

### The Original Grammar:

$\text{exp} \rightarrow \text{exp} \mid \mid \text{term} \mid \text{term}$

$\text{term} \rightarrow \text{term} \&\& \text{factor} \mid \text{factor}$

$\text{factor} \rightarrow \text{factor} \text{comop} \text{operand} \mid \text{operand}$

$\text{comop} \rightarrow > \mid = \mid <$

$\text{operand} \rightarrow ! \text{operand} \mid \text{Identifier}$

**-We notice that there is left recursion needs to be solved in the following:**

$\text{exp} \rightarrow \text{exp} \mid \mid \text{term} \mid \text{term}$

$\text{term} \rightarrow \text{term} \&\& \text{factor} \mid \text{factor}$

$\text{factor} \rightarrow \text{factor} \text{comop} \text{operand} \mid \text{operand}$

**Like applying the rule to:  $A \rightarrow \alpha A \mid \beta$**

Solution:

$A \rightarrow \beta \mid A'$

$A' \rightarrow \alpha A' \mid \epsilon$

**Then:**

$\text{exp} \rightarrow \text{term exp'}$

$\text{exp'} \rightarrow | | \text{term exp'} | \epsilon$

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$\text{term} \rightarrow \text{factor term'}$

$\text{term'} \rightarrow \&\& \text{factor term'} | \epsilon$

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$\text{factor} \rightarrow \text{operand factor'}$

$\text{factor'} \rightarrow \text{comp operand factor'} | \epsilon$

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$\text{comp} \rightarrow > | = | <$

$\text{operand} \rightarrow ! \text{operand} | \text{ID}$

Production	First	Follow
$\text{exp} \rightarrow \text{term exp'}$	$\{!, \text{ID}\}$	$\{\$ \}$
$\text{exp'} \rightarrow    \text{term exp'} \mid \epsilon$	$\{  , \epsilon\}$	$\{\$ \}$
$\text{term} \rightarrow \text{factor term'}$	$\{!, \text{ID}\}$	$\{  , \$ \}$
$\text{term'} \rightarrow \&\& \text{factor term'} \mid \epsilon$	$\{\&\&, \epsilon\}$	$\{  , \$ \}$
$\text{factor} \rightarrow \text{operand factor'}$	$\{!, \text{ID}\}$	$\{\&\&,   , \$ \}$
$\text{factor'} \rightarrow \text{comp operand factor'} \mid \epsilon$	$\{>, =, <, \epsilon\}$	$\{\&\&,   , \$ \}$
$\text{comp} \rightarrow > \mid = \mid <$	$\{>, =, <\}$	$\{!, \text{ID}\}$
$\text{operand} \rightarrow ! \text{operand} \mid \text{ID}$	$\{!, \text{ID}\}$	$\{>, =, <, \&\&,   , \$ \}$

Non Terminal	Input Symbols							
	!	ID		&&	>	<	=	\$
exp	exp → term exp'	exp → term exp'						
exp'			exp' →    term exp'					exp' → ε
term	term → factor term'	term → factor term'						
term'			term' → ε	term' → && factor term'				term' → ε
factor	factor → operand factor'	factor → operand factor'						
factor'			factor' → ε	factor' → ε	factor' → comp operand factor'	factor' → comp operand factor'	factor' → comp operand factor'	factor' → ε
comp					comp → >	comp → <	comp → =	
operand	operand → ! operand	operand → ID						