

1. Problem 2.18(a)


$\text{First}(E_s) = \{ \text{atom}, ', (, \varepsilon \}$ // based on rule $E_s \rightarrow E E_s$, add $\text{first}(E)$
// $E_s \rightarrow \varepsilon$, textbook does not include ε in first sets


$\text{Follow}(E) = \{ \$ \$, \text{atom}, ', (,) \}$ // $P \rightarrow E \$ \$$
// $E \rightarrow ' E$ add $\text{follow}(E)$, not change
// $E \rightarrow (E E_s$ add $\text{first}(E_s)$
// $E_s \rightarrow E E_s$ add $\text{first}(E_s)$ and $\text{follow}(E_s)$, no change.


$\text{Predict}(E_s \rightarrow \varepsilon) = (\text{first}(\varepsilon) - \varepsilon) \cup \text{follow}(E_s) = \{) \}$
where $\text{follow}(E_s) = \{) \}$ // $E \rightarrow (E E_s$
// $E_s \rightarrow E E_s$, not change

2. First , add $S'' \rightarrow S$

Follow symbol order S, A.

$S \rightarrow Sab$		$S \rightarrow AcS'$
$\quad Ac$		$S' \rightarrow abS'$
	Remove left recursion	$\quad \epsilon$

$A \rightarrow Ade$		$A \rightarrow Ade$
$\quad fgA$		$\quad fgA$
$\quad hi$	Replace S	$\quad hi$
$\quad Sjk$		$\quad AcS'jk$

		$A \rightarrow fgAA'$
	Remove left recursion	$\quad hiA'$
		$A' \rightarrow deA'$
		$\quad cS'jkA'$
		$\quad \epsilon$

3. First , add $S' \rightarrow B$

Follow symbol order B, T, C. The predict sets are calculated based on the first and follow sets. Note that there is no conflict for predict sets.

$B \rightarrow B \text{ or } T$
| T

Remove left recursion

$B \rightarrow T B'$
 $B' \rightarrow \text{or } T B'$
| ϵ

predict={not, (, true, false}
predict={or}
predict={\$,)}

$T \rightarrow T \text{ and } C$
| C

Remove left recursion

$T \rightarrow C T'$
 $T' \rightarrow \text{and } C T'$
| ϵ

predict={not, (, true, false}
predict={and}
predict={\$,), or}

$C \rightarrow \text{not } C$
| (B)
| true
| false

predict={not}
predict={{}
predict={true}
predict={false}

	First	Follow
S'	{not, (, true, false}	{\$}
B	{not, (, true, false}	{\$,)}
B'	{or, ϵ }	{\$,)}
T	{not, (, true, false}	{\$,), or}
T'	{and, ϵ }	{\$,), or}
C	{not, (, true, false}	{\$,), or, and}

4.

```
S()
{
  if (match('+') || match('-'))
  {
    if (S())
      return T();
    else return Error;
  } else if (match('a'))
    return Ok;
  else
    return Error;
}
```

```
T()
{
  if (match('V') || match('^'))
    return S();
  else if (match('b'))
    return Ok;
  else
    return Error;
}
```