Automata Design Document

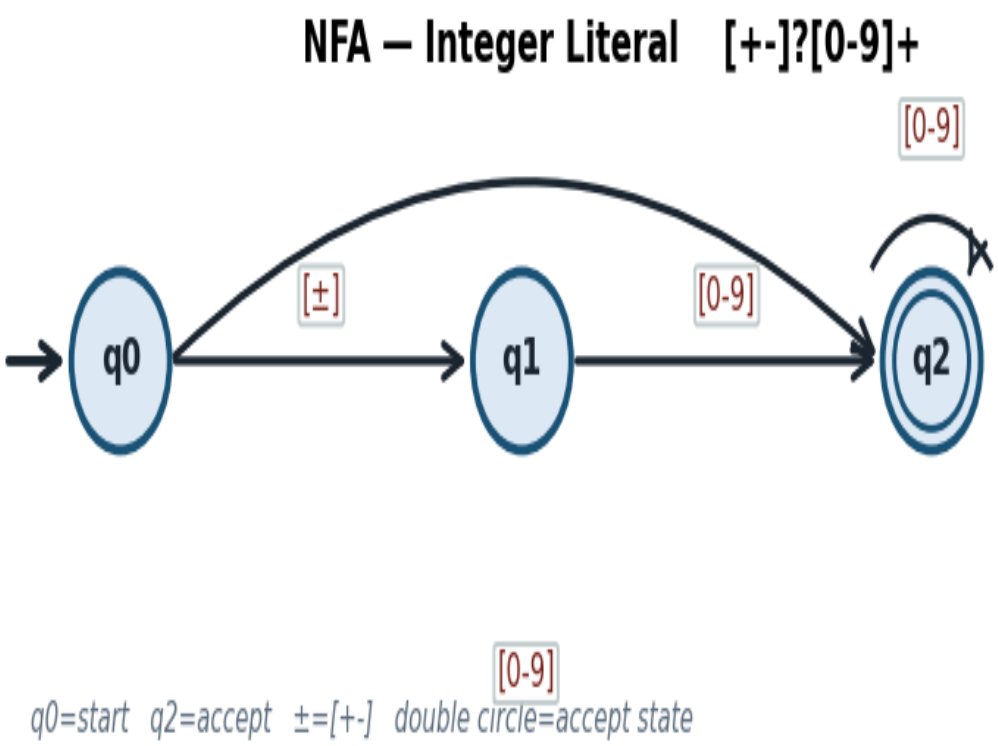
CS4031 — Compiler Construction | Assignment 01 | Spring 2026

1. Regular Expression Specifications

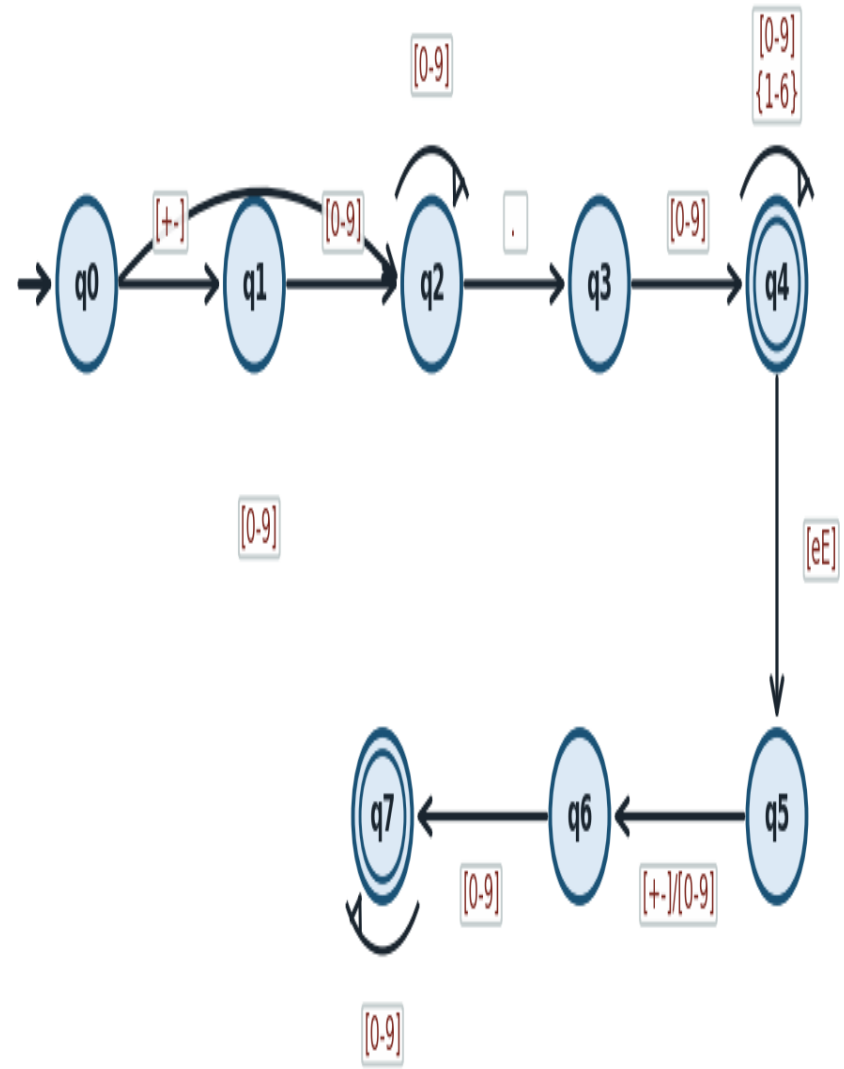
Token Type	Regular Expression
Keywords	`(start|finish|loop|condition|declare|output|input|function|return|break|continue|else)`
Identifier	`[A-Z][a-z0-9_]{0,30}`
Integer Literal	`[+-]?[0-9]+`
Float Literal	`[+-]?[0-9]+\.[0-9]{1,6}([eE][+-]?[0-9]+)?`
String Literal	`"([^"\\\n]|\\["\\ntr])*"`
Char Literal	`'([^'\\\n]|\\['\\ntr])'`
Boolean Literal	`(true|false)`
Arith. Operator	`(\*\*|[+\-*/%])`
Relational Op	`(==|!=|<=|>=|<|>)`
Logical Op	`(&&||||!)`
Assignment Op	`(\+=|-=|\*=|/=|=)`
Increment Op	`\+\+`
Decrement Op	`--`
Punctuators	`[(){}\[\],;:]`
Single Comment	`##[^\n]*`
Multi Comment	`#\*([^*]|\*+[^*#])*\*+#`
Whitespace	`[\t\r\n ]+ (skipped)`

2. NFA Diagrams

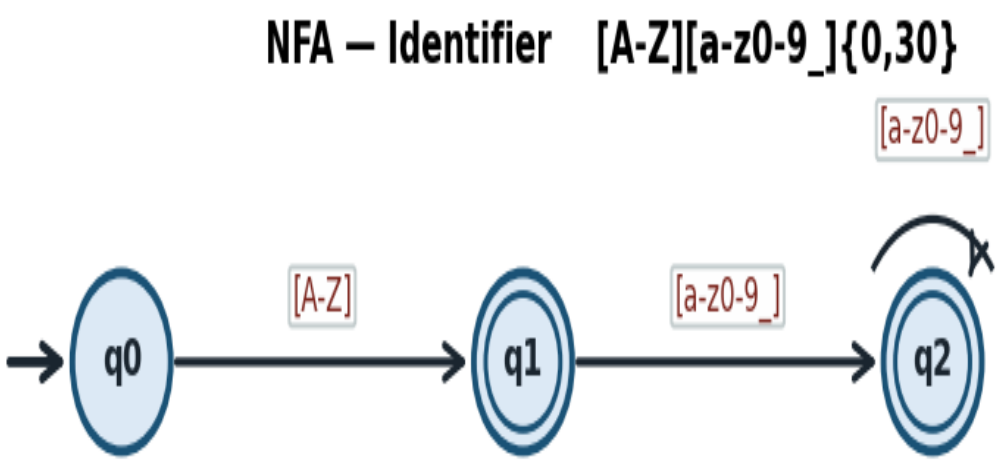
2.1 NFA — Integer Literal



2.2 NFA — Floating-Point Literal

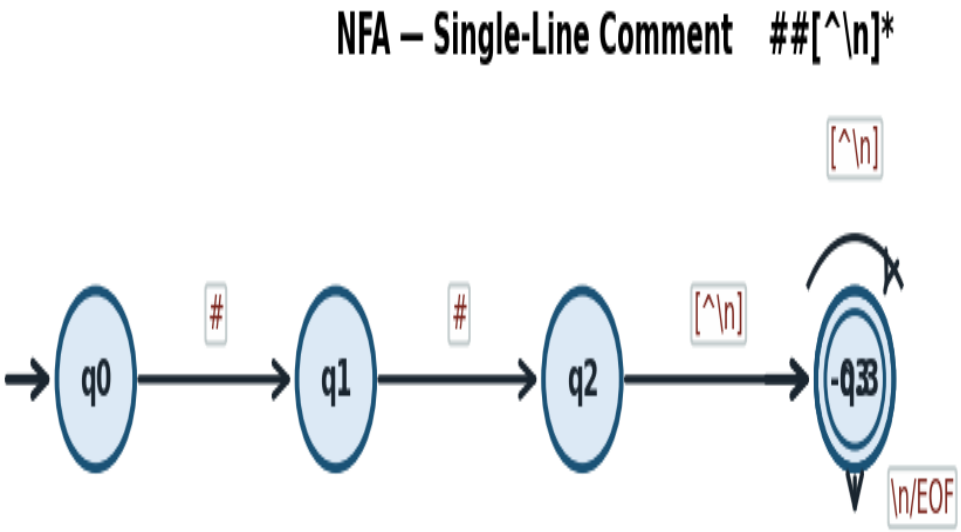


2.3 NFA — Identifier



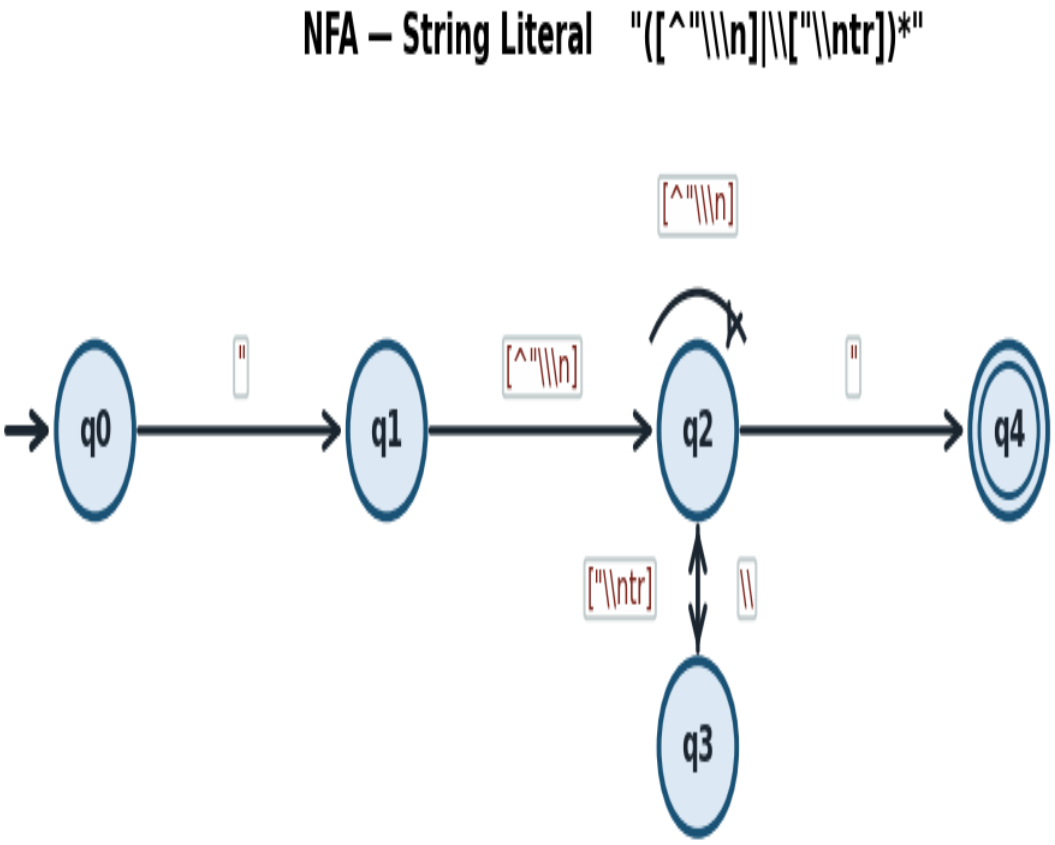
q0=start q1=accept (single uppercase valid) q2=accept (body chars, max 30 more)

2.4 NFA — Single-Line Comment

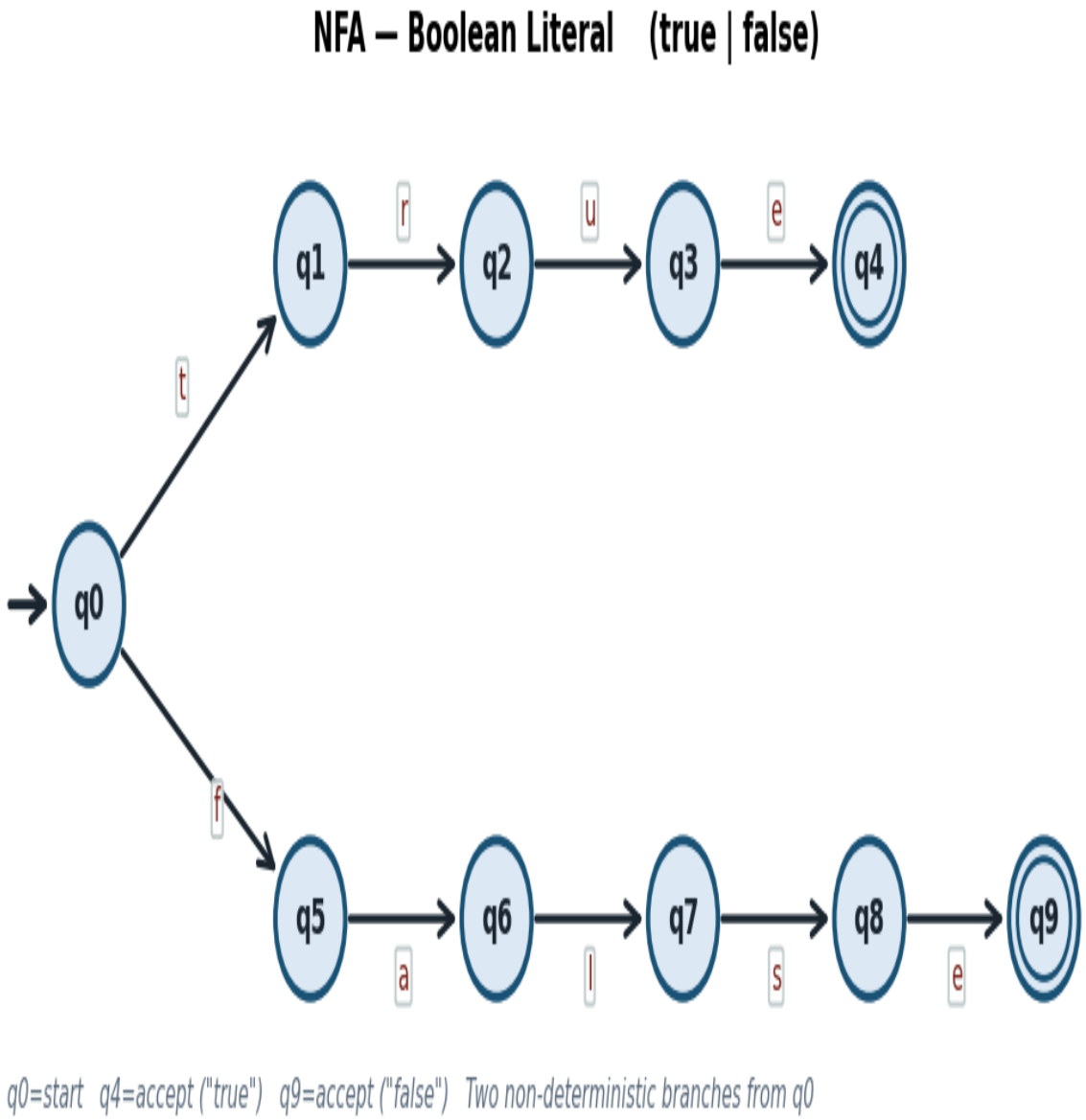


q0=start q2=after ## q3=reading body (accept via ε at end) q4=accept on \n or EOF

2.5 NFA — String Literal

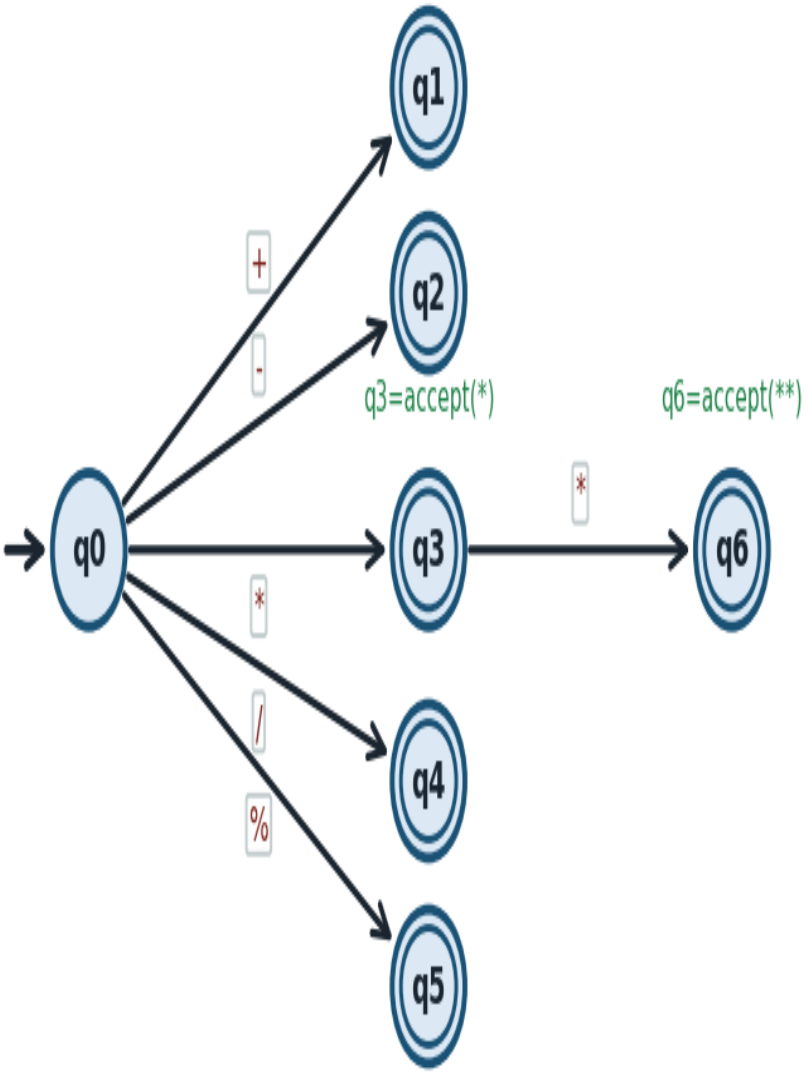


2.6 NFA — Boolean Literal



2.7 NFA — Arithmetic Operator

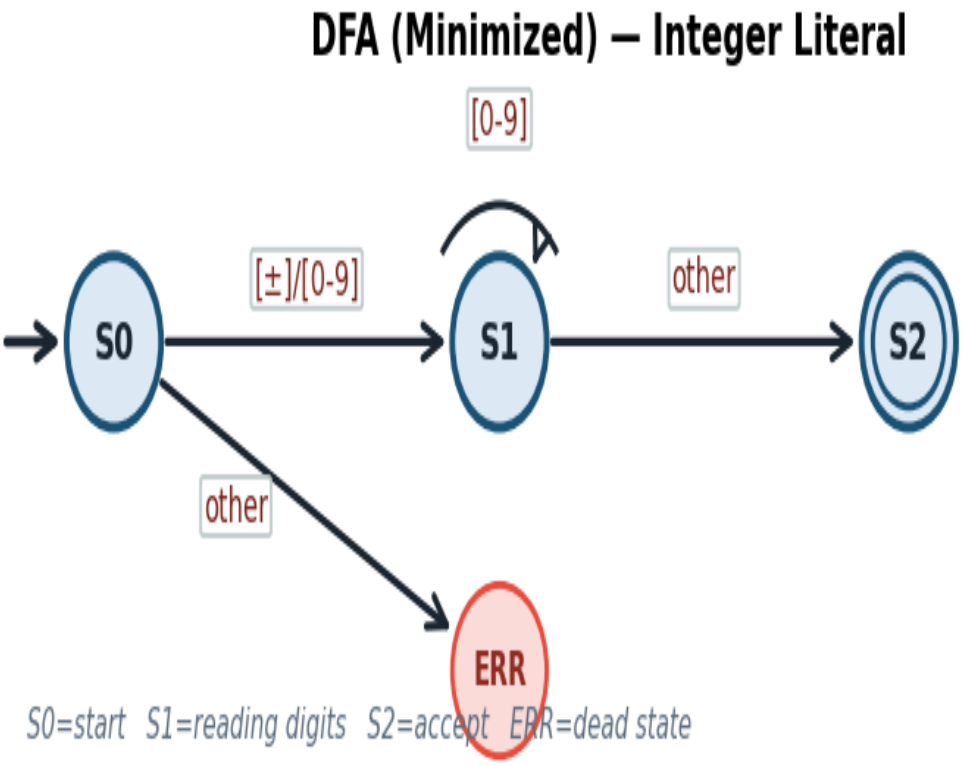
NFA — Arithmetic Operator (**|[+\-*/%])



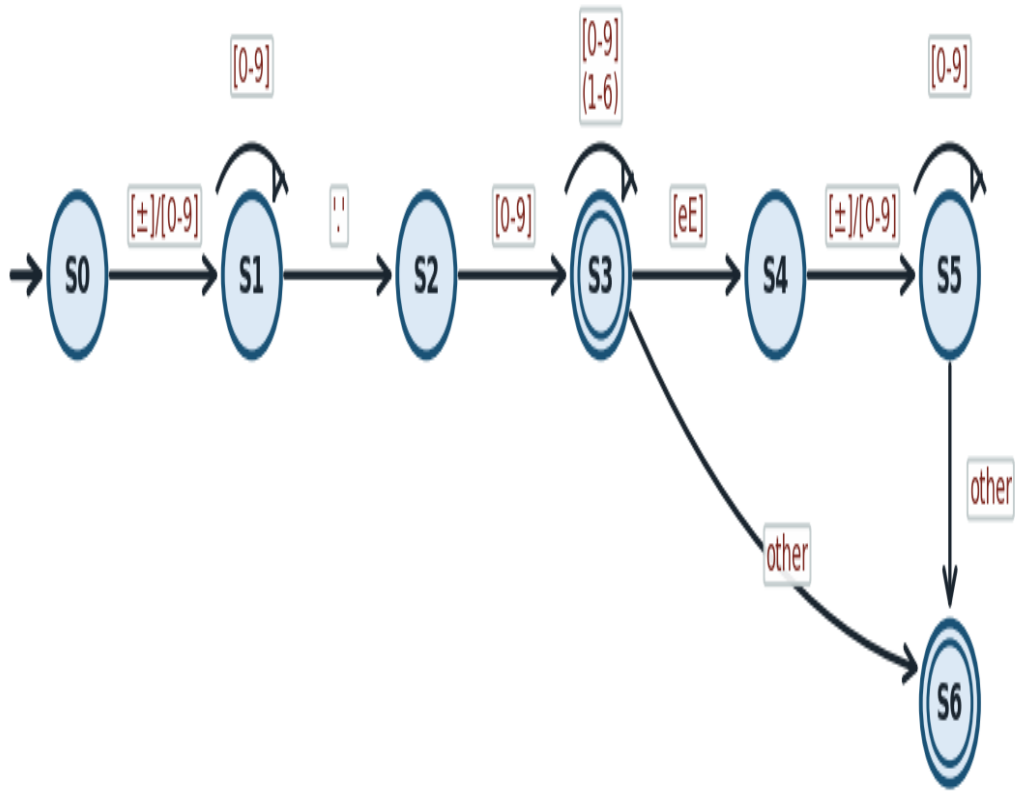
*q0=start q1=accept(+) q2=accept(-) q3=accept(*) → q6 on 2nd * q4=accept(/) q5=accept(%) q6=accept(**)*

3. DFA Diagrams — Minimized

3.1 DFA — Integer Literal

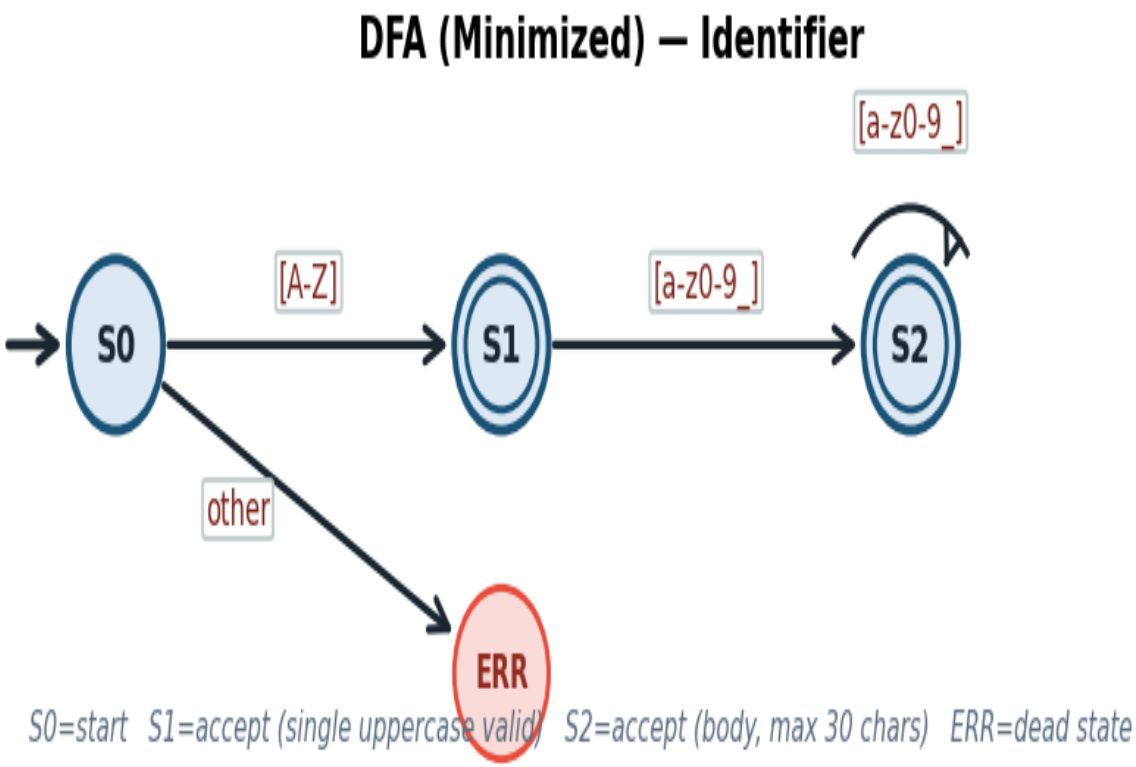


3.2 DFA — Floating-Point Literal

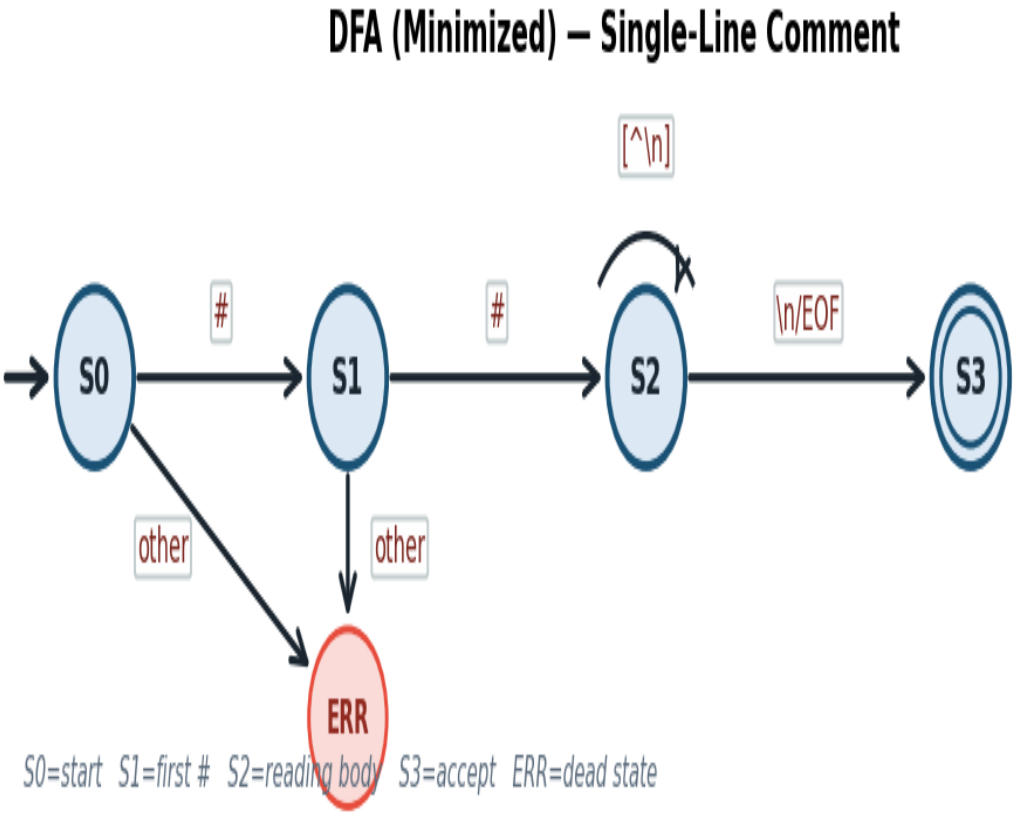


S0=start S1=integer part S2=after . S3=fraction (accept=no exp) S4=after e/E S5=exp digits S6=accept

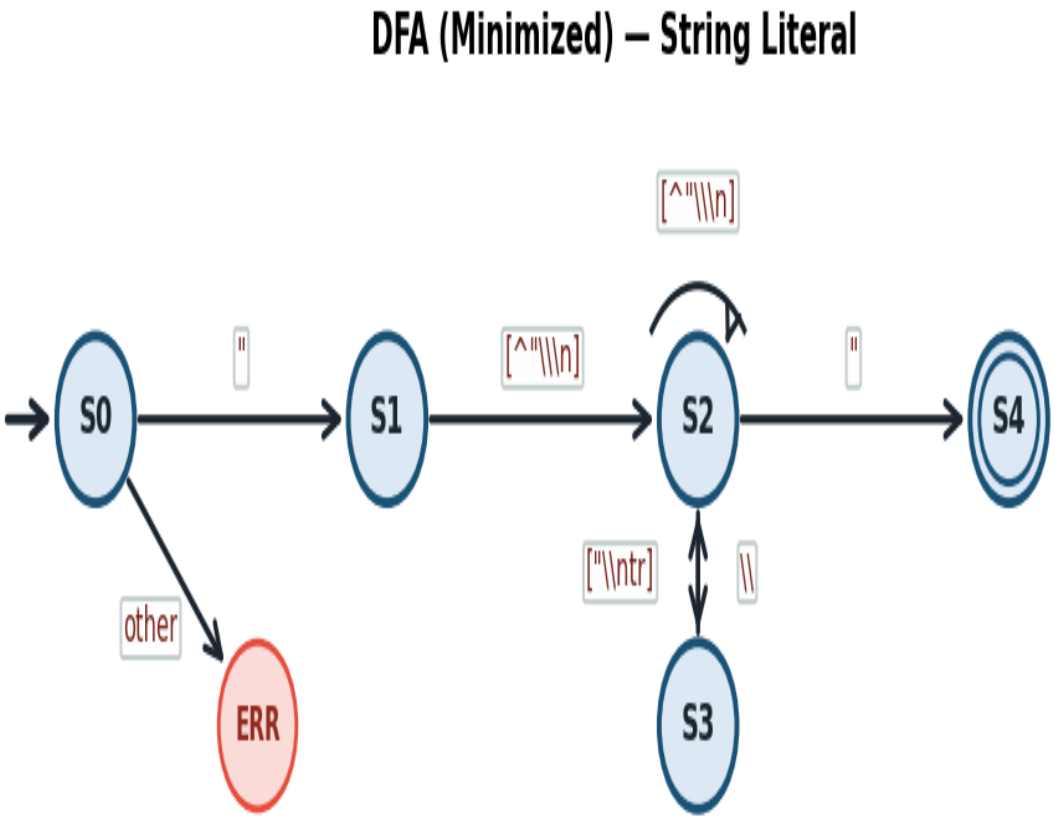
3.3 DFA — Identifier



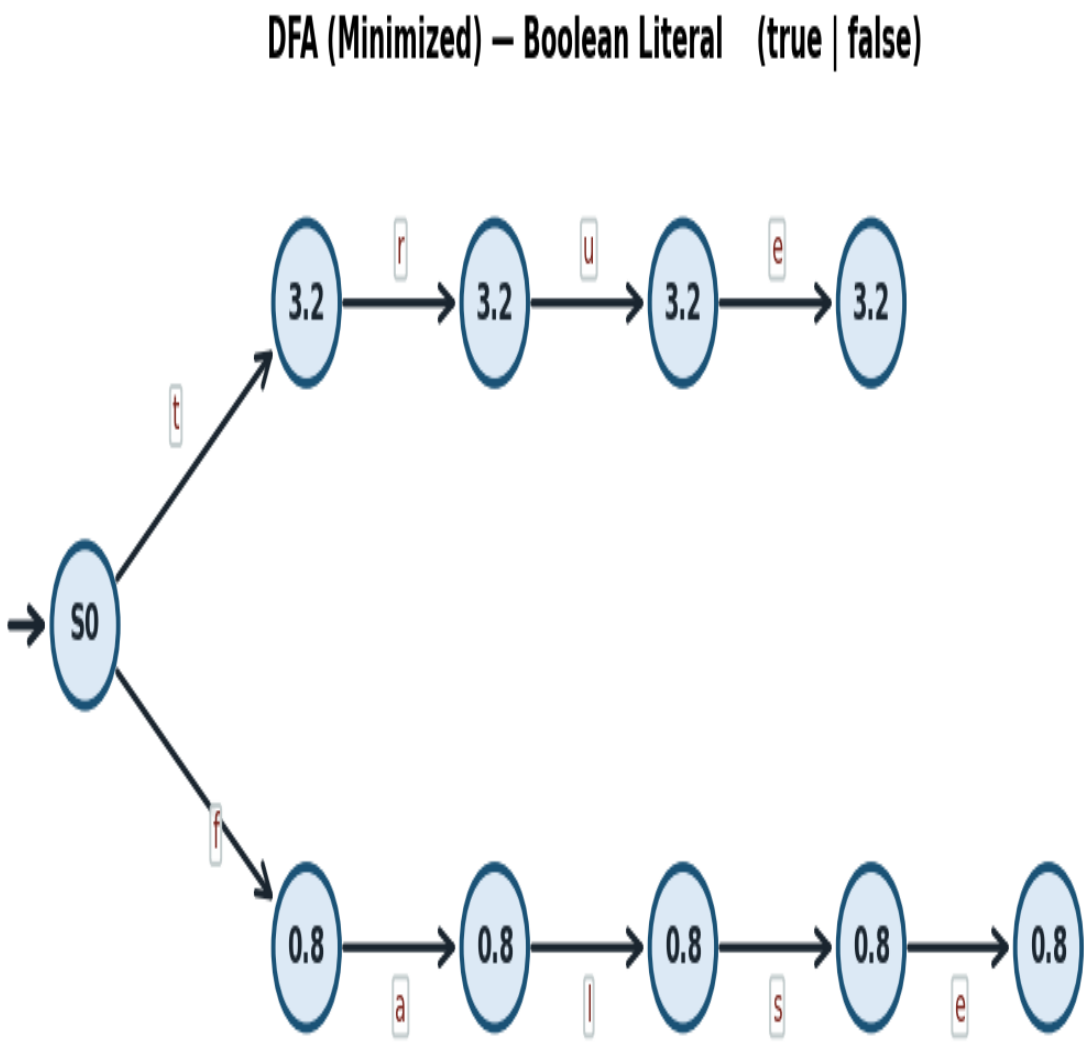
3.4 DFA — Single-Line Comment



3.5 DFA — String Literal

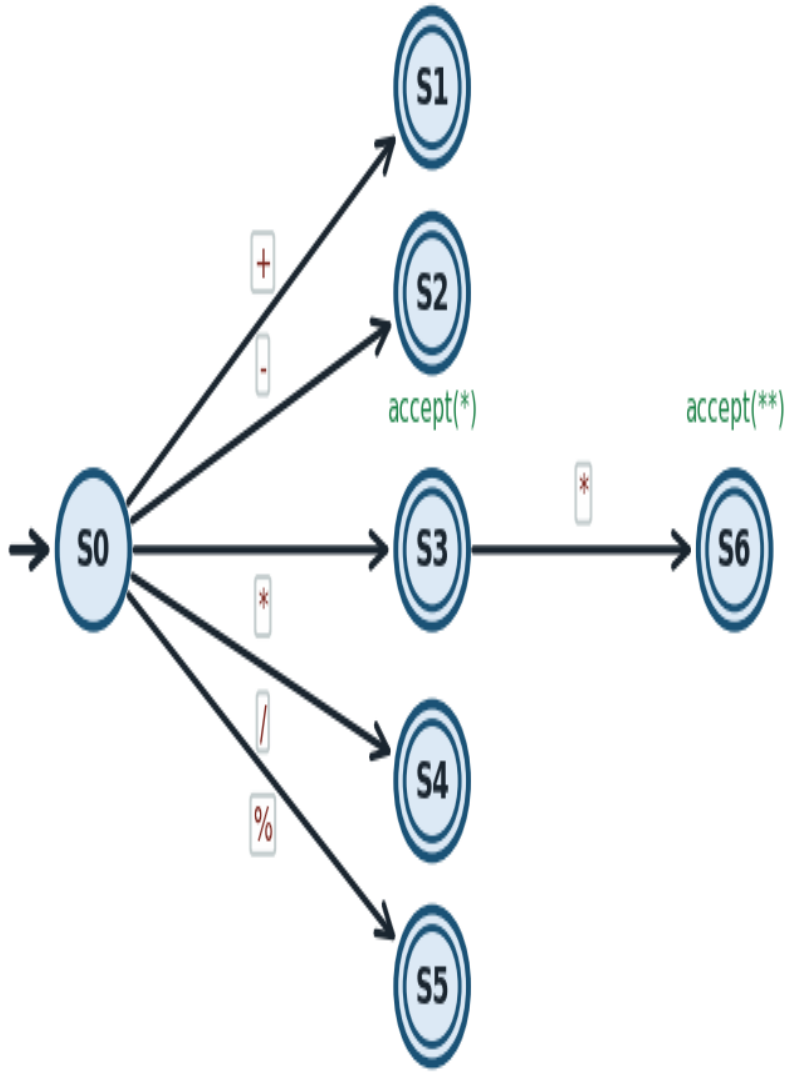


3.6 DFA — Boolean Literal



3.7 DFA — Arithmetic Operator

DFA (Minimized) — Arithmetic Operator (**|[+\-*/%])



*S0=start S1=accept(+) S2=accept(-) S3=accept(*) also →S6 on second * S4=accept(/) S5=accept(%) S6=accept(**)*

4. DFA Transition Tables

4.1 Integer Literal

State	[±]	[0-9]	other	Accept?
S0 (start)	S1	S1	ERR	—
S1	ERR	S1	S2	—
S2 (accept)	ERR	ERR	ERR	✓
ERR (dead)	ERR	ERR	ERR	—

4.2 Floating-Point Literal

State	[±]	[0-9]	[.]	[eE]	other	Accept?
S0 (start)	S1	S1	ERR	ERR	ERR	—
S1 (int part)	ERR	S1	S2	ERR	ERR	—
S2 (after .)	ERR	S3	ERR	ERR	ERR	—
S3 (frac)	ERR	S3	ERR	S4	S6	✓
S4 (after e/E)	S5	S5	ERR	ERR	ERR	—
S5 (exp)	ERR	S5	ERR	ERR	S6	—
S6 (accept)	ERR	ERR	ERR	ERR	ERR	✓

4.3 Identifier

State	[A-Z]	[a-z0-9_]	other	Accept?
S0 (start)	S1	ERR	ERR	—
S1 (1st char)	ERR	S2	ERR	✓
S2 (body)	ERR	S2	ERR	✓
ERR (dead)	ERR	ERR	ERR	—

4.4 Single-Line Comment

State	#	[^\n]	\n / EOF	other	Accept?
S0 (start)	S1	ERR	ERR	ERR	—
S1 (one #)	S2	ERR	ERR	ERR	—
S2 (body)	S2	S2	S3	ERR	—
S3 (accept)	ERR	ERR	ERR	ERR	✓

4.5 String Literal

State	"	\\	[^"\\\n]	\n	esc char	Accept?
S0 (start)	"→S1	ERR	ERR	ERR	ERR	—
S1 (opened)	S4	S3	S2	ERR	ERR	—
S2 (inside)	S4	S3	S2	ERR	ERR	—
S3 (escape \\)	S2	S2	S2	S2	S2	—
S4 (accept)	ERR	ERR	ERR	ERR	ERR	✓

4.6 Boolean Literal

State	t	r	u	e	f	a	l	s	Accept?
S0 (start)	S1	—	—	—	S5	—	—	—	—
S1	—	S2	—	—	—	—	—	—	—
S2	—	—	S3	—	—	—	—	—	—
S3	—	—	—	S4	—	—	—	—	—
S4 (accept)	—	—	—	—	—	—	—	—	✓
S5	—	—	—	—	—	S6	—	—	—
S6	—	—	—	—	—	—	S7	—	—
S7	—	—	—	—	—	—	—	S8	—
S8	—	—	—	S9	—	—	—	—	—
S9 (accept)	—	—	—	—	—	—	—	—	✓

4.7 Arithmetic Operator

State	+	-	*	/	%	Accept?
S0 (start)	S1	S2	S3	S4	S5	—
S1 (+)	ERR	ERR	ERR	ERR	ERR	✓
S2 (-)	ERR	ERR	ERR	ERR	ERR	✓
S3 (*)	ERR	ERR	S6	ERR	ERR	✓
S4 (/)	ERR	ERR	ERR	ERR	ERR	✓
S5 (%)	ERR	ERR	ERR	ERR	ERR	✓
S6 (**)	ERR	ERR	ERR	ERR	ERR	✓