

CSC135 Fall 2017
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Assignment 1

FIRST and FOLLOW :

	FIRST	FOLLOW
piece	$\text{FIRST}(\text{stmtnt}) \cup \text{FIRST}(\text{lststmtnt}) \cup \{ \lambda \}$ $= \{ \mathbf{U}, \mathbf{X}, \mathbf{Y}, \mathbf{W}, \mathbf{I}, \mathbf{P}, \mathbf{R}, \mathbf{K}, \lambda \}$	$= \text{FOLLOW}(\text{block}) \cup \{ \$ \}$ $= \{ \mathbf{E}, \mathbf{S}, \$ \}$
block	$= \text{FIRST}(\text{piece}) = \{ \mathbf{U}, \mathbf{X}, \mathbf{Y}, \mathbf{W}, \mathbf{I}, \mathbf{P}, \mathbf{R}, \mathbf{K}, \lambda \}$	$\{ \mathbf{E}, \mathbf{S} \}$
stmtnt	$= \text{FIRST}(\text{assignst}) \cup \text{FIRST}(\text{whilst}) \cup \text{FIRST}(\text{ifst}) \cup \text{FIRST}(\text{forst})$ $= \{ \mathbf{U}, \mathbf{X}, \mathbf{Y}, \mathbf{W}, \mathbf{I}, \mathbf{P} \}$	$\{ ; \}$
assignst	$= \text{FIRST}(\text{varlist}) = \{ \mathbf{U}, \mathbf{X}, \mathbf{Y} \}$	$= \text{FOLLOW}(\text{stmtnt}) = \{ ; \}$
whilst	$\{ \mathbf{W} \}$	$= \text{FOLLOW}(\text{stmtnt}) = \{ ; \}$
ifst	$\{ \mathbf{I} \}$	$= \text{FOLLOW}(\text{stmtnt}) = \{ ; \}$
forst	$\{ \mathbf{P} \}$	$= \text{FOLLOW}(\text{stmtnt}) = \{ ; \}$
lststmtnt	$\{ \mathbf{R}, \mathbf{K} \}$	$\{ ; \}$
varlist	$= \text{FIRST}(\text{varname}) = \{ \mathbf{U}, \mathbf{X}, \mathbf{Y} \}$	$\{ = \}$
explst	$= \text{FIRST}(\text{expr})$	$\text{FOLLOW}(\text{assignst}) \cup \text{FOLLOW}(\text{lststmtnt}) = \{ ; \}$

	$= \{ \mathbf{N, F, V, 0, 1, 2, 3, 4, 5, U, X, Y, (, -, \&, \#} \}$	
expr	$\text{FIRST}(\text{term}) \cup \text{FIRST}(\text{unop})$ $= \{ \mathbf{N, F, V, 0, 1, 2, 3, 4, 5, U, X, Y, (, -, \&, \#} \}$	$\{ \mathbf{D} \} \cup \{ \mathbf{T} \} \cup \{ , \} \cup \text{FOLLOW}(\text{expst}) \cup \{ \}$ $= \{ \mathbf{D, T, ,, ;, } \}$
term	$= \{ \mathbf{N, F, V} \} \cup \text{FIRST}(\text{num}) \cup \text{FIRST}(\text{varname}) \cup \{ (\}$ $= \{ \mathbf{N, F, V, 0, 1, 2, 3, 4, 5, U, X, Y, (} \}$	$= \text{FIRST}(\text{binop}) \cup \text{FOLLOW}(\text{expst})$ $= \{ +, -, *, /, <, >, \mathbf{A, O, ;} \}$
binop	$\{ +, -, *, /, <, >, \mathbf{A, O} \}$	$= \text{FIRST}(\text{expr})$ $= \{ \mathbf{N, F, V, 0, 1, 2, 3, 4, 5, U, X, Y, (, -, \&, \#} \}$
unop	$\{ -, \&, \# \}$	$= \text{FIRST}(\text{expr})$ $= \{ \mathbf{N, F, V, 0, 1, 2, 3, 4, 5, U, X, Y, (, -, \&, \#} \}$
varname	$= \text{FIRST}(\text{letter}) = \{ \mathbf{U, X, Y} \}$	$= \{ = \} \cup \{ , \} \cup \text{FOLLOW}(\text{varlist}) \cup \text{FOLLOW}(\text{term})$ $= \{ =, ,, +, -, *, /, <, >, \mathbf{A, O} \}$
num	$= \text{FIRST}(\text{digit}) = \{ \mathbf{0, 1, 2, 3, 4, 5} \}$	$= \text{FOLLOW}(\text{term}) = \{ +, -, *, /, <, >, \mathbf{A, O, ;} \}$
letter	$\{ \mathbf{U, X, Y} \}$	$= \text{FOLLOW}(\text{varname}) \cup \text{FIRST}(\text{letter}) \cup \text{FIRST}(\text{digit})$ $= \{ =, +, -, *, /, <, >, \mathbf{A, O, U, X, Y, 0, 1, 2, 3, 4, 5} \}$
digit	$\{ \mathbf{0, 1, 2, 3, 4, 5} \}$	$= \text{FOLLOW}(\text{varname}) \cup \text{FIRST}(\text{digit})$ $= \{ =, +, -, *, /, <, >, \mathbf{A, O, 0, 1, 2, 3, 4, 5} \}$

Proof :

piece	$\text{FIRST}(\text{lststmnt}) \cap \text{FOLLOW}(\text{piece}) = \{ \mathbf{R}, \mathbf{K} \} \cap \{ \mathbf{E}, [,], \$ \} = \emptyset$ $\text{FIRST}(\text{stmnt}) \cap \text{FIRST}(\text{lststmnt}) = \{ \mathbf{U}, \mathbf{X}, \mathbf{Y}, \mathbf{W}, \mathbf{I}, \mathbf{P} \} \cap \{ \mathbf{R}, \mathbf{K} \} = \emptyset$
block	
stmnt	<p>The sets $\text{FIRST}(\text{assignst})$, $\text{FIRST}(\text{whilst})$, $\text{FIRST}(\text{ifst})$, $\text{FIRST}(\text{forst})$ i.e. $\{ \mathbf{U}, \mathbf{X}, \mathbf{Y} \}, \{ \mathbf{W} \}, \{ \mathbf{I} \}, \{ \mathbf{P} \}$ are mutually disjoint.</p>
assignst	
whilst	
ifst	$\{ \mathbf{S} \} \cap \{ \mathbf{E} \} = \emptyset$
forst	$\{ , \} \cap \{ \mathbf{D} \} = \emptyset$
lststmnt	$\{ \mathbf{R} \} \cap \{ \mathbf{K} \} = \emptyset$ $\text{FOLLOW}(\text{lststmnt}) \cap \text{FIRST}(\text{explst}) = \{ ; \} \cap \{ \mathbf{N}, \mathbf{F}, \mathbf{V}, \mathbf{0}, \mathbf{1}, \mathbf{2}, \mathbf{3}, \mathbf{4}, \mathbf{5}, \mathbf{U}, \mathbf{X}, \mathbf{Y}, (, -, \&, \# \} = \emptyset$
varlist	$\text{FOLLOW}(\text{varlist}) \cap \{ , \} = \{ = \} \cap \{ , \} = \emptyset$
explst	$\text{FOLLOW}(\text{explst}) \cap \text{FIRST}(\text{expr}) = \{ ; \} \cap \{ \mathbf{N}, \mathbf{F}, \mathbf{V}, \mathbf{0}, \mathbf{1}, \mathbf{2}, \mathbf{3}, \mathbf{4}, \mathbf{5}, \mathbf{U}, \mathbf{X}, \mathbf{Y}, (, -, \&, \# \} = \emptyset$
expr	$\text{FIRST}(\text{term}) \cap \text{FIRST}(\text{unop}) = \{ \mathbf{N}, \mathbf{F}, \mathbf{V}, \mathbf{0}, \mathbf{1}, \mathbf{2}, \mathbf{3}, \mathbf{4}, \mathbf{5}, \mathbf{U}, \mathbf{X}, \mathbf{Y}, (\} \cap \{ +, -, *, /, <, >, \mathbf{A}, \mathbf{O} \} = \emptyset$ $\text{FOLLOW}(\text{expr}) \cap \text{FIRST}(\text{binop}) = \{ \mathbf{D}, \mathbf{T}, ,, , ; ,) \} \cap \{ +, -, *, /, <, >, \mathbf{A}, \mathbf{O} \} = \emptyset$
term	The sets $\{ \mathbf{N} \}, \{ \mathbf{F} \}, \{ \mathbf{V} \}$, $\text{FIRST}(\text{num})$, $\text{FIRST}(\text{varname})$, $\{ (\}$

	i.e. $\{ \mathbf{N} \}, \{ \mathbf{F} \}, \{ \mathbf{V} \}, \{ \mathbf{0}, \mathbf{1}, \mathbf{2}, \mathbf{3}, \mathbf{4}, \mathbf{5} \}, \{ \mathbf{U}, \mathbf{X}, \mathbf{Y} \}, \{ (\}$ are mutually disjoint.
binop	The sets $\{ + \}, \{ - \}, \{ * \}, \{ / \}, \{ < \}, \{ > \}, \{ \mathbf{A} \}, \{ \mathbf{O} \}$ are mutually disjoint.
unop	The sets $\{ - \}, \{ \& \}, \{ \# \}$ are mutually disjoint.
varname	$\text{FIRST}(\text{letter}) \cap \text{FIRST}(\text{digit}) = \{ \mathbf{U}, \mathbf{X}, \mathbf{Y} \} \cap \{ \mathbf{0}, \mathbf{1}, \mathbf{2}, \mathbf{3}, \mathbf{4}, \mathbf{5} \} = \emptyset$ $\text{FOLLOW}(\text{varname}) \cap \text{FIRST}(\text{digit}) = \{ =, ,, +, -, *, /, <, >, \mathbf{A}, \mathbf{O} \} \cap \{ \mathbf{0}, \mathbf{1}, \mathbf{2}, \mathbf{3}, \mathbf{4}, \mathbf{5} \} = \emptyset$ $\text{FOLLOW}(\text{varname}) \cap \text{FIRST}(\text{letter}) = \{ =, ,, +, -, *, /, <, >, \mathbf{A}, \mathbf{O} \} \cap \{ \mathbf{U}, \mathbf{X}, \mathbf{Y} \} = \emptyset$
num	$\text{FOLLOW}(\text{num}) \cap \text{FIRST}(\text{digit}) = \{ +, -, *, /, <, >, \mathbf{A}, \mathbf{O}, ; \} \cap \{ \mathbf{0}, \mathbf{1}, \mathbf{2}, \mathbf{3}, \mathbf{4}, \mathbf{5} \} = \emptyset$
letter	The sets $\{ \mathbf{U} \}, \{ \mathbf{X} \}, \{ \mathbf{Y} \}$ are mutually disjoint.
digit	The sets $\{ \mathbf{0} \}, \{ \mathbf{1} \}, \{ \mathbf{2} \}, \{ \mathbf{3} \}, \{ \mathbf{4} \}, \{ \mathbf{5} \}$ are mutually disjoint.