

Universidad San Carlos de Guatemala

Centro Universitario de Occidente

División de Ciencias de la Ingeniería

Lenguajes Formales y de Programación Sección "A"

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Segundo Semestre 2025

**Estudiante:**

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**Carné:** 202430233

***Procedimiento Teórico Práctico Proyecto #1 2025***

# AFD proyecto No 1

Reconocimiento de identificadores:

$A = \{ a, b, c, d, e, f, g, h, i, j, k, l,$   
 $m, n, \tilde{n}, o, p, q, r, s, t, u, v,$   
 $w, x, y, z, A, B, C, D, E, F, G, H,$   
 $I, J, K, L, M, N, \tilde{N}, O, P, Q, R, S, T,$   
 $U, V, W, X, Y, Z, \emptyset, 1, 2, 3,$   
 $4, 5, 6, 7, 8, 9 \}$

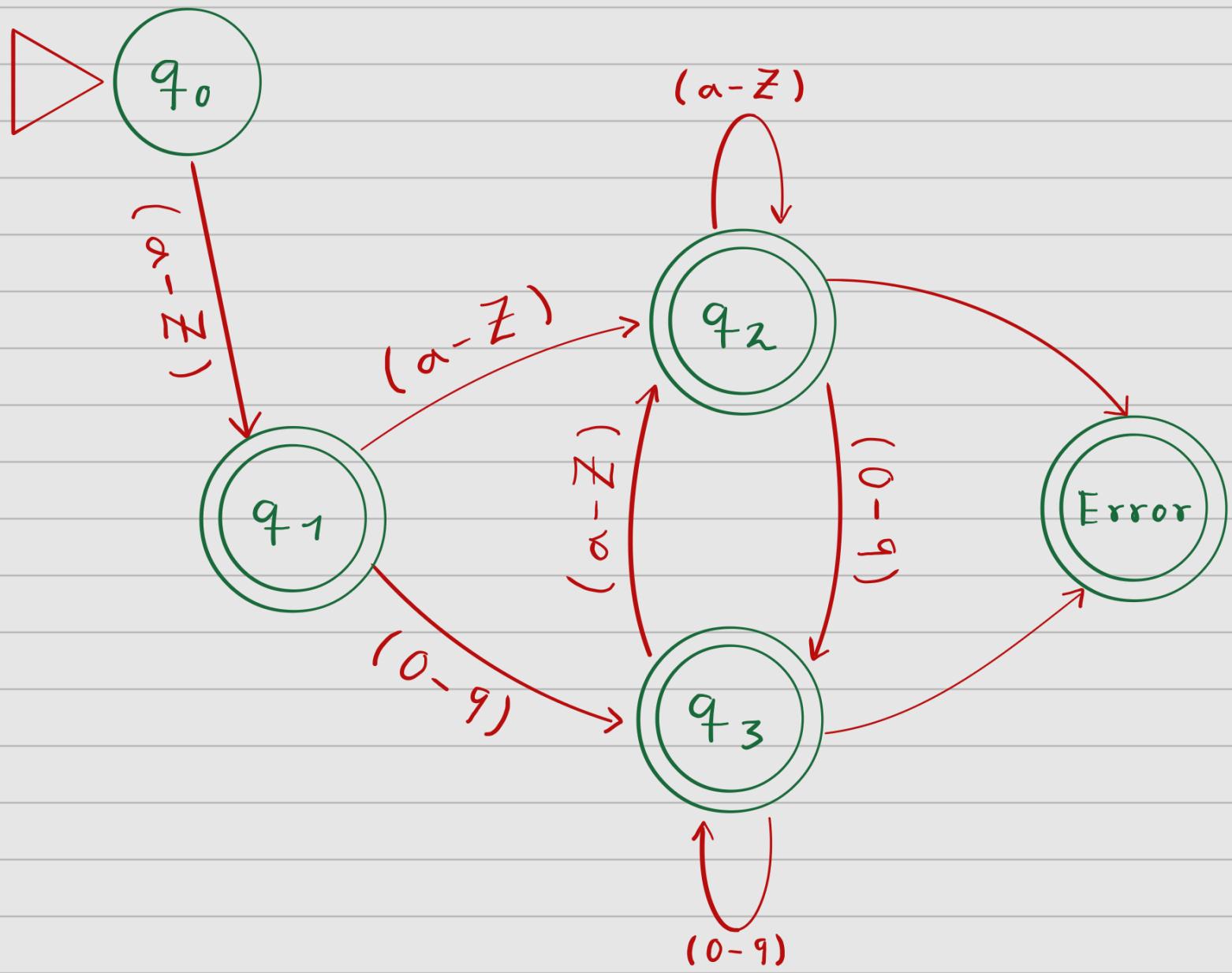
$F = \{ q_1, q_2 \}$

$Q = \{ q_0, q_1, q_2 \}$

$q_0 = \{ q_0 \}$

$\delta = \{ q_0 (a-Z) \rightarrow q_1, q_0 (0-9) \rightarrow q_2,$   
 $q_1 (a-Z) \rightarrow q_1, q_2 (0-9) \rightarrow q_2,$   
 $q_1 (0-9) \rightarrow q_2, q_2 (a-Z) \rightarrow q_1 \}$

## • Diagrama de Transiciones:



## • Tabla de Transiciones:

	(a-Z)	(0-9)	
$\rightarrow q_0$	$q_1$	—	
* $q_1$	$q_2$	$q_3$	
* $q_2$	$q_2$	$q_3$	
* $q_3$	$q_2$	$q_3$	

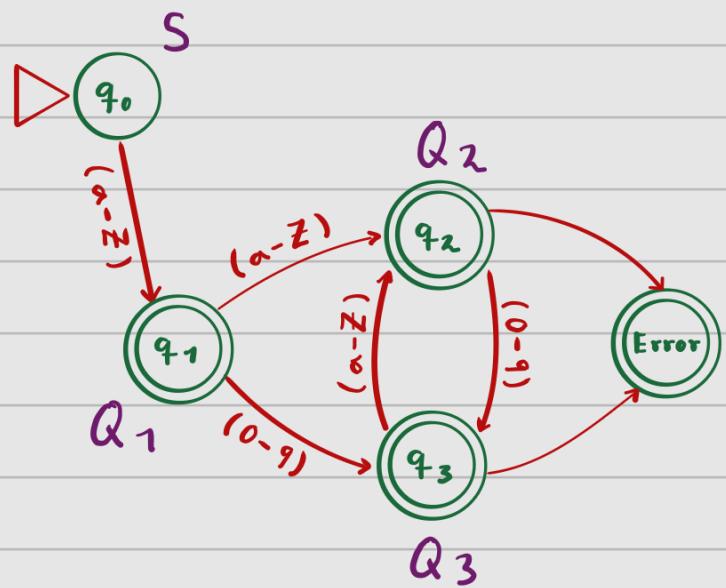
## • Expresión Regular:

(a|b|c|d|e|f|g|h|i|j|k|l|  
m|n|ñ|o|p|q|r|s|t|u|v  
w|x|y|z|A|B|C|D|E|F|G|H|  
I|J|K|L|M|N|Ñ|O|P|Q|R|S|T|  
U|V|W|X|Y|Z|Ø|1|2|3|  
4|5|6|7|8|9 )(a|b|c|d|e|f|g|  
h|i|j|k|l|m|n|ñ|o|p|q|r|s|t|  
u|v|w|x|y|z|A|B|C|D|E|F|  
G|H|I|J|K|L|M|N|Ñ|O|P|Q|R|S|T|  
U|V|W|X|Y|Z|Ø|1|2|3|4|5|  
6|7|8|9 )\*

# • Gramatica regular:

$$S = \{ S \}$$

$$N = \{ S, Q_1, Q_2, Q_3 \}$$



$$T = \{ a, b, c, d, e, f, g, h, i, j, k, l,$$

$$m, n, \tilde{n}, o, p, q, r, s, t, u, v,$$

$$w, x, y, z, A, B, C, D, E, F, G, H,$$

$$I, J, K, L, M, N, \tilde{N}, O, P, Q, R, S, T,$$

$$U, V, W, X, Y, Z, \emptyset, 1, 2, 3,$$

$$4, 5, 6, 7, 8, 9 \}$$

$P = \{ S \rightarrow [a-z] | [0-9] Q_1,$

$Q_1 \rightarrow [a-z] Q_2,$

$Q_1 \rightarrow [0-9] Q_3,$

$Q_2 \rightarrow [0-9] Q_3,$

$Q_3 \rightarrow [a-z] Q_2,$

$Q_1 \rightarrow [a-z],$

$Q_2 \rightarrow [a-z],$

$Q_3 \rightarrow [0-9] \}$

## Reconocimiento de Números:

$$A = \{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 \}$$

$$F = \{ q_1 \}$$

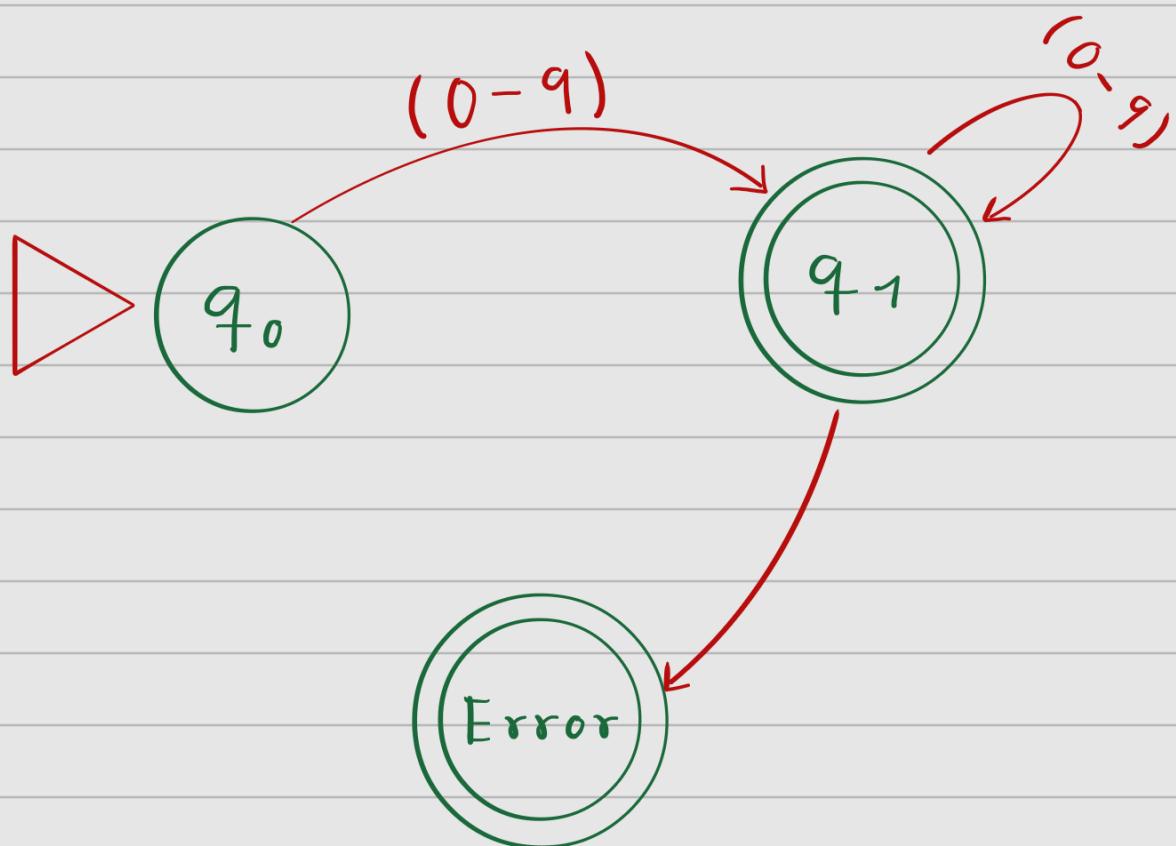
$$Q = \{ q_0, q_1 \}$$

$$q_0 = \{ q_0 \}$$

$$\delta = \{ q_0 (0-9) \rightarrow q_1,$$

$$q_1 (0-9) \rightarrow q_1 \}$$

• Diagrama de Transiciones:



• Tabla de Transiciones:

		$(0-9)$
$\rightarrow q_0$	$q_1$	
$*$ $q_1$		$q_1$

• Expresión Regular:

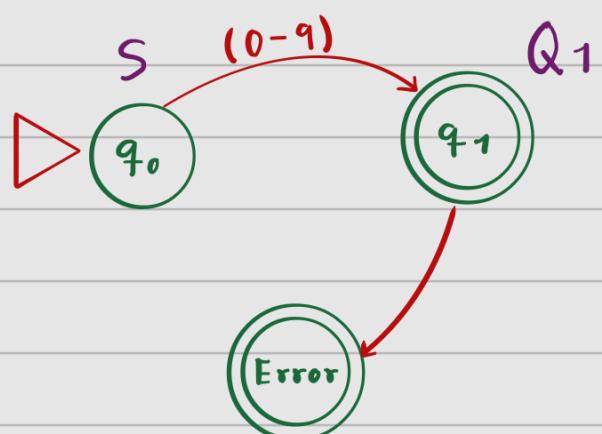
$$(0|1|2|3|4|5|6|7|8|9)(0|1|2|3|4|5|6|7|8|9)^*$$

• Gramática regular:

$$S = \{ S \}$$

$$N = \{ S, Q_1 \}$$

$$T = \{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 \}$$



$P = \{ S \rightarrow [0-9] Q_1,$

$Q_1 \rightarrow [0-9] Q_1,$

$Q_1 \rightarrow [0-9] \}$

## Reconocimiento de Decimales:

$$A = \{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, . \}$$

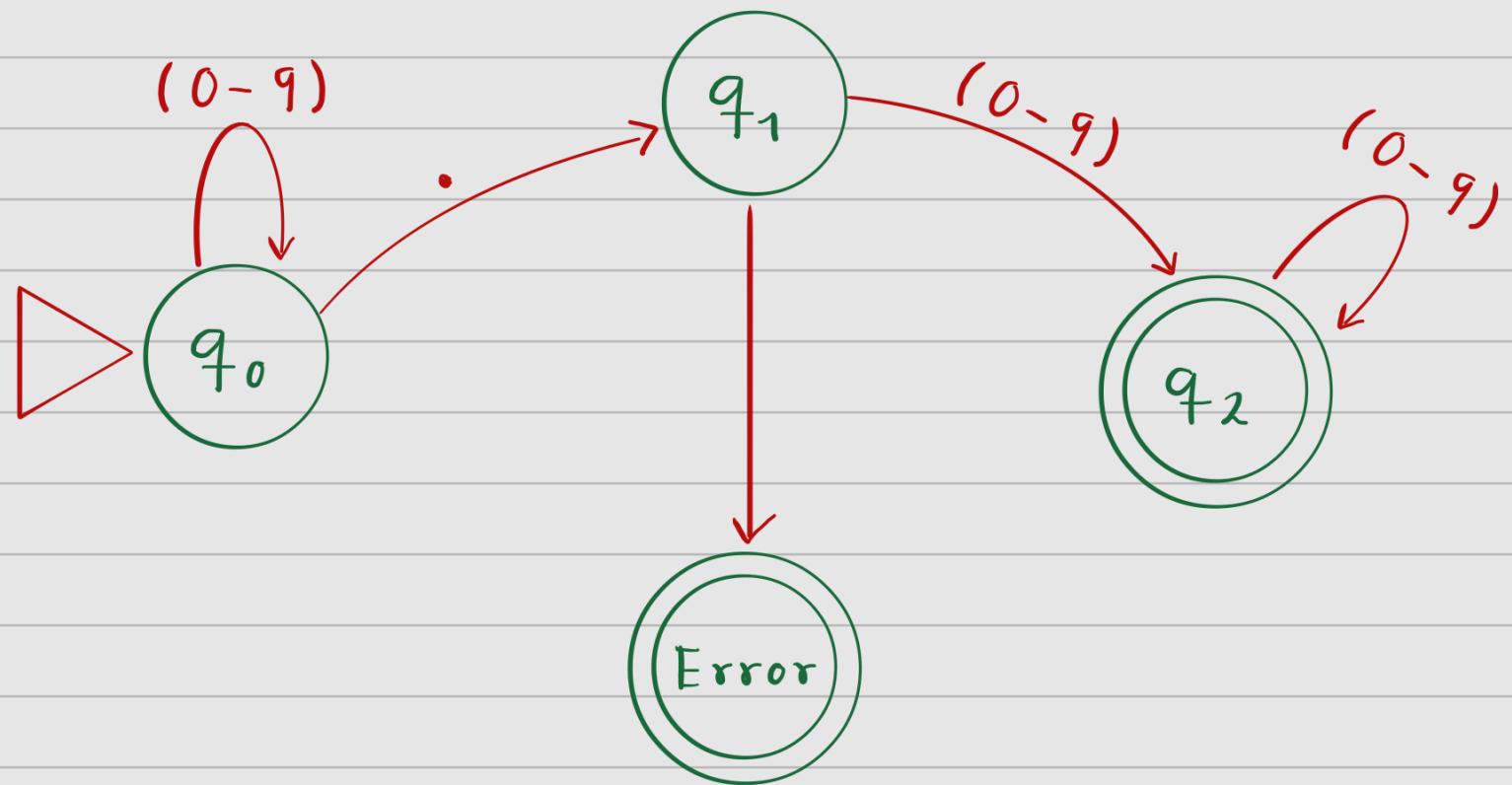
$$F = \{ q_2 \}$$

$$Q = \{ q_0, q_1, q_2 \}$$

$$q_0 = \{ q_0 \}$$

$$\delta = \{ q_0(0-9) \rightarrow q_0, q_0(.) \rightarrow q_1, \\ q_1(0-9) \rightarrow q_2, q_2(0-9) \rightarrow q_2 \}$$

• Diagrama de Transiciones:



## • Tabla de Transiciones:

	(0 - 9)	.	
→ $q_0$	$q_0$	$q_1$	
$q_1$	$q_2$	—	
* $q_2$	$q_2$	—	

## • Expresión Regular:

$[(0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9)](0 |$

$1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9)^* . [(0 | 1$

$| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9)](0 | 1 | 2 |$

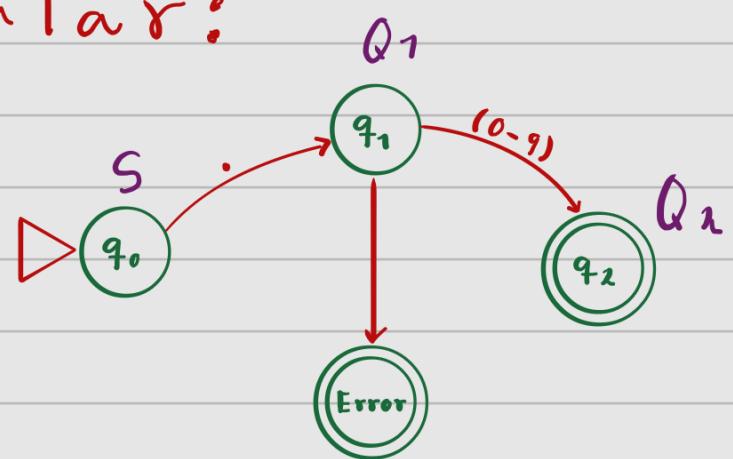
$3 | 4 | 5 | 6 | 7 | 8 | 9)^*$

## • Gramatica regular:

$$S = \{ S \}$$

$$N = \{ S, Q_1, Q_2 \}$$

$$T = \{ \text{ } , 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, . \}$$



$$P = \{ S \rightarrow [0-9] S, \quad$$

$$S \rightarrow . Q_1,$$

$$Q_1 \rightarrow [0-9] Q_2,$$

$$Q_2 \rightarrow [0-9] Q_2,$$

$$Q_2 \rightarrow [0-9] \}$$

## Reconocimiento de Cadenas de texto:

$A = \{ a, b, c, d, e, f, g, h, i, j, k, l,$   
 $m, n, \tilde{n}, o, p, q, r, s, t, u, v,$   
 $w, x, y, z, A, B, C, D, E, F, G, H,$   
 $I, J, K, L, M, N, \tilde{N}, O, P, Q, R, S, T,$   
 $U, V, W, X, Y, Z, \emptyset, 1, 2, 3,$   
 $4, 5, 6, 7, 8, 9, "\}$

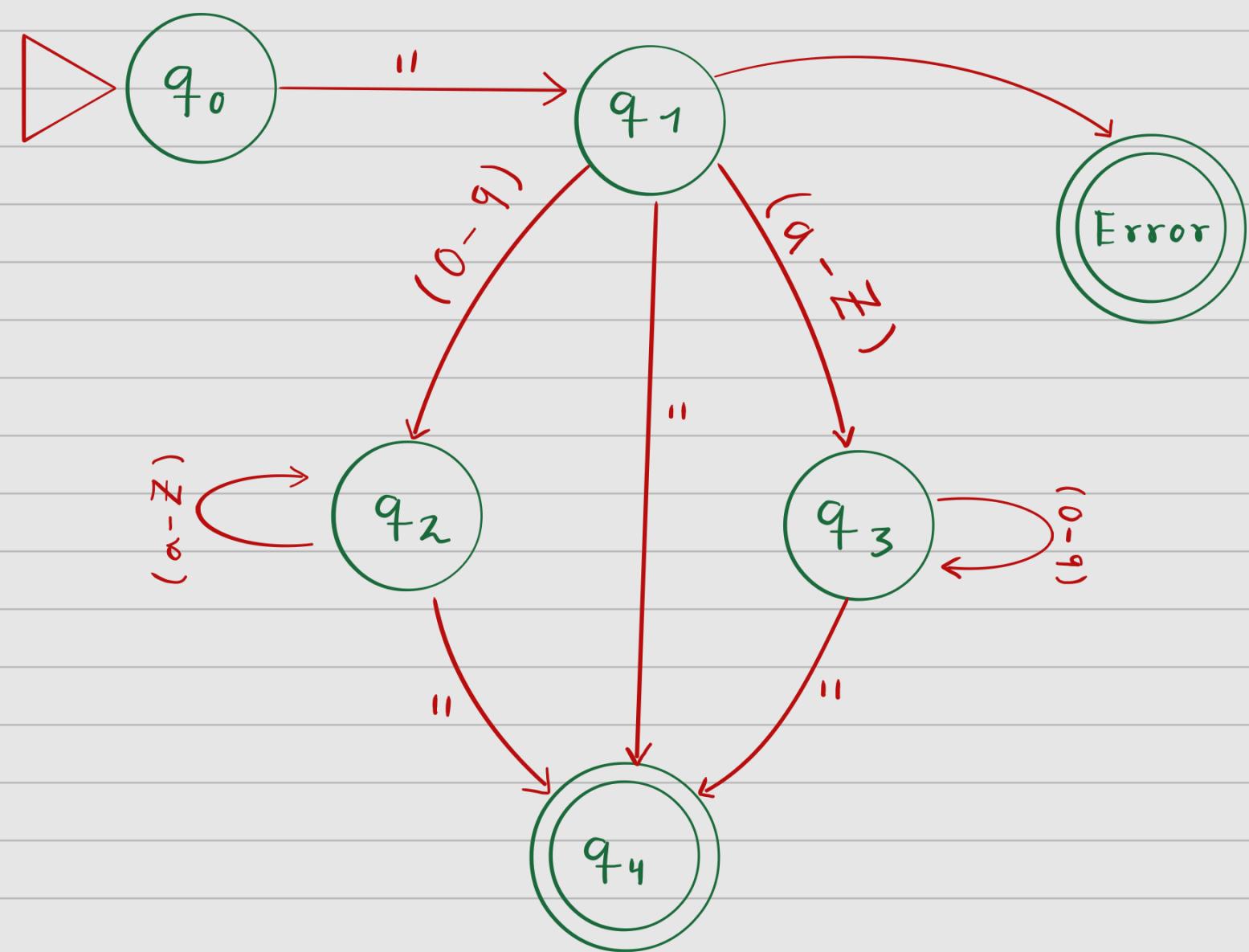
$F = \{ q_4 \}$

$Q = \{ q_0, q_1, q_2, q_3, q_4 \}$

$q_0 = \{ q_0 \}$

$\delta = \{ q_0 ("") \rightarrow q_1, q_1 ("") \rightarrow q_4,$   
 $q_1 (0 - 9) \rightarrow q_2, q_1 (a - z) \rightarrow q_3,$   
 $q_3 (0 - 9) \rightarrow q_3, q_2 (a - z) \rightarrow q_2,$   
 $q_2 ("") \rightarrow q_4, q_3 ("") \rightarrow q_4 \}$

## • Diagrama de Transiciones:



## • Tabla de Transiciones:

	$(0-9)$	$(a-Z)$	$''$	
$\rightarrow q_0$	—	—	$q_1$	
$q_1$	$q_2$	$q_3$	$q_4$	
$q_2$	—	$q_2$	$q_4$	
$q_3$	$q_3$	—	$q_4$	
$* q_4$	—	—	—	

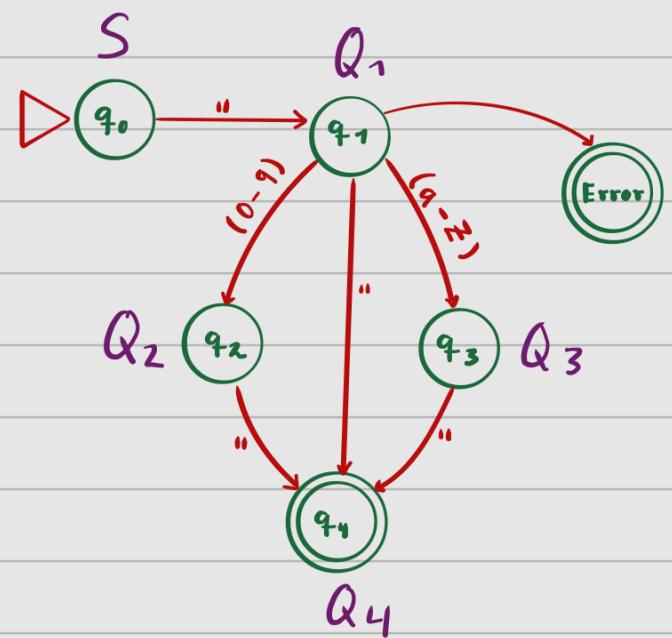
## • Expresión Regular:

"[(a|b|c|d|e|f|g|h|i|j|k|l|  
 m|n|ñ|o|p|q|r|s|t|u|v|  
 w|x|y|z|A|B|C|D|E|F|G|H|  
 I|J|K|L|M|N|Ñ|O|P|Q|R|S|T|  
 U|V|W|X|Y|Z|Ø|1|2|3|  
 4|5|6|7|8|9)\*]!"

## • Gramática regular:

$$S = \{ S \}$$

$$N = \{ S, Q_1, Q_2, Q_3, Q_4 \}$$



$T = \{ a, b, c, d, e, f, g, h, i, j, k, l,$   
 $m, n, \tilde{n}, o, p, q, r, s, t, u, v,$   
 $w, x, y, z, A, B, C, D, E, F, G, H,$   
 $I, J, K, L, M, N, \tilde{N}, O, P, Q, R, S, T,$   
 $U, V, W, X, Y, Z, \emptyset, 1, 2, 3,$   
 $4, 5, 6, 7, 8, 9, " \}$

$P = \{ S \rightarrow " Q_1, Q_1 \rightarrow ",$   
 $Q_1 \rightarrow [0-9] Q_2,$   
 $Q_2 \rightarrow [a-z] Q_2,$   
 $Q_2 \rightarrow ",$   
 $Q_1 \rightarrow [a-z] Q_3,$   
 $Q_3 \rightarrow [0-9] Q_3,$   
 $Q_3 \rightarrow " \}$

## Reconocimiento de Palabras Reservadas:

$A = \{ SI, si, ENTONCES,$   
 $entonces, PARA, para,$   
 $ESCRIBIR, escribir \}$

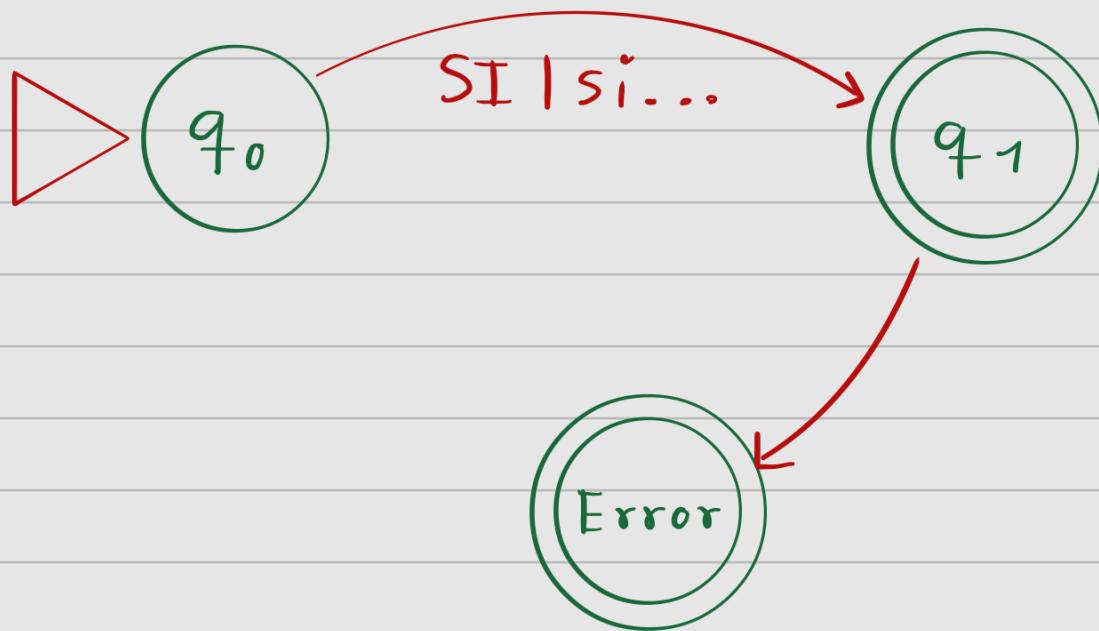
$F = \{ q_1 \}$

$Q = \{ q_0, q_1 \}$

$q_0 = \{ q_0 \}$

$\delta = \{ q_0 ( SI | si | ENTONCES |$   
 $entonces | PARA | para | ESCRIBIR$   
 $| escribir ) \rightarrow q_1 \}$

## • Diagrama de Transiciones:



## • Tabla de Transiciones:

		SILentonces...
→ $q_0$		$q_1$
* $q_1$		—

• Expresión Regular:

(SI | si | ENTONCES |

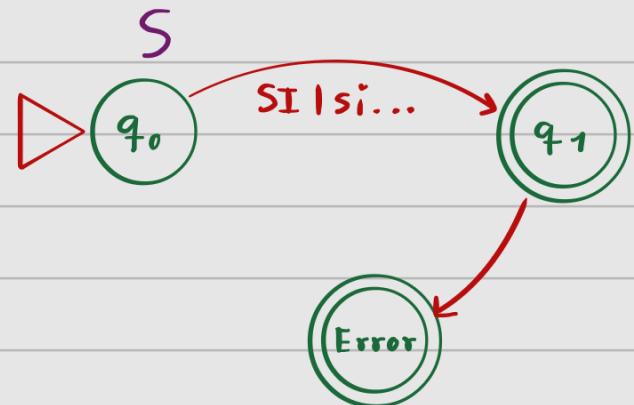
entonces | PARA | para |

ESCRIBIR | escribir )

• Gramática regular:

$$S = \{ S \}$$

$$N = \{ S \}$$



$$T = \{ SI, si, ENTONCES,$$

entonces, PARA, para,

ESCRIBIR, escribir }

$$P = \{ S \rightarrow SI | si | ENTONCES |$$

entonces | PARA | para |

ESCRIBIR | escribir }

## Reconocimiento de signos de puntuacion:

$$A = \{ . , , , ; , : \}$$

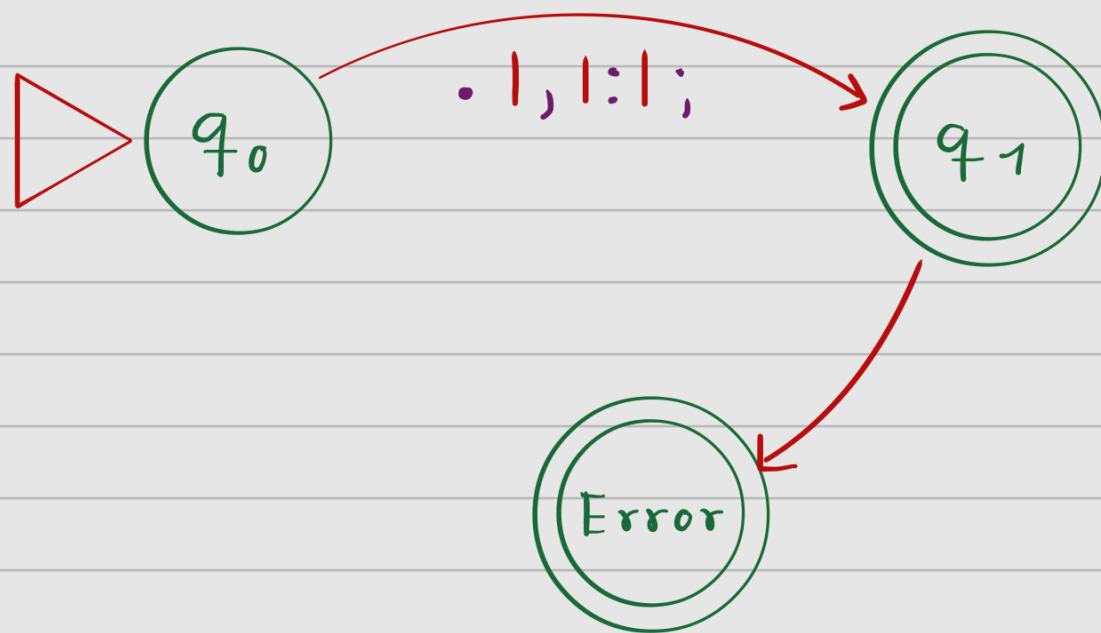
$$F = \{ q_1 \}$$

$$Q = \{ q_0, q_1 \}$$

$$q_0 = \{ q_0 \}$$

$$\delta = \{ q_0 ( . | , | ; | : ) \rightarrow q_1 \}$$

• Diagrama de Transiciones:



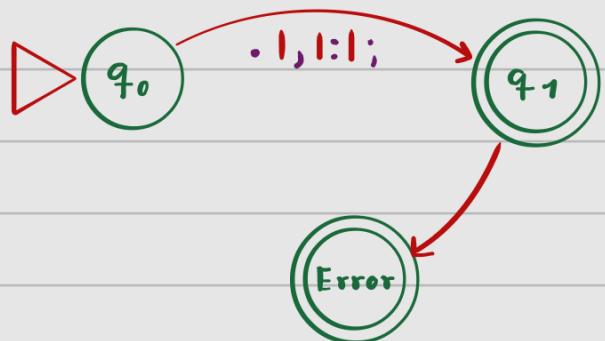
• Expresión Regular:

$$( . | , | ; | : )$$

## • Gramatica regular:

$$S = \{ S \}$$

$$N = \{ S \}$$



$$T = \{ . , , , ; , : \}$$

$$P = \{ S \rightarrow . \mid , \mid ; \mid : \}$$

## • Tabla de Transiciones:

	.		,		;		:
$\rightarrow q_0$							
$* q_1$							

## Reconocimiento de operadores matematicos:

$$A = \{ +, -, *, /, \% , = \}$$

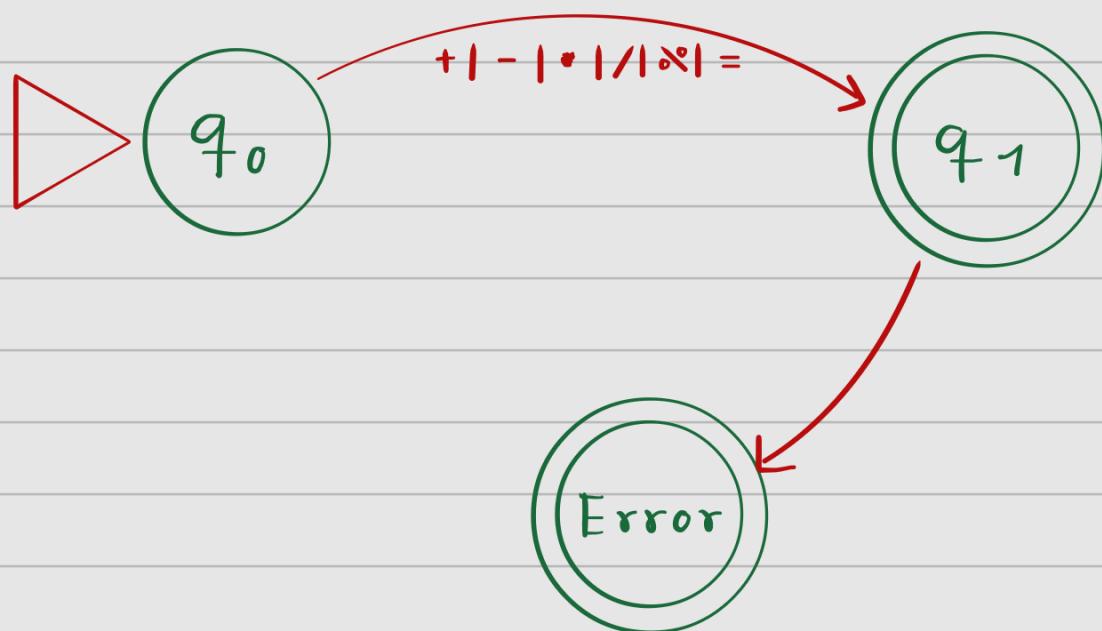
$$F = \{ q_1 \}$$

$$Q = \{ q_0, q_1 \}$$

$$q_0 = \{ q_0 \}$$

$$\delta = \{ q_0 ( + | - | * | / | \% | = ) \rightarrow q_1 \}$$

• Diagrama de Transiciones:



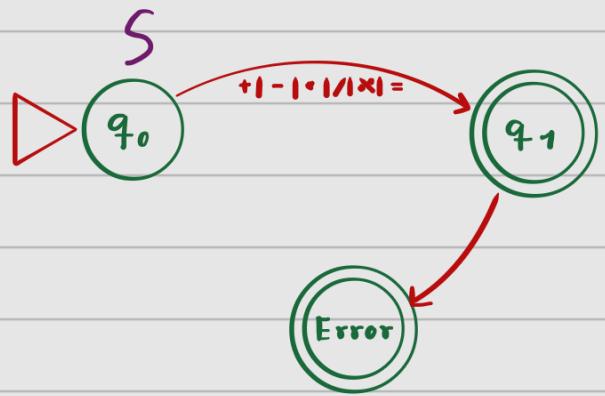
• Expresión Regular:

$$( + | - | * | / | \% | = )$$

## • Gramatica regular:

$$S = \{ S \}$$

$$N = \{ S \}$$



$$T = \{ +, -, *, /, \% , = \}$$

$$P = \{ S \rightarrow + | - | * | / | \% | = \}$$

## • Tabla de Transiciones:

		$+   -   *   /   \%   =$
$\rightarrow q_0$	$q_1$	
$* q_1$		—

## Reconocimiento de signos de agrupacion:

$$A = \{ ( , ) , [ , ] , \{ , \} \}$$

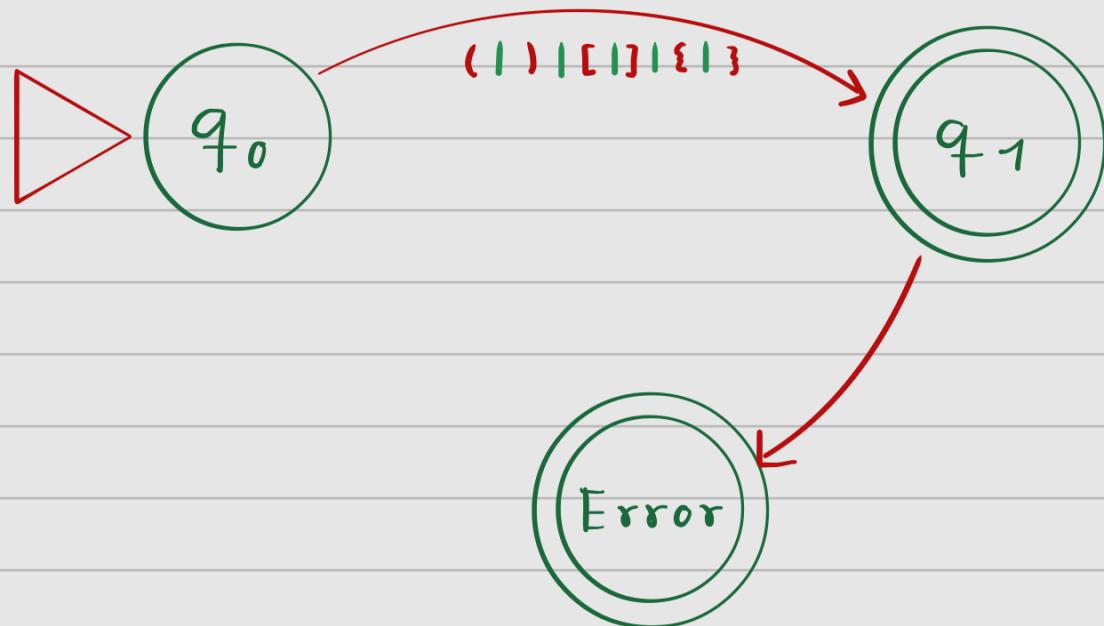
$$F = \{ q_1 \}$$

$$Q = \{ q_0, q_1 \}$$

$$q_0 = \{ q_0 \}$$

$$\delta = \{ q_0 ((|) | [|] | \{| \}) \rightarrow q_1 \}$$

• Diagrama de Transiciones:



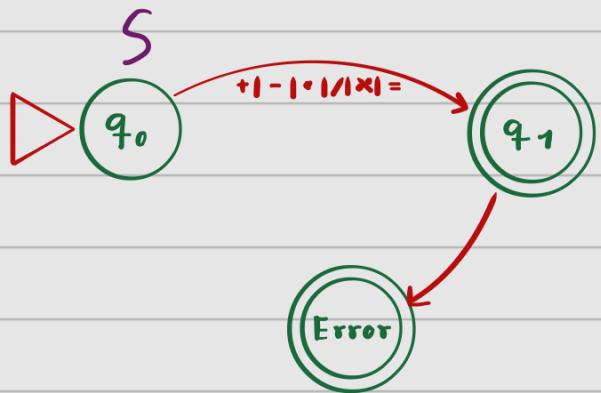
• Expresión Regular:

$$( (|) | [|] | \{| \} )$$

## • Gramatica regular:

$$S = \{ S \}$$

$$N = \{ S \}$$



$$T = \{ (, ) , [ , ] , \{ , \} \}$$

$$P = \{ S \rightarrow ( | ) | [ | ] | \{ | \} \}$$

## • Tabla de Transiciones:

	(   )	[   ]	{   }	
$\rightarrow q_0$			$q_1$	
$* q_1$				—

## Reconocimiento de comentarios de una linea:

A = { a, b, c, d, e, f, g, h, i, j, K, l,  
m, n, ñ, o, p, q, r, s, t, u, v,  
w, x, y, z, A, B, C, D, E, F, G, H,  
I, J, K, L, M, N, Ñ, O, P, Q, R, S, T,  
U, V, W, X, Y, Z, Ø, 1, 2, 3,  
4, 5, 6, 7, 8, 9, / }

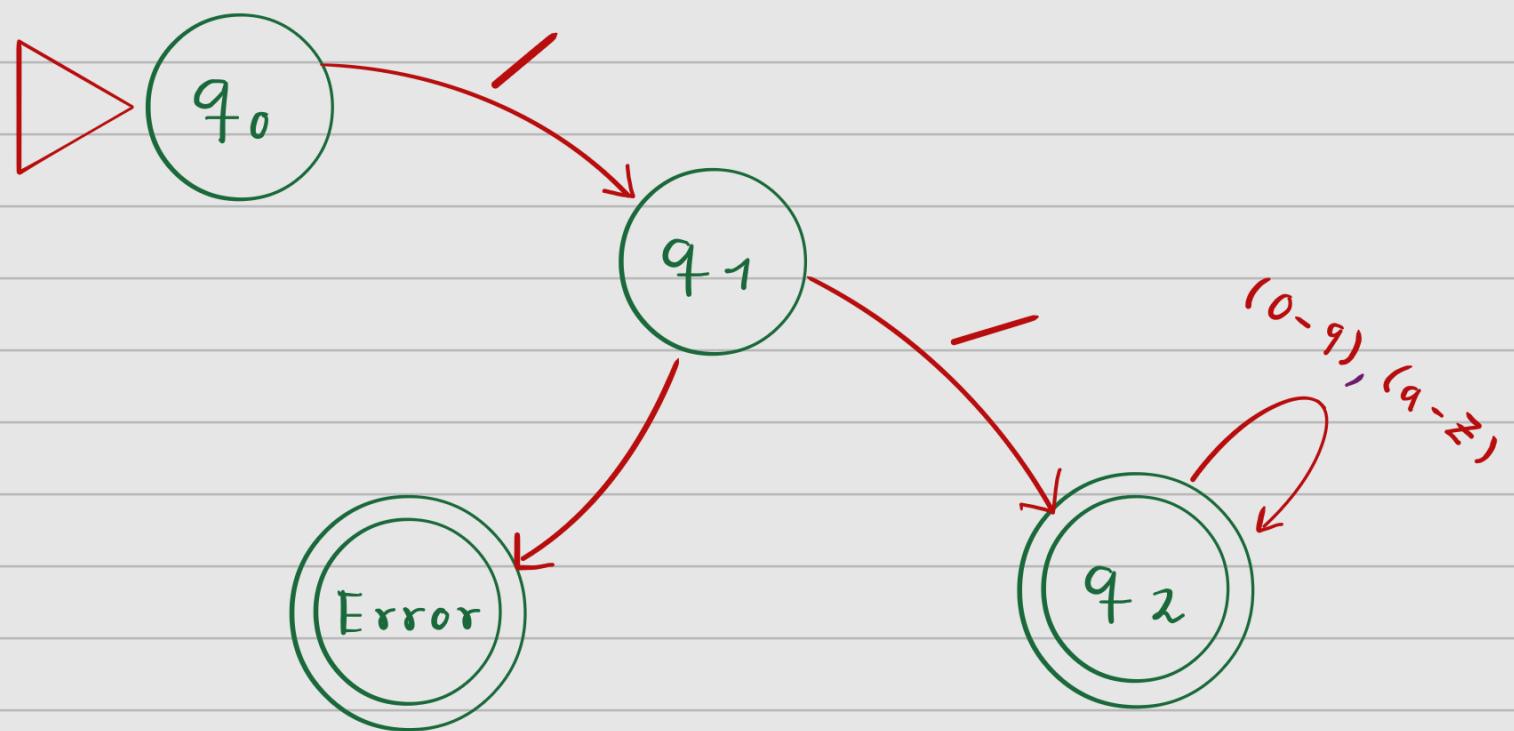
$$F = \{ q_2 \}$$

$$Q = \{ q_0, q_1, q_2 \}$$

$$q_0 = \{ q_0 \}$$

$$\begin{aligned} \delta = & \{ q_0 (/) \rightarrow q_1, \\ & q_1 (/) \rightarrow q_2, \\ & q_2 [(0-9) | (a-z)] \rightarrow q_2 \} \end{aligned}$$

## • Diagrama de Transiciones:



## • Tabla de Transiciones:

	$(0-q)$	$(a-Z)$	/	
$\rightarrow q_0$	—	—	$q_1$	
$q_1$	—	—	$q_2$	
$* q_2$	$q_2$	$q_2$	—	

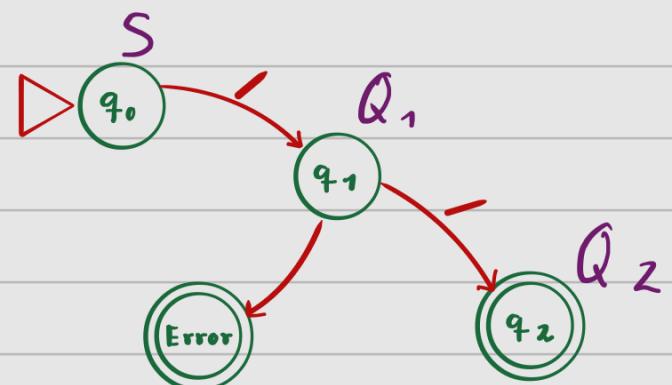
## • Expresión Regular:

// [(a|b|c|d|e|f|g|h|i|j|K|l|  
 m|n|ñ|o|p|q|r|s|t|u|v|  
 w|x|y|z|A|B|C|D|E|F|G|H|  
 I|J|K|L|M|N|Ñ|O|P|Q|R|S|T|  
 U|V|W|X|Y|Z|Ø|1|2|3|  
 4|5|6|7|8|9 )\* ]

## • Gramática regular:

$$S = \{ S \}$$

$$N = \{ S, Q_1, Q_2 \}$$



$T = \{ a, b, c, d, e, f, g, h, i, j, K, l,$   
 $m, n, ñ, o, p, q, r, s, t, u, v,$   
 $w, x, y, z, A, B, C, D, E, F, G, H,$

I, J, K, L, M, N,  $\tilde{N}$ , O, P, Q, R, S, T,  
U, V, W, X, Y, Z, Ø, 1, 2, 3,  
4, 5, 6, 7, 8, 9, / }

P = { S → / Q<sub>1</sub>,

Q<sub>1</sub> → / Q<sub>2</sub>,

Q<sub>2</sub> → [a - z] Q<sub>2</sub>,

Q<sub>2</sub> → [0 - 9] Q<sub>2</sub>,

Q<sub>2</sub> → [a - z] | [0 - 9] }

## Reconocimiento de comentarios de bloque:

A = { a, b, c, d, e, f, g, h, i, j, K, l,  
m, n, ñ, o, p, q, r, s, t, u, v,  
w, x, y, z, A, B, C, D, E, F, G, H,  
I, J, K, L, M, N, Ñ, O, P, Q, R, S, T,  
U, V, W, X, Y, Z, Ø, 1, 2, 3,  
4, 5, 6, 7, 8, 9, /, \* }

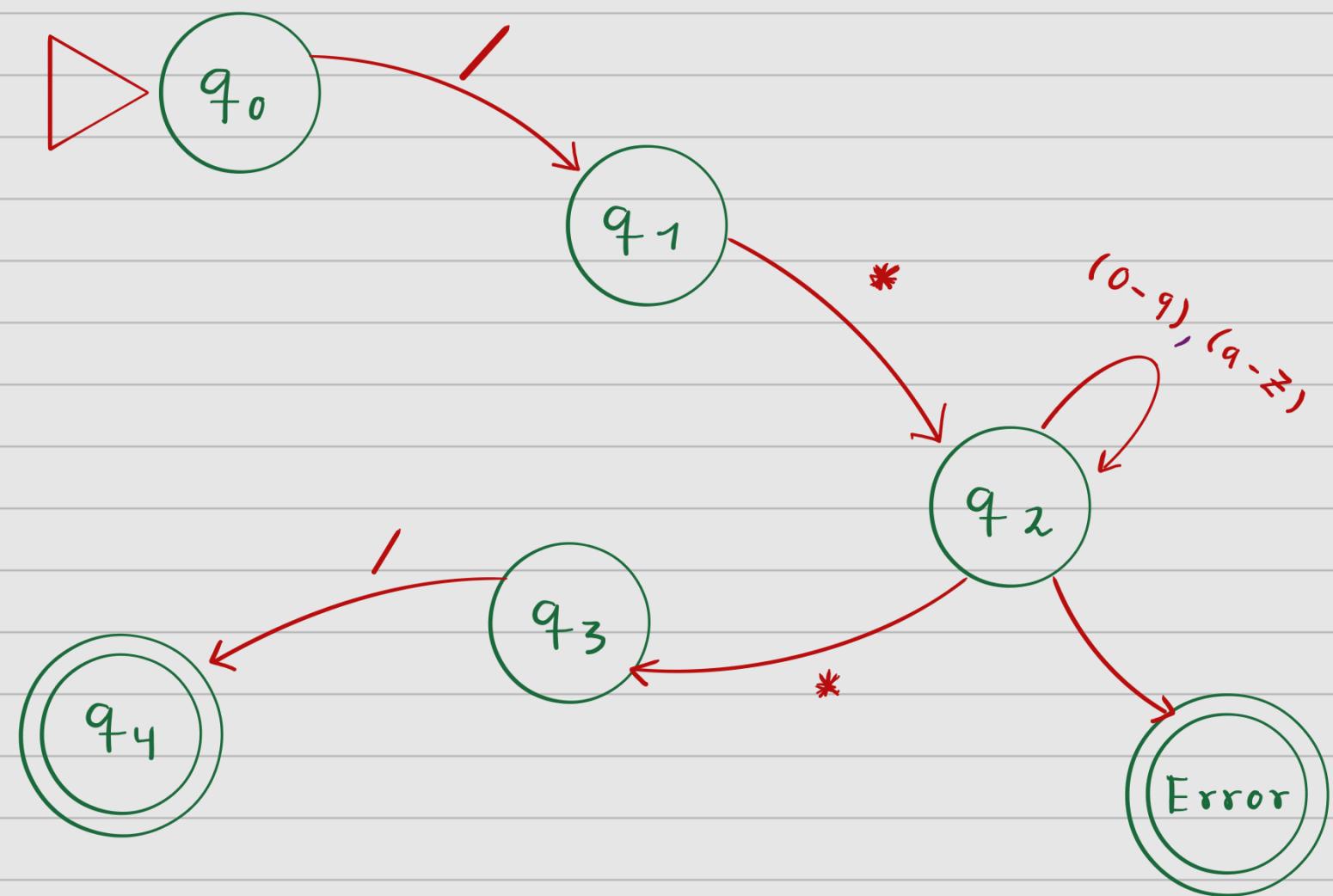
F = { q<sub>4</sub> }

Q = { q<sub>0</sub>, q<sub>1</sub>, q<sub>2</sub>, q<sub>3</sub>, q<sub>4</sub> }

q<sub>0</sub> = { q<sub>0</sub> }

δ = { q<sub>0</sub> (/) → q<sub>1</sub>, q<sub>1</sub> (\*) → q<sub>2</sub>,  
q<sub>2</sub> [(0 - 9) | (a - z)] → q<sub>2</sub>,  
q<sub>2</sub> (/) → q<sub>3</sub>,  
q<sub>3</sub> (\*) → q<sub>4</sub> }

## • Diagrama de Transiciones:



## • Tabla de Transiciones:

	$(0-9)$	$(a-Z)$	/	*
$\rightarrow q_0$	—	—	$q_1$	—
$q_1$	—	—	—	$q_2$
$q_2$	$q_2$	$q_2$	—	$q_3$
$q_3$	—	—	$q_4$	—
$q_4$	—	—	—	—

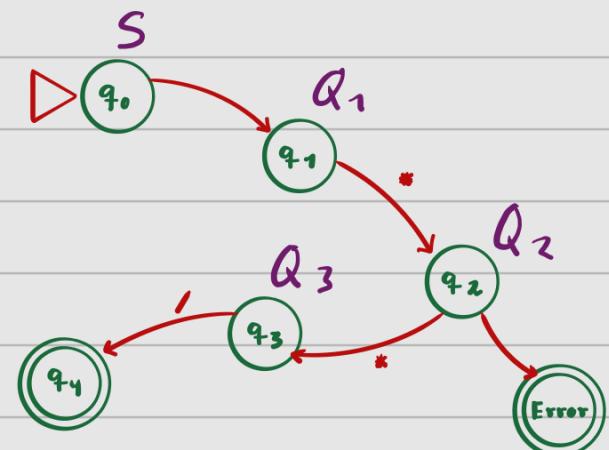
## • Expresión Regular:

/\* [(a|b|c|d|e|f|g|h|i|j|K|l|  
 m|n|ñ|o|p|q|r|s|t|u|v  
 w|x|y|z|A|B|C|D|E|F|G|H|  
 I|J|K|L|M|N|Ñ|O|P|Q|R|S|T|  
 U|V|W|X|Y|Z|Ø|1|2|3|  
 4|5|6|7|8|9 )\* ]\* /

## • Gramática regular:

$$S = \{ S \}$$

$$N = \{ S, Q_1, Q_2, Q_3 \}$$



$$T = \{ a, b, c, d, e, f, g, h, i, j, K, l,$$

m, n, ñ, o, p, q, r, s, t, u, v,

w, x, y, z, A, B, C, D, E, F, G, H,

I, J, K, L, M, N,  $\tilde{N}$ , O, P, Q, R, S, T,  
U, V, W, X, Y, Z, Ø, 1, 2, 3,  
4, 5, 6, 7, 8, 9, /, \*

P = { S → / Q<sub>1</sub>,

Q<sub>1</sub> → \* Q<sub>2</sub>,

Q<sub>2</sub> → [a - z] Q<sub>2</sub>,

Q<sub>2</sub> → [0 - 9] Q<sub>2</sub>,

Q<sub>2</sub> → \* Q<sub>3</sub>,

Q<sub>3</sub> → / }