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Homework 1

10/08/2017

1. First and Follow

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| **NON-Terminal** | First | Follow |
| piece | First (stmnt) ∩First(lststmnt) =  {U,X,Y,W,I,P,R,K} | {$} ∪Follow(block)=  {$,E,S} |
| block | First(piece) =  {U,X,Y,W,I,P,R,K} | {E,S} |
| stmnt | First(assignst) ∪ First(whilst) ∪ First(ifst) ∪ First(forst) = {U,X,Y,W,I,P} | {;} |
| assignst | First(varlist) = {U,X,Y} | Follow(stmnt) = {;} |
| whilst | {W} | Follow(stmnt) = {;} |
| ifst | {I} | Follow (stmnt) = {;} |
| forst | {P} | Follow (stmnt) = {;} |
| lststmnt | {R,K} | {;} |
| varlist | First(varname) = {U,X,Y} | {=} |
| explst | First(expr) =  {N,F,V,0,1,2,3,4,5,U,X,Y,(,-,&,# } | Follow(assignst) ∪Follow(lststmnt) =  {;} |
| expr | First(term) ∪ First (unop) =  {N,F,V,0,1,2,3,4,5,U,X,Y,( , -,&,#} | {**,** , ) , D , T} |
| term | {N,F,V} ∪ First(num) ∪First(varname) ∪ { ( }= {N,F,V,0,1,2,3,4,5,U,X,Y,( } | First(binop) ∪ Follow(expr) =  {+,-,\*,/,<,>,A,O, **,** , ) , D , T } |
| binop | {+,-,\*,/,<,>,A,O} | First(expr) = {N,F,V,0,1,2,3,4,5,U,X,Y,( , -,&,#} |
| unop | {-,&,#} | First(expr) = {N,F,V,0,1,2,3,4,5,U,X,Y,( , -,&,#} |
| varname | First(letter)={U,X,Y} | { **,** ,**=**} ∪Follow(varlist) ∪ Follow(term) = {+,-,\*,/,<,>,A,O, **,** , ) , D , T ,=} |
| num | First(digit)={0,1,2,3,4,5} | Follow(term) = {+,-,\*,/,<,>,A,O, **,** , ) , D , T } |
| letter | {U,X,Y} | First (letter) ∪ First(digit) ∪ Follow(varname) = {+,-,\*,/,<,>,A,O, **,** , ) , D , T ,=, U,X,Y, 0,1,2,3,4,5 } |
| digit | {0,1,2,3,4,5} | First(digit) ∪ follow(num) ∪ Follow(varname)=  {+,-,\*,/,<,>,A,O, **,** , ) , D , T ,=, 0,1,2,3,4,5} |

2) proof of decent

A) For every production A ::= α 1 | α 2 | α 3 | ... | α n , we must have FIRST ( αi ) ∩ FIRST ( αj ) = ∅ for each pair i, j, i ≠ j

**For all containing |**

* **stmnt ::= assignst | whilst | ifst | forst**

First(whilst) = {W} ∩ First(assignst) = {U,X,Y} ∩ First(forst) = {P} ∩ First(ifst) = {I} = ∅ √

* **explst ::= expr , {expr ,}**

First(expr)∩Follow(explst) ={N,F,V,0,1,2,3,4,5,U,X,Y,( , -,&,#} ∩ {;} =∅ √

* **expr = term [ binop expr ] | unop expr**

First(term) ={N,F,V,0,1,2,3,4,5,U,X,Y,( } ∩ First(unop) = {-,&,#} = ∅ √

And First(binop) ∩ Follow(expr) = {+,-,\*,/,<,>,A,O} ∩ {**,** , ) , D , T} = ∅ √

* **term ::= N | F | V | num | varname | ( expr )**

{N}∩{F}∩{V}∩ First(num) = {0,1,2,3,4,5} ∩ First(varnam) = {U,X,Y} ∩ {(} = ∅ √

* **binop ::= + | - | \* | / | < | > | A | O**

{**+**}∩{**-**}∩{\*}∩{/}∩{<}∩{>}∩{A}∩{O}= ∅ √

* **unop ::= - | & | #**

{-}∩{&}∩{#}=∅ √

* **varlist ::= varname { , varname}**

{,}∩Follow(varlist)= {,} ∩ {=} = ∅ √

* **varname ::= letter { letter | digit }**

First(letter) = {U,X,Y} ∩ First(digit) = {0,1,2,3,4,5} = ∅ √

And First(letter)∪First(digit) ∩ follow(varname) =

{U,X,Y} ∪{0,1,2,3,4,5}∩{+,-,\*,/,<,>,A,O, **,** , ) , D , T ,=} = ∅ √

* **letter ::= U | X | Y**

{U}∩{X}∩{Y}=∅ √

* **digit ::= 0 | 1 | 2 | 3 | 4 | 5**

{0}∩{1}∩{2}∩{3}∩{4}∩{5}= ∅ √

* **piece ::= {stmnt ; } [lststmnt ; ]**

first(lststmnt) ∩follow(piece) ={R,K}∩{$,E,S}= ∅ √

* **ifst ::= I expr T block [S block] E**

{S}∩{E}=∅ √

* **lststmnt ::= R [explst] | K**

First(explst)∩follow (lststmnt)= {N,F,V,0,1,2,3,4,5,U,X,Y,(,-,&,# }∩{;} =∅ √

* **num ::= digit { digit }**

First(digit) ∩ Follow(num)= {0,1,2,3,4,5}∩{+,-,\*,/,<,>,A,O, {**,** , ) , D , T }=∅ √

* **forst ::= P varname = expr , expr [ , expr] D block E**

{,}∩{D}= ∅ √

B) λ is not part of the language.