



40-414 Compiler Design

Top-Down Parsing

Lecture 5

Exercise

Question?

Choose the next parse state given the grammar, parse table, and current state below. The initial string is:

if true then { true } else { if false then { false } } \$

	if	then	else	{	}	true	false	\$
E	if Bthen { E }E'				ϵ	B	B	ϵ
E'			else { E }		ϵ			ϵ
B						true	false	

- | | Stack | Input |
|-----------------------|-------------------------------|-------------------------------------|
| Current | E'\$ | else { if false then { false } } \$ |
| <input type="radio"/> | \$ | \$ |
| <input type="radio"/> | else { E } \$ | else { if false then { false } } \$ |
| <input type="radio"/> | E} \$ | if false then { false } } \$ |
| <input type="radio"/> | else { if Bthen { E } E' } \$ | else { if false then { false } } \$ |

$E \rightarrow \text{if B then } \{ E \} E' \mid B \mid \epsilon$
 $E' \rightarrow \text{else } \{ E \} \mid \epsilon$
 $B \rightarrow \text{true} \mid \text{false}$

Answer!

Choose the next parse state given the grammar, parse table, and current state below. The initial string is:

if true then { true } else { if false then { false } } \$

	if	then	else	{	}	true	false	\$
E	if Bthen { E }E'				ϵ	B	B	ϵ
E'			else { E }		ϵ			ϵ
B						true	false	

- | | Stack | Input |
|-----------------------|-------------------------------|-------------------------------------|
| Current | E'\$ | else { if false then { false } } \$ |
| <input type="radio"/> | \$ | \$ |
| <input type="radio"/> | else { E } \$ | else { if false then { false } } \$ |
| <input type="radio"/> | E} \$ | if false then { false } } \$ |
| <input type="radio"/> | else { if Bthen { E } E' } \$ | else { if false then { false } } \$ |

$E \rightarrow \text{if B then } \{ E \} E' \mid B \mid \epsilon$
 $E' \rightarrow \text{else } \{ E \} \mid \epsilon$
 $B \rightarrow \text{true} \mid \text{false}$

Question?

For the given grammar, find the First and Follow of Non-terminals and the Parse table

$S \rightarrow i E \dagger S S' \mid a$	First(S) =	Follow(S) =
$S' \rightarrow e S \mid \epsilon$	First(S') =	Follow(S') =
$E \rightarrow b$	First(E) =	Follow(E) =

	a	b	e	i	†	\$
S						
S'						
E						

Answer!

For the given grammar, find the First and Follow of Non-terminals and the Parse table

$S \rightarrow i E t S S' \mid a$	$\text{First}(S) = \{ i, a \}$	$\text{Follow}(S) = \{ e, \$ \}$
$S' \rightarrow e S \mid \epsilon$	$\text{First}(S') = \{ e, \epsilon \}$	$\text{Follow}(S') = \{ e, \$ \}$
$E \rightarrow b$	$\text{First}(E) = \{ b \}$	$\text{Follow}(E) = \{ t \}$

	a	b	e	i	t	\$
S	a			$i E t S S'$		
S'			$e S, \epsilon$			ϵ
E		b				

Question?

For the given grammar,
find the First and Follow
of Non-terminals and
the Parse table

$E \rightarrow T E'$
 $E' \rightarrow + T E' \mid \epsilon$
 $T \rightarrow F T'$
 $T' \rightarrow * F T' \mid \epsilon$
 $F \rightarrow (E) \mid id$

First(E,T,F) =

First(E') =

First(T') =

Follow(E) =

Follow(T) =

Follow(F) =

Follow(E') =

Follow(T') =

	id	+	*	()	\$
E						
E'						
T						
T'						
F						

Answer!

For the given grammar,
find the First and Follow
of Non-terminals and
the Parse table

$E \rightarrow T E'$
 $E' \rightarrow + T E' \mid \epsilon$
 $T \rightarrow F T'$
 $T' \rightarrow * F T' \mid \epsilon$
 $F \rightarrow (E) \mid id$

$First(E, T, F) = \{ id, (\}$

$First(E') = \{ +, \epsilon \}$

$First(T') = \{ *, \epsilon \}$

$Follow(E) = \{ \$,) \}$ $Follow(E') = \{ \$,) \}$

$Follow(T) = \{ + , \$,) \}$ $Follow(T') = \{ + , \$,) \}$

$Follow(F) = \{ * , + , \$,) \}$

	id	+	*	()	\$
E	$T E'$			$T E'$		
E'		$+ T E'$			ϵ	ϵ
T	$F T'$			$F T'$		
T'		ϵ	$* F T'$		ϵ	ϵ
F	id			(E)		

Question?

- Consider the grammar

$$E \rightarrow TX$$

$$T \rightarrow (E) \mid \text{int } Y$$

$$X \rightarrow + E \mid \varepsilon$$

$$Y \rightarrow * T \mid \varepsilon$$

- Convert the given grammar to a transition diagram
- Simplify the Diagram (if it is possible)
- Write a step-by-step parsing of input 'int * int'
- Draw the parse tree of the input

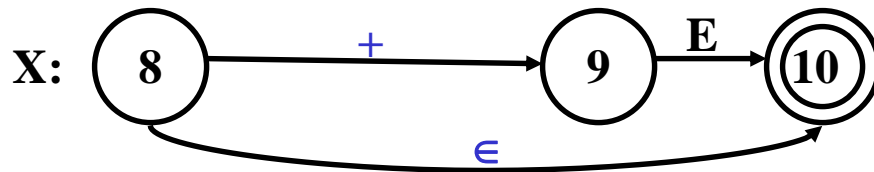
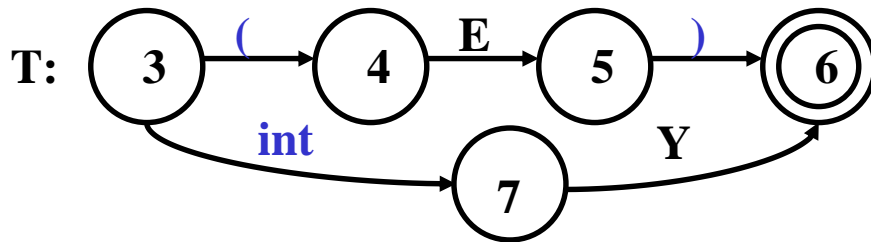
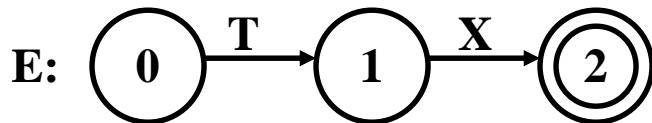
Answer!

$E \rightarrow TX$

$T \rightarrow (E) \mid \text{int } Y$

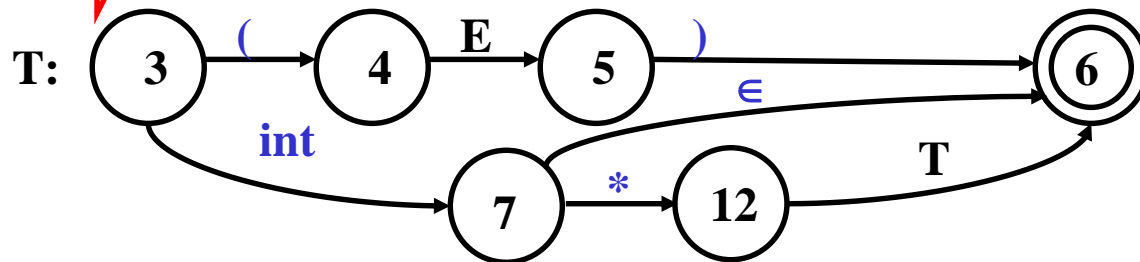
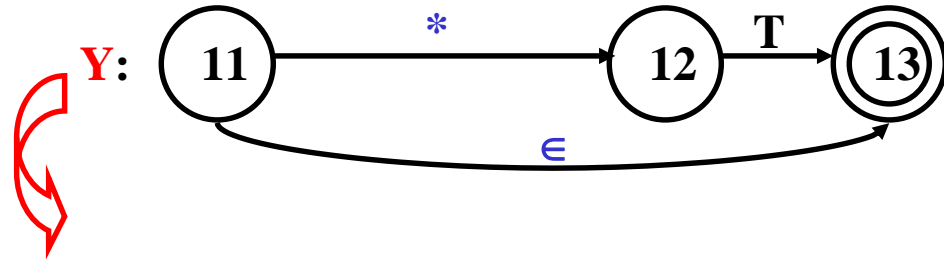
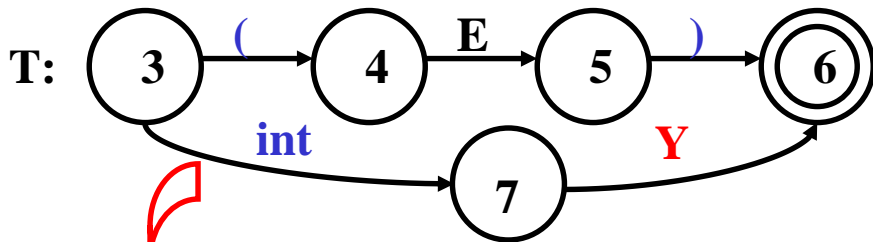
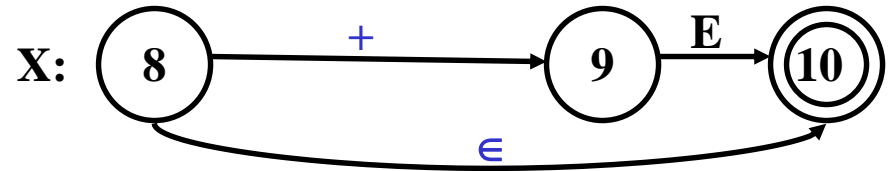
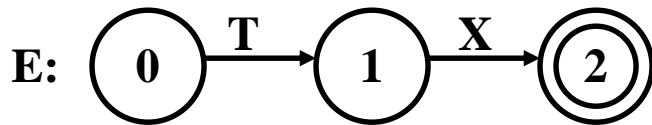
$X \rightarrow + E \mid \epsilon$

$Y \rightarrow * T \mid \epsilon$



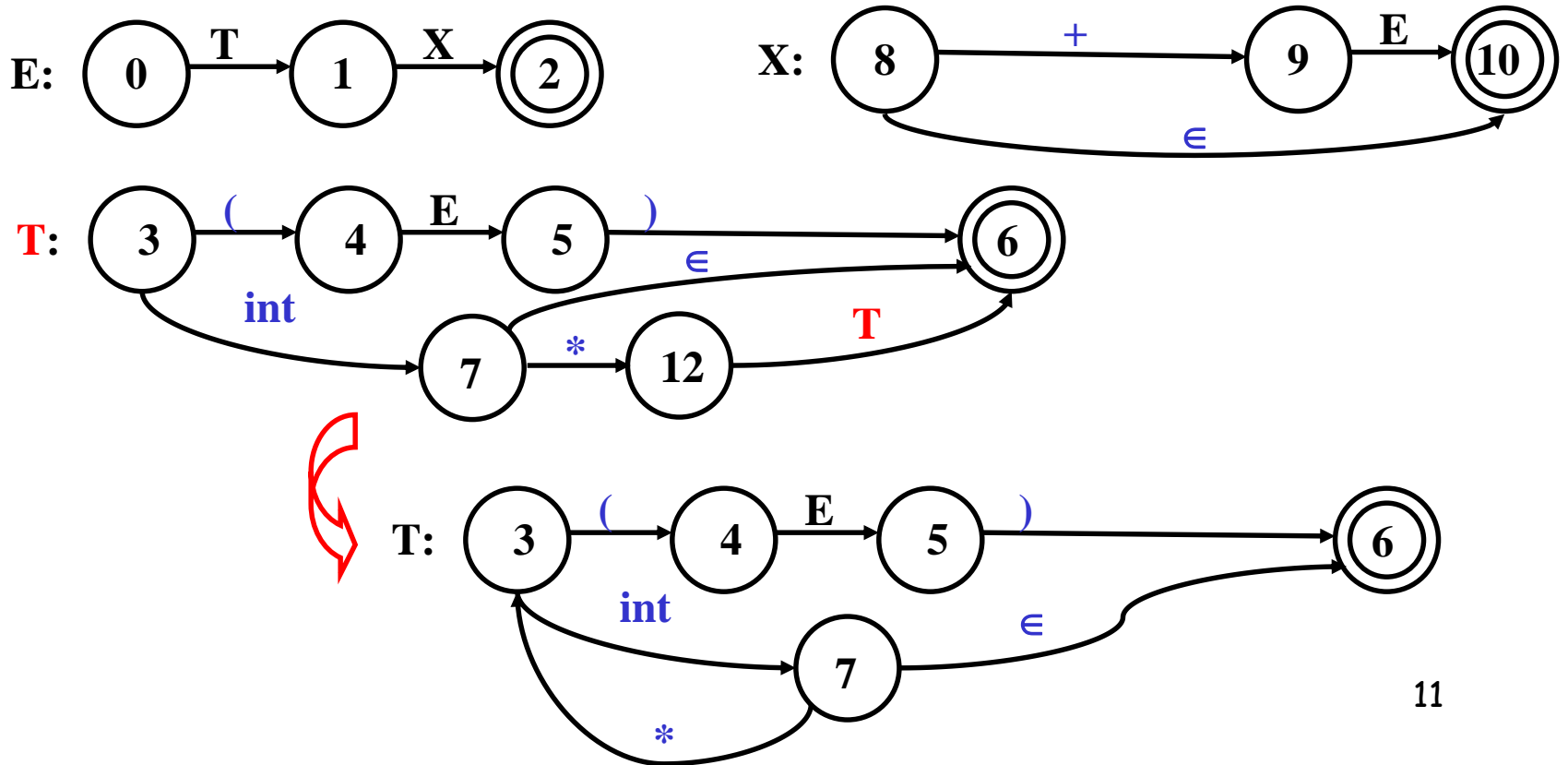
Answer! (Cont.)

$E \rightarrow TX$	$X \rightarrow + E \mid \epsilon$
$T \rightarrow (E) \mid \text{int } Y$	$Y \rightarrow * T \mid \epsilon$



Answer! (Cont.)

$E \rightarrow TX$	$X \rightarrow + E \mid \epsilon$
$T \rightarrow (E) \mid \text{int } Y$	$Y \rightarrow * T \mid \epsilon$



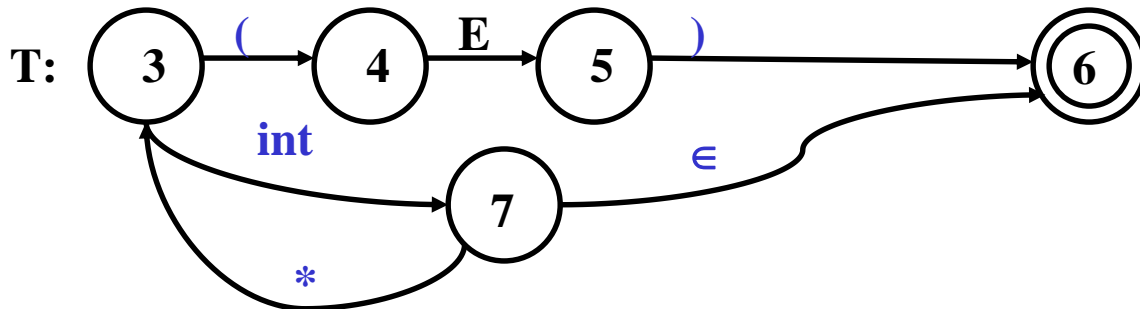
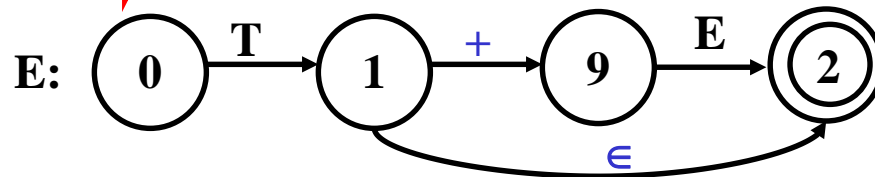
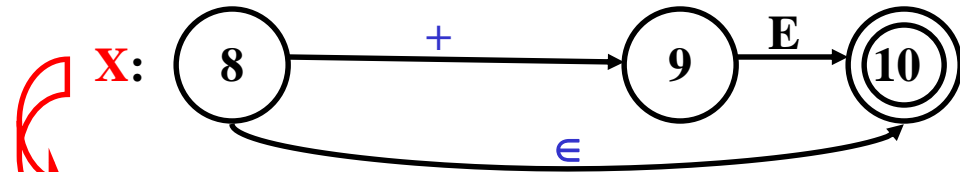
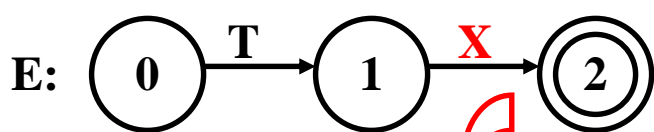
Answer! (Cont.)

$E \rightarrow TX$

$T \rightarrow (E) \mid \text{int } Y$

$X \rightarrow + E \mid \epsilon$

$Y \rightarrow * T \mid \epsilon$



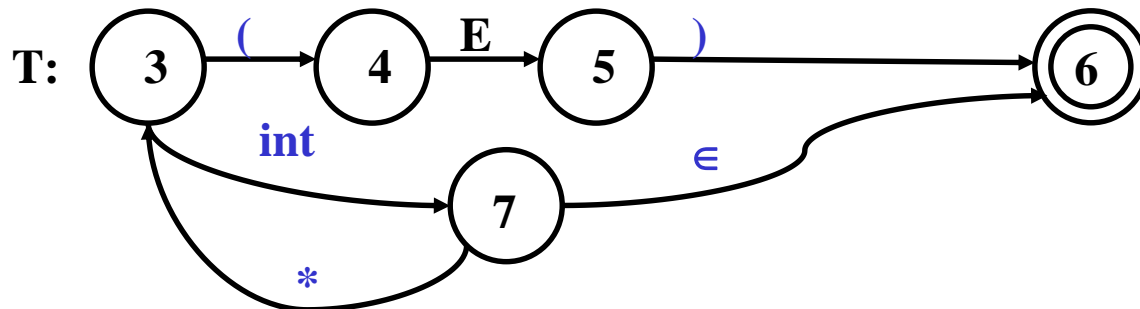
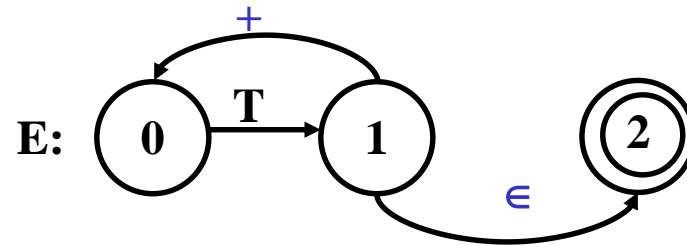
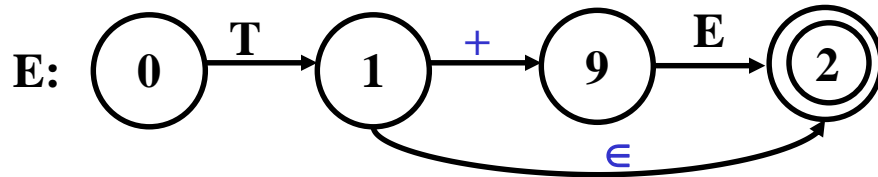
Answer! (Cont.)

$E \rightarrow TX$

$T \rightarrow (E) \mid \text{int } Y$

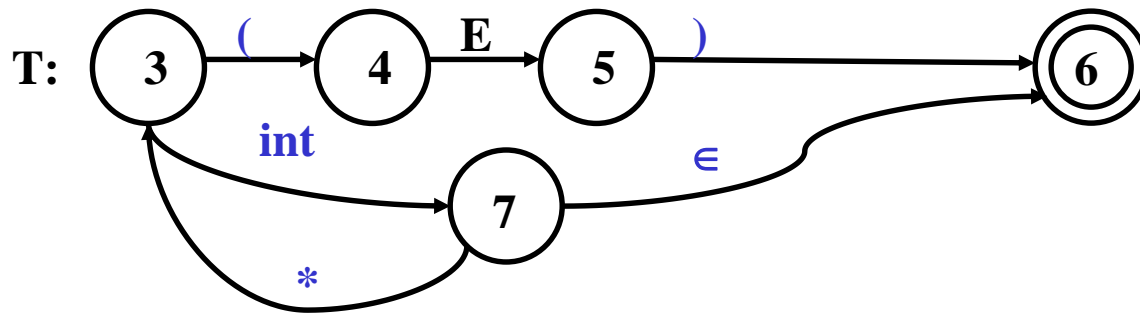
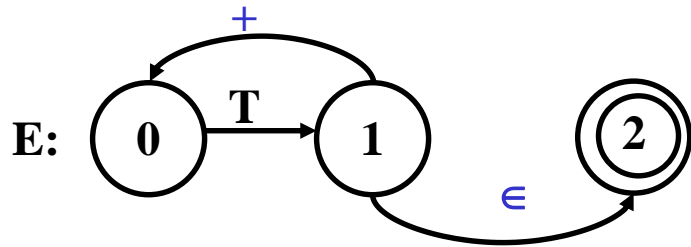
$X \rightarrow + E \mid \epsilon$

$Y \rightarrow * T \mid \epsilon$



Answer! (Cont.)

$E \rightarrow T + E \mid T$
 $T \rightarrow (E) \mid \text{int} * T \mid \text{int}$



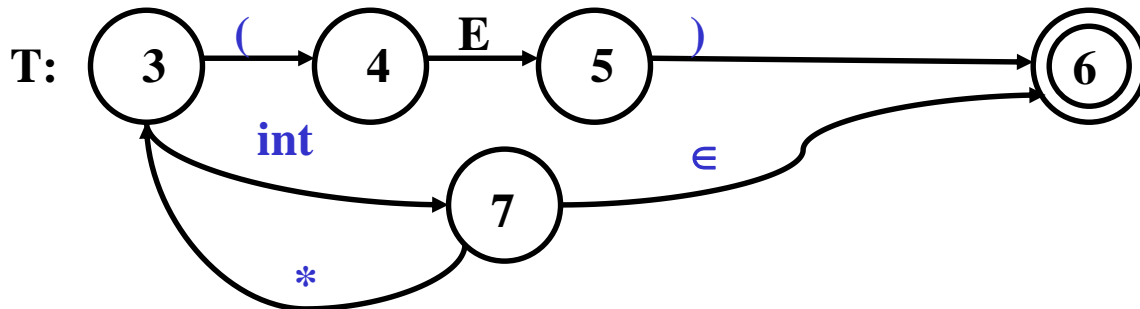
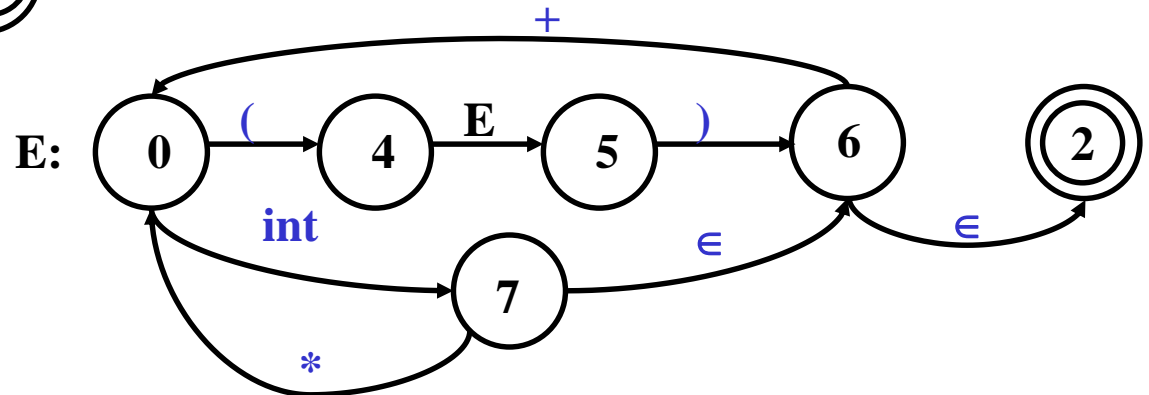
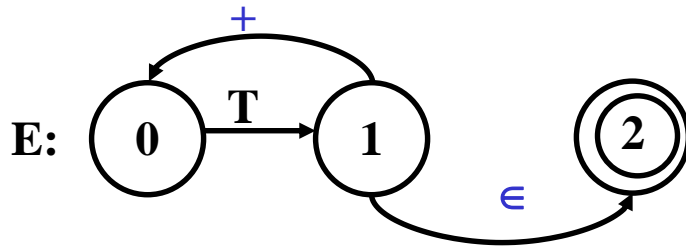
Answer! (Cont.)

$E \rightarrow TX$

$T \rightarrow (E) \mid \text{int } Y$

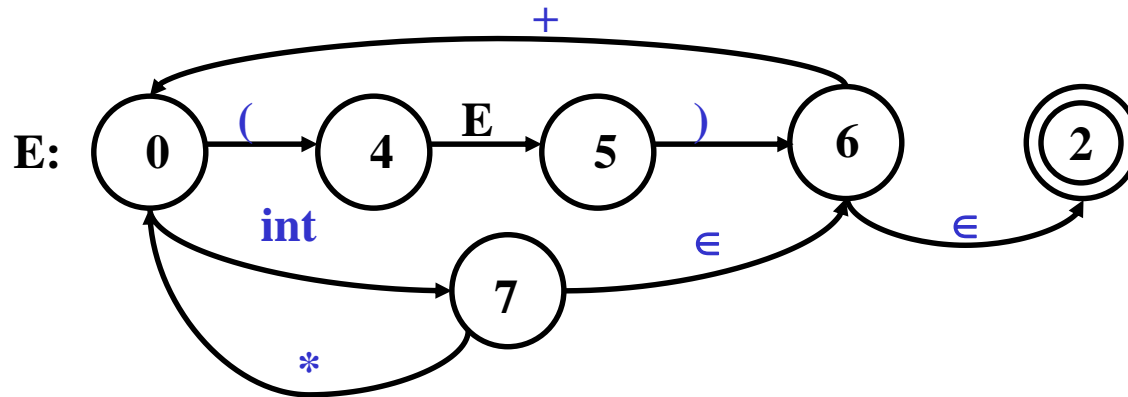
$X \rightarrow + E \mid \epsilon$

$Y \rightarrow * T \mid \epsilon$

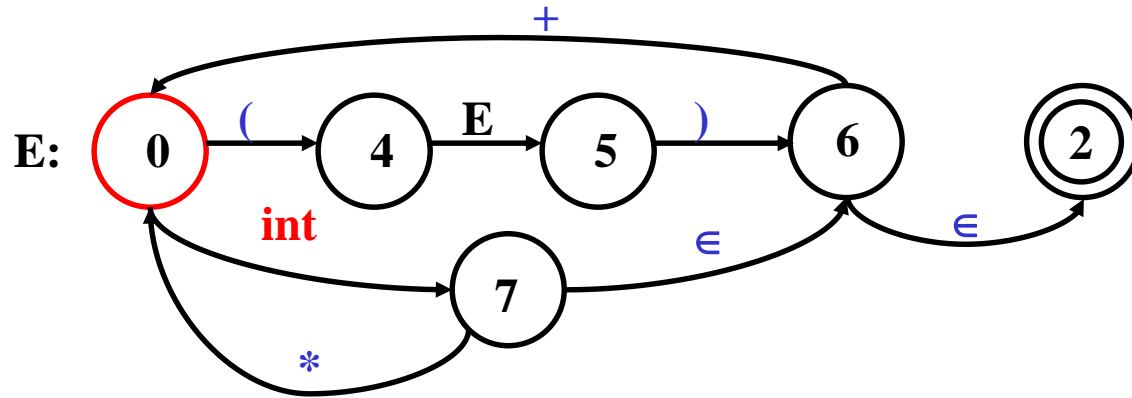


Answer! (Cont.)

$E \rightarrow (E) \mid (E) + E \mid \text{int} * E \mid \text{int} + E \mid \text{int}$



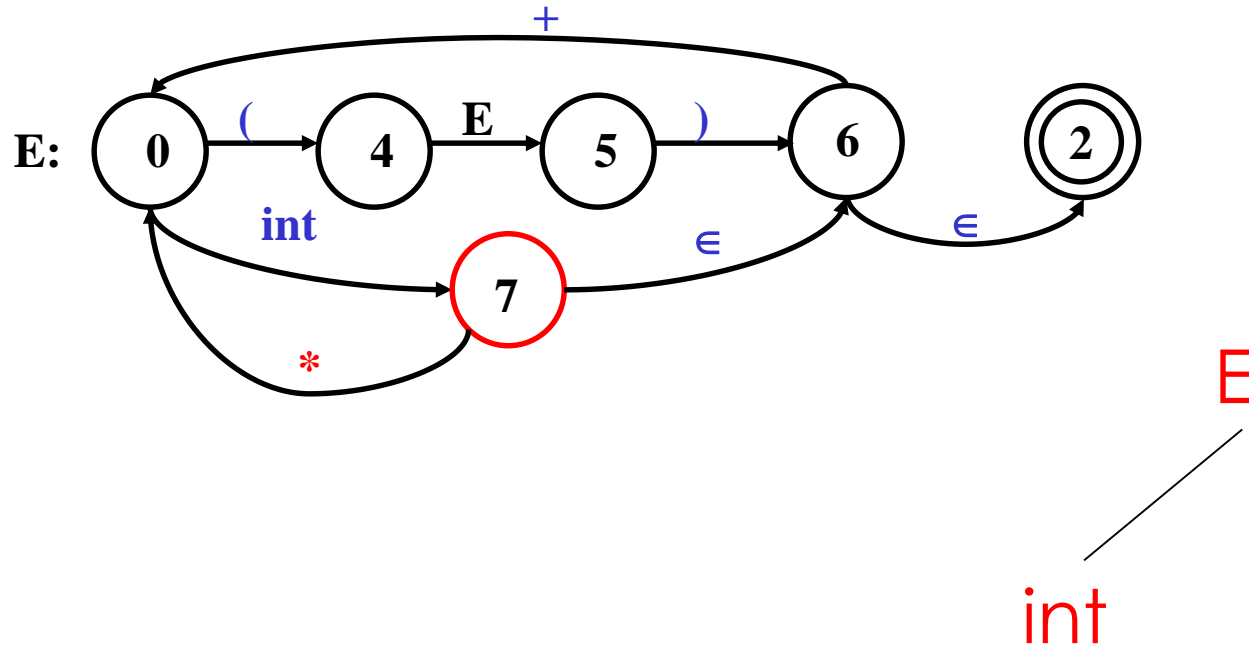
Answer! (Cont.)



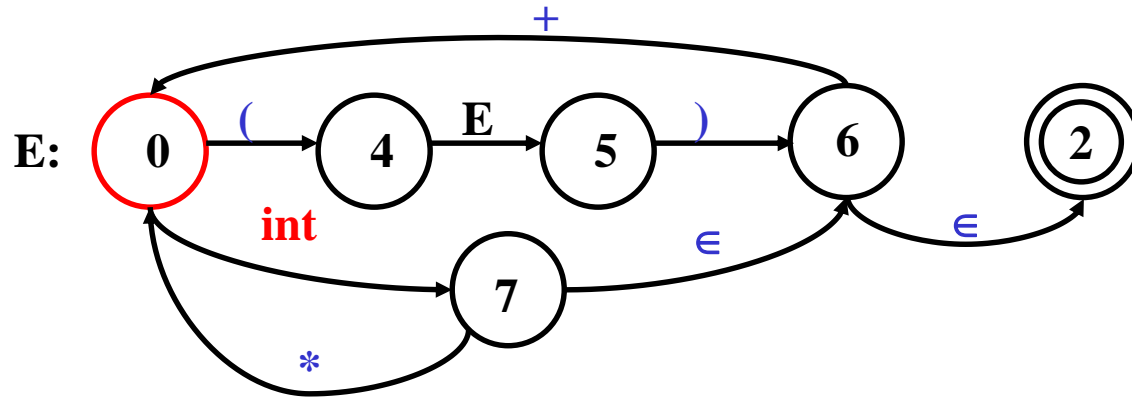
Input:
int * int \$

E

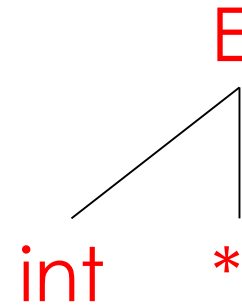
Answer! (Cont.)



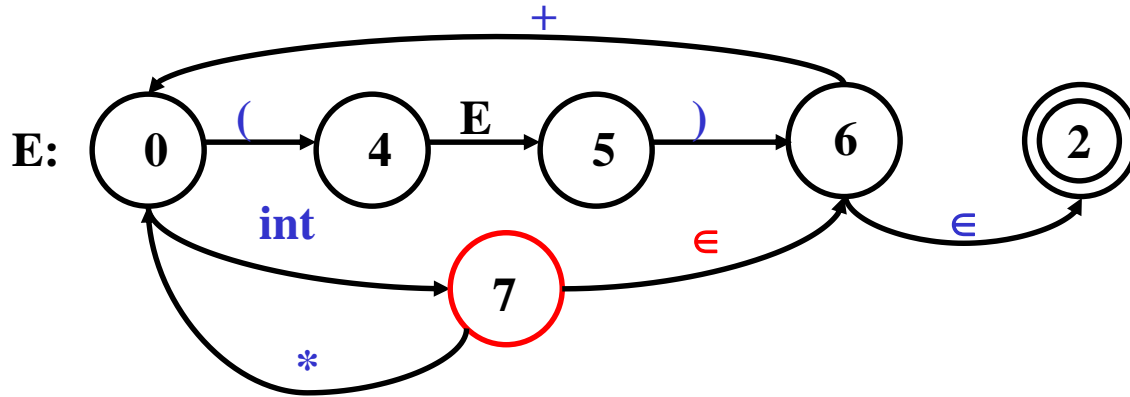
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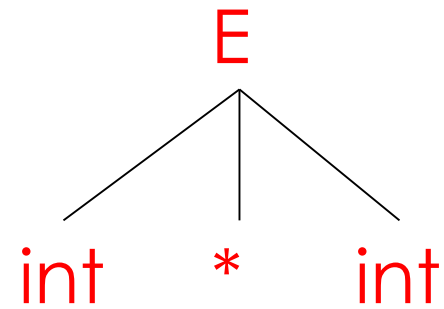
Input:
int \$



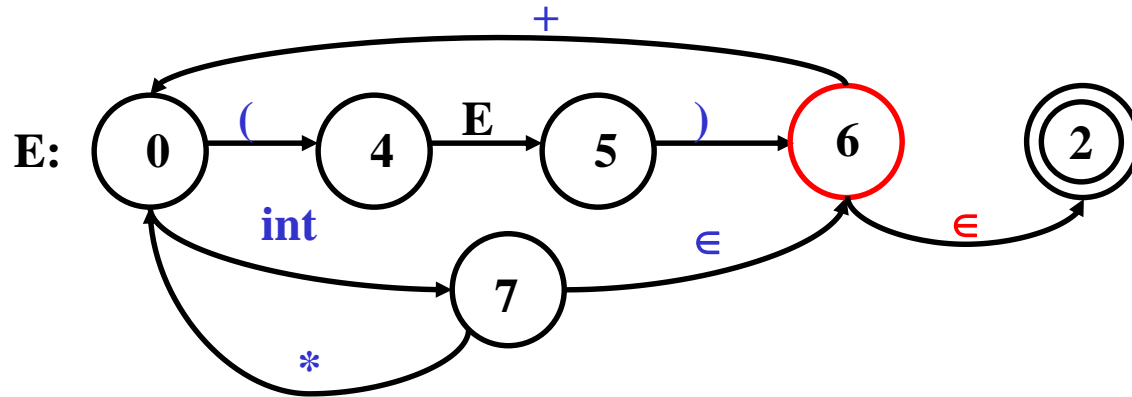
Answer! (Cont.)



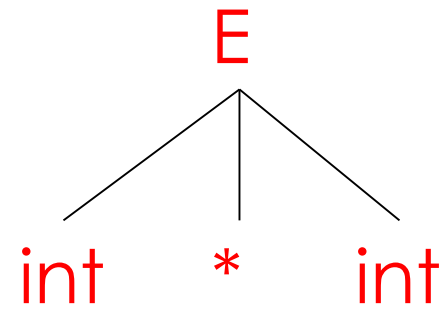
Input:
\$



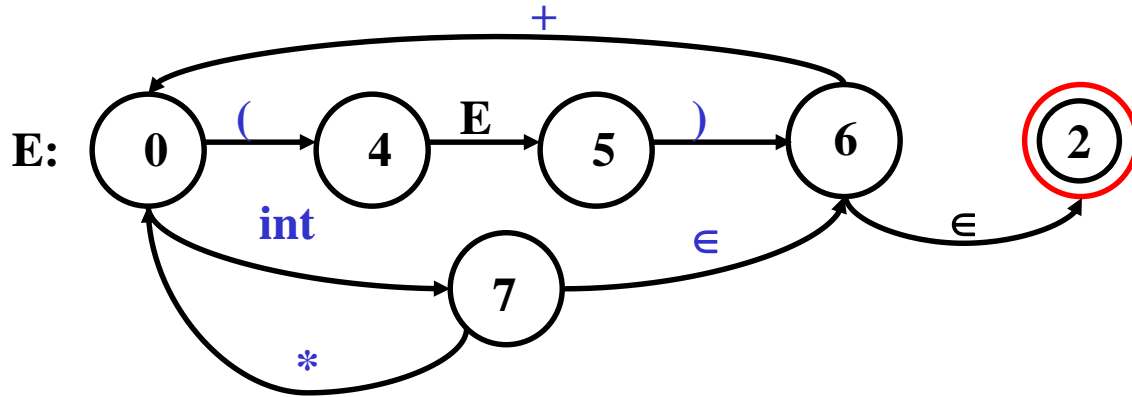
Answer! (Cont.)



Input:
\$



Answer! (Cont.)



Input:
\$

