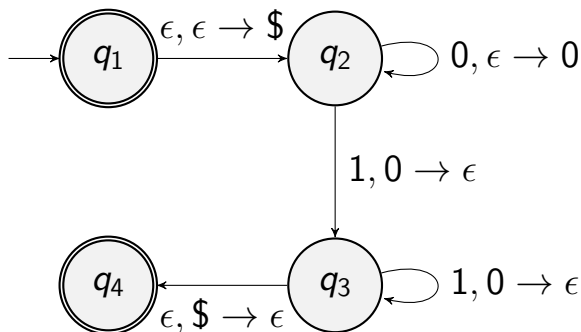


Example of DPDA I

- Example

$$\{0^n 1^n \mid n \geq 0\}$$

The diagram we had earlier is



Example of DPDA II

- The δ function

	0			1			ϵ		
	0	\$	ϵ	0	\$	ϵ	0	\$	ϵ
q_1	\emptyset	\emptyset	\emptyset	\emptyset	\emptyset	\emptyset	\emptyset	\emptyset	$(q_2, \$)$
q_2	\emptyset	\emptyset	$(q_2, 0)$	(q_3, ϵ)	q_r	\emptyset	\emptyset	\emptyset	\emptyset
q_3	q_r	\emptyset	\emptyset	(q_3, ϵ)	\emptyset	\emptyset	\emptyset	(q_4, ϵ)	\emptyset
q_4	q_r	q_r	\emptyset	q_r	q_r	\emptyset	\emptyset	\emptyset	\emptyset
q_r	q_r	q_r	\emptyset	q_r	q_r	\emptyset	\emptyset	\emptyset	\emptyset

- For the first row,

$$\delta(q_1, \epsilon, \epsilon) = (q_2, \$)$$

Example of DPDA III

implies that

$$\delta(q_1, a, x) = \delta(q_1, a, \epsilon) = \delta(q_1, \epsilon, x) = \emptyset, \forall a \in \Sigma, x \in \Gamma$$

Thus we see everything else in the first row is \emptyset

- For the second row,

$$\delta(q_2, 0, \epsilon) = (q_2, 0)$$

implies

	0			1			ϵ		
	0	\$	ϵ	0	\$	ϵ	0	\$	ϵ
q_2	\emptyset	\emptyset	$(q_2, 0)$				\emptyset	\emptyset	\emptyset

Example of DPDA IV

Then

$$\delta(q_2, 1, 0) = (q_3, \epsilon)$$

further implies

0				1			ϵ		
0	\$		ϵ	0	\$	ϵ	0	\$	ϵ
q_2	\emptyset	\emptyset	$(q_2, 0)$	(q_3, ϵ)	\emptyset	\emptyset	\emptyset	\emptyset	\emptyset

Finally, we must have

0				1			ϵ		
0	\$		ϵ	0	\$	ϵ	0	\$	ϵ
q_2	\emptyset	\emptyset	$(q_2, 0)$	(q_3, ϵ)	$\neq \emptyset$	\emptyset	\emptyset	\emptyset	\emptyset

Example of DPDA V

because

$$\delta(q_2, 1, \epsilon) = \delta(q_2, \epsilon, \$) = \delta(q_2, \epsilon, \epsilon) = \emptyset$$

- Thus we consider an additional state q_r . We need it to ensure that one of the four is not \emptyset
- Formally, we should have

$$\delta(q_2, 1, \$) = (q_r, \epsilon)$$

though we wrote only q_r for simplicity

- For the third row, we have

Example of DPDA VI

	0			1			ϵ		
	0	\$	ϵ	0	\$	ϵ	0	\$	ϵ
q_3				(q_3, ϵ)	\emptyset	\emptyset	\emptyset	\emptyset	\emptyset

Then

	0			1			ϵ		
	0	\$	ϵ	0	\$	ϵ	0	\$	ϵ
q_3	\emptyset	\emptyset	\emptyset	(q_3, ϵ)	\emptyset	\emptyset	\emptyset	(q_4, ϵ)	\emptyset

In the end

$$\delta(q_3, 0, 0) = q_r$$

- For the fourth row, there is no out link at q_4

Example of DPDA VII

- We let

$$\delta(q_4, a, x) = q_r$$

and

$$\delta(q_4, a, \epsilon) = \delta(q_4, \epsilon, x) = \delta(q_4, \epsilon, \epsilon) = \emptyset$$

- We can do the same for the last row
- Consider an input string 011

$$q_1 \xrightarrow{\epsilon} q_2, \{\$ \} \xrightarrow{0} q_2, \{0\$ \} \xrightarrow{1} q_3, \{\$ \} \xrightarrow{\epsilon} q_4, \emptyset$$

Example of DPDA VIII

- From q_4 , the two possible moves are

$$\delta(q_4, 1, \epsilon) \text{ and } \delta(q_4, \epsilon, \epsilon)$$

Both are \emptyset , so we don't know where to go

- Thus this input string is rejected