**c**
Pop	cΔ	cccdc**c**
$Read_3$	cΔ	cccdcc
Pop	Δ	cccdcc
$Read_3$	Δ	cccdcc
Pop	Δ	cccdcc
Accept	Δ	cccdcc

Figure 11: Q03.e

STATE	STACK	TAPE
Start	Δ	**ccccdd**
$Read_1$	Δ	c**cccdd**
Push	cΔ	c**cccdd**
$Read_2$	cΔ	cc**ccdd**
Push	ccΔ	cc**ccdd**
$Read_2$	ccΔ	ccc**cdd**
Push	cccΔ	ccc**cdd**
$Read_2$	cccΔ	cccc**dd**
Push	ccccΔ	cccc**dd**
$Read_2$	ccccΔ	ccccd**d**
Pop	cccΔ	ccccd**d**
$Read_2$	cccΔ	ccccdd
Pop	ccΔ	ccccdd
$Read_3$	ccΔ	ccccdd
Pop	cΔ	ccccdd
Reject	cΔ	ccccdd

Q04: a^n and b^n must be on the outside edges of the string and not larger than one. While this language is not quite an EVENPALINDROME it must be even with the internal b^m and a^m grouped in twos. This allows the string to get pumped up in the center and remain even.

Figure 12: Q05-07: Conversion Form

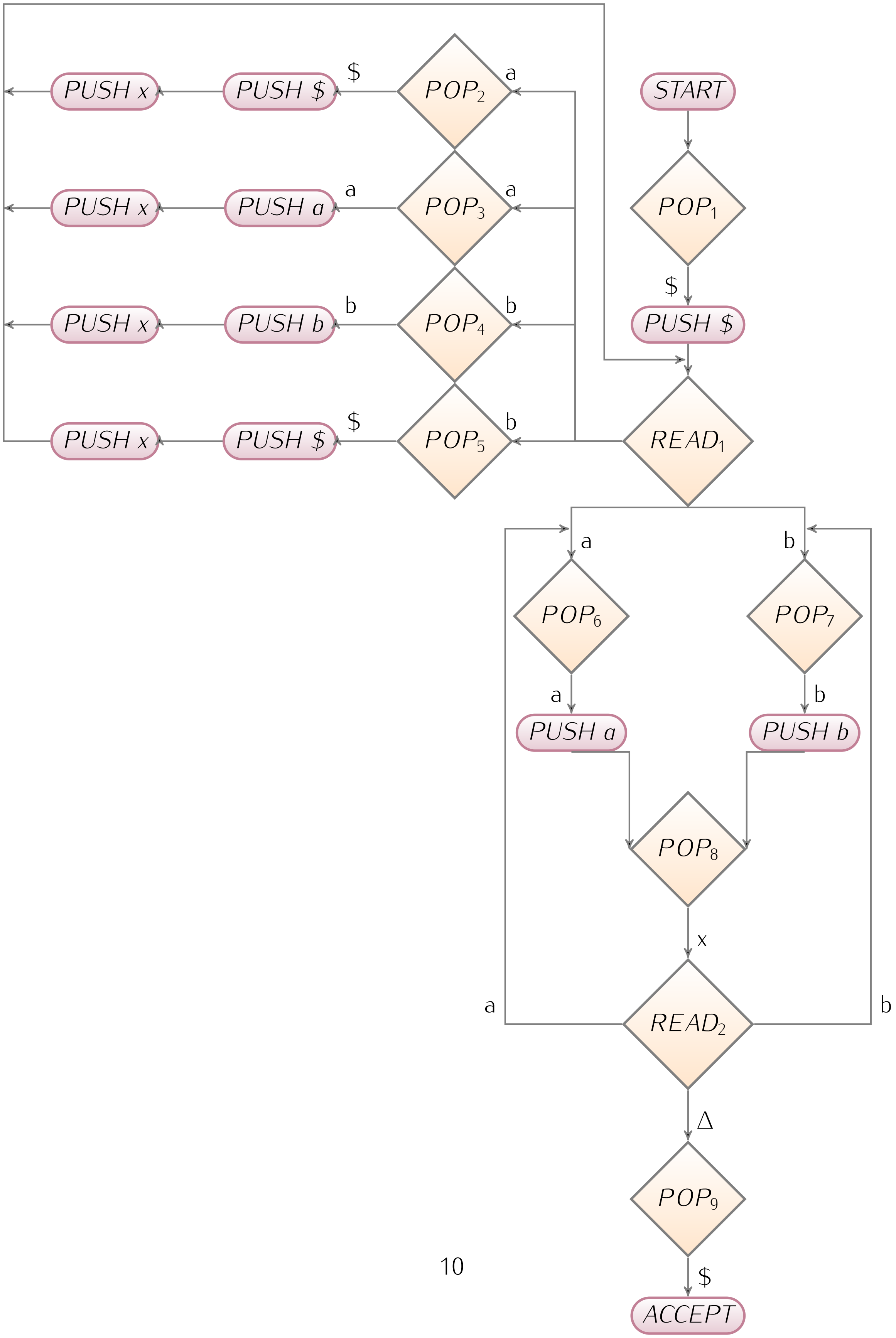


Figure 13: Q05-07: Summary Table

FROM Where	To Where	READ What	POP What	PUSH What	ROW Number
START	$READ_1$	Λ	\$	\$	1
$READ_1$	$READ_1$	a	\$	x\$	2
$READ_1$	$READ_1$	a	a	xa	3
$READ_1$	$READ_1$	b	b	xb	4
$READ_1$	$READ_1$	b	\$	x\$	5
$READ_1$	$READ_2$	a	ax	a	6
$READ_1$	$READ_2$	b	bx	b	7
$READ_2$	$READ_2$	a	ax	a	8
$READ_2$	$READ_2$	b	bx	b	9
$READ_2$	$ACCEPT$	Δ	\$	–	10

Figure 14: Q05

$$Net(READ_1, READ_1, a)Row2$$
$$Net(READ_1, READ_2, b)Row7$$
$$Net(READ_2, ACCEPT, \Delta)Row10$$

Example with Tape

STATE	STACK	TAPE
Start	Δ	a b
$Read_1$	Δ	a b
$Push_x$	xΔ	a b
$Read_1$	xΔ	a b
Pop	Δ	a b
$Read_2$	Δ	a b
Pop	Δ	a b
Accept	Δ	a b

Figure 15: Q06

$$Net(READ_1, READ_1, b)Row5$$
$$Net(READ_1, READ_1, b)Row5$$
$$Net(READ_1, READ_1, b)Row5$$
$$Net(READ_1, READ_2, a)Row6$$
$$Net(READ_2, ACCEPT, \Delta)Row10$$

Example with Tape

STATE	STACK	TAPE
Start	Δ	$\boxed{b}\boxed{b}\boxed{b}\boxed{a}$
$Read_1$	Δ	$\boxed{b}\boxed{b}\boxed{b}\boxed{a}$
$Push_x$	xΔ	$\boxed{b}\boxed{b}\boxed{b}\boxed{a}$
$Read_1$	xΔ	$\boxed{b}\boxed{b}\boxed{b}\boxed{a}$
$Push_x$	xxΔ	$\boxed{b}\boxed{b}\boxed{b}\boxed{a}$
$Read_1$	xxΔ	$\boxed{b}\boxed{b}\boxed{b}\boxed{a}$
Pop	xΔ	$\boxed{b}\boxed{b}\boxed{b}\boxed{a}$
$Read_2$	xΔ	$\boxed{b}\boxed{b}\boxed{b}\boxed{a}$
Pop	Δ	$\boxed{b}\boxed{b}\boxed{b}\boxed{a}$
$Read_2$	Δ	$\boxed{b}\boxed{b}\boxed{b}\boxed{a}$
Pop	Δ	$\boxed{b}\boxed{b}\boxed{b}\boxed{a}$
Accept	Δ	$\boxed{b}\boxed{b}\boxed{b}\boxed{a}$

Figure 16: Q07: FA PALINDROME

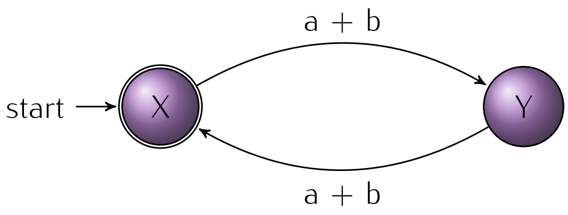


Figure 17: Q08-11: Conversion Form

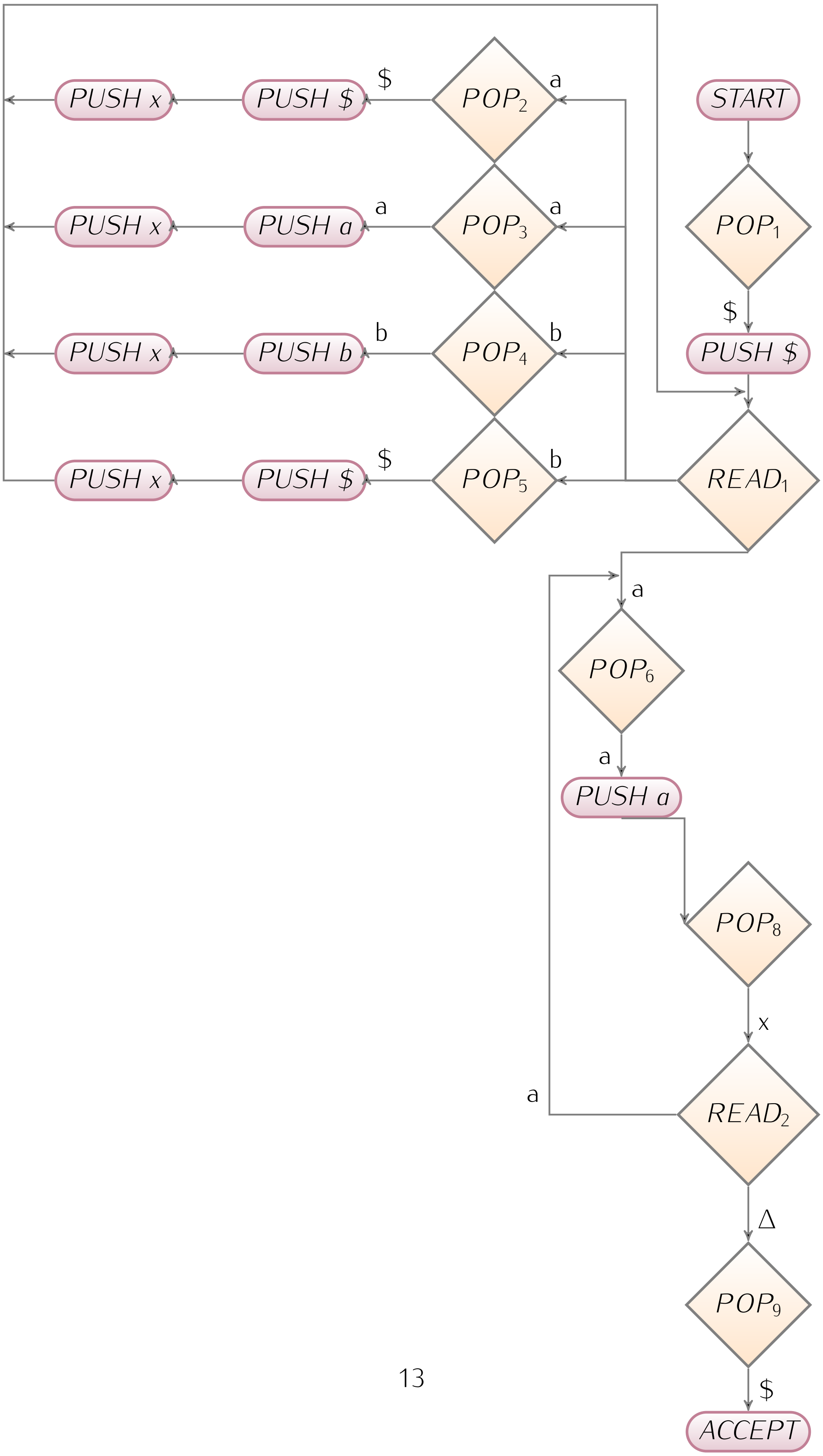


Figure 18: Q08-11: Summary Table

FROM Where	To Where	READ What	POP What	PUSH What	ROW Number
START	$READ_1$	Λ	\$	\$	1
$READ_1$	$READ_1$	a	\$	x\$	2
$READ_1$	$READ_1$	a	a	xa	3
$READ_1$	$READ_1$	b	b	xb	4
$READ_1$	$READ_1$	b	\$	x\$	5
$READ_1$	$READ_2$	a	ax	a	6
$READ_2$	$READ_2$	a	ax	a	8
$READ_2$	$ACCEPT$	Δ	\$	-	10

Figure 19: Q08

$Net(READ_1, READ_1, a)Row2$

$Net(READ_1, READ_2, a)Row6$

$Net(READ_2, ACCEPT, \Delta)Row10$

Example with Tape

STATE	STACK	TAPE
Start	Δ	a b
$Read_1$	Δ	a b
$Push$	xΔ	a b
$Read_1$	xΔ	a b
Pop	Δ	a b
$Read_2$	Δ	a b
Pop	Δ	a b
Accept	Δ	a b

Figure 20: Q09

$Net(READ_1, READ_1, b)Row5$

$Net(READ_1, READ_1, a)Row2$

$Net(READ_1, READ_1, b)Row5$

$Net(READ_1, READ_2, a)Row6$

$Net(READ_2, READ_2, a)Row8$

$Net(READ_2, READ_2, a)Row8$

$Net(READ_2, ACCEPT, \Delta)Row10$

Example with Tape

STATE	STACK	TAPE
Start	Δ	b a b a a a
$Read_1$	Δ	a a b a a a
$Push$	xΔ	a a b a a a
$Read_1$	xΔ	a a b a a a
$Push$	xxΔ	a a b a a a
$Read_1$	xxΔ	a a a a a a
$Push$	xxxΔ	a a a a a a
$Read_1$	xxxΔ	a a a a a a
Pop	xxΔ	a a a a a a
$Read_2$	xxΔ	a a a a a a
Pop	xΔ	a a a a a a
$Read_2$	xΔ	a a a a a b
Pop	Δ	a a a a a b
$Read_2$	Δ	a a a a a b
Pop	Δ	a a a a a b
Accept	Δ	a a a a a b

Figure 21: Q10

The PDA for 8-11 is an EVENPALINDROME therefore it is impossible to balance the amount of readable tape with the stack if not even as shown below.If instead of the below example we were to remain in READ 1 an additional cycle then we would have to many x's on the Stack and the tape would complete too soon. In this case the tape completes too late.

$Net(READ_1, READ_1, b)Row5$
$Net(READ_1, READ_1, a)Row2$
$Net(READ_1, READ_1, b)Row5$
$Net(READ_1, READ_2, a)Row6$
$Net(READ_2, READ_2, a)Row8$
$Net(READ_2, READ_2, b)Row8$
CRASH

Example with Tape

STATE	STACK	TAPE
Start	Δ	b a b a a a b
$Read_1$	Δ	a a b a a a b
$Push$	xΔ	a a b a a a b
$Read_1$	xΔ	a a b a a a b
$Push$	xxΔ	a a b a a a b
$Read_1$	xxΔ	a a a a a a b
$Push$	xxxΔ	a a a a a a b
$Read_1$	xxxΔ	a a a a a a b
Pop	xxΔ	a a a a a a b
$Read_2$	xxΔ	a a a a a a b
Pop	xΔ	a a a a a a b
$Read_2$	xΔ	a a a a a a b
Pop	Δ	a a a a a a b
$Read_2$	Δ	a a a a a a b
Pop	Δ	a a a a a a b

Figure 22: Q11

Once again the PDA for 8-11 is an EVENPALINDROME therefore it is impossible to balance the amount of readable tape with the stack if not even as shown below. If instead of the below example we were to remain in READ 1 an additional cycle then we would have to many x's on the Stack and the tape would complete too soon. In this case the tape completes too late. This example is identical to the falure shown above with the exception of the extra character on the string being a 'a'

$Net(READ_1, READ_1, b)Row5$

$Net(READ_1, READ_1, a)Row2$

$Net(READ_1, READ_1, b)Row5$

$Net(READ_1, READ_2, a)Row6$

$Net(READ_2, READ_2, a)Row8$

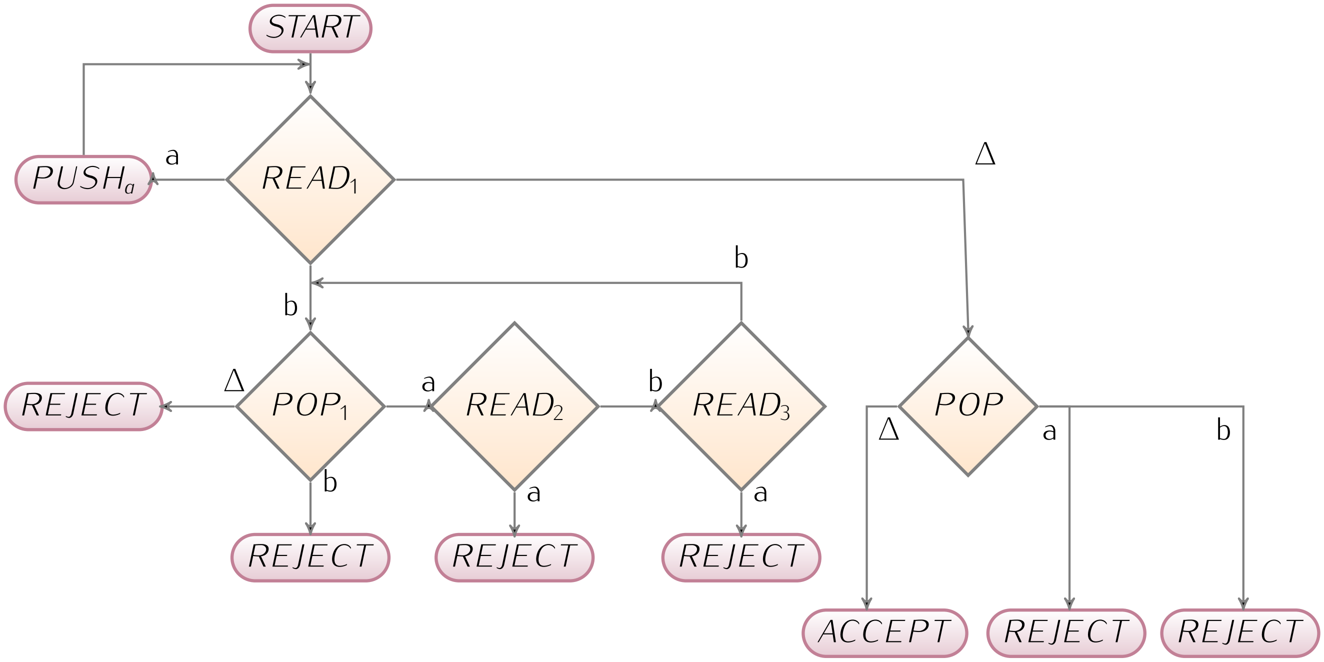
$Net(READ_2, READ_2, a)Row8$

CRASH

Example with Tape

STATE	STACK	TAPE
Start	Δ	babaaaa
$Read_1$	Δ	aabaaaa
$Push$	xΔ	aabaaaa
$Read_1$	xΔ	aabaaaa
$Push$	xxΔ	aabaaaa
$Read_1$	xxΔ	aaaaaaa
$Push$	xxxΔ	aaaaaaa
$Read_1$	xxxΔ	aaaaaaa
Pop	xxΔ	aaaaaaa
$Read_2$	xxΔ	aaaaaaa
Pop	xΔ	aaaaaaa
$Read_2$	xΔ	aaaaaaa
Pop	Δ	aaaaaaa
$Read_2$	Δ	aaaaaab
Pop	Δ	aaaaaab

Figure 23: Q12: PDA


START
PUSH$_a$
a
READ$_1$
Δ
b
b
REJECT
Δ
POP$_1$
a
READ$_2$
b
READ$_3$
POP
Δ
a
b
b
a
a
REJECT
REJECT
REJECT
ACCEPT
REJECT
REJECT