**1) Programs 🡪 Functions**

**First (Programs) = First (Functions) = First (OtherFuns) U First (MainFun) = {TK\_KEY\_FUN}**

**Follow (Programs) = Follow (Functions) = {EOF}**

**2) Functions 🡪 MainFun**

**3) Functions 🡪 OtherFuns MainFun**

**4) MainFun 🡪 TK\_KEY\_FUN TK\_KEY\_MAIN TK\_KEY\_BEGIN FunBody TK\_KEY\_END**

**First(MainFun) = {TK\_KEY\_FUN}**

**Follow (MainFun) = Follow (Functions) = {EOF}**

**5) OtherFuns 🡪 Funct OtherFuns**

6) **OtherFuns 🡪 ε**

**7) Funct 🡪 TK\_KEY\_FUN TK\_ID TK\_OPEN Parameters TK\_CLOSE TK\_KEY\_BEGIN FunBody TK\_KEY\_END**

**First (OtherFuns) = First (Funct) U {e} = { TK\_KEY\_FUN, e}**

**Follow (OtherFuns) = First (MainFun) = {TK\_KEY\_FUN}**

**First (Funct) = {TK\_KEY\_FUN}**

**Follow (Funct) = {TK\_KEY\_FUN}**

**8) Parameters 🡪 TK\_KEY\_IN TK\_COLON InList TK\_SEMI TK\_KEY\_OUT TK\_COLON OutID**

**First (Parameters) = {TK\_KEY\_IN}**

**Follow (Parameters) = {TK\_CLOSE}**

**9) InList 🡪 TK\_KEY\_NONE**

**10) InList 🡪 IDList**

**First (InList) = {TK\_KEY\_NONE, IK\_ID}**

**Follow (InList) = {TK\_SEMI}**

**11) IDList 🡪 TK\_ID RemID**

**First (IDList) = {TK\_ID}**

**Follow (IDList) = Follow (InList) = {TK\_SEMI}**

**12) RemID 🡪 TK\_COMMA TK\_ID RemID**

**13) RemID 🡪 ε**

**First (RemID) = {TK\_COMMA, e}**

**Follow (RemID) = Follow (IDList) = {TK\_SEMI}**

**14) OutID 🡪 TK\_KEY\_NONE**

**15) OutID 🡪 TK\_ID**

**First (OutID) = {TK\_KEY\_NONE, TK\_ID}**

**Follow (OutID) = Follow (Parameters) = {TK\_CLOSE}**

**16) FunBody 🡪 Declarations OtherStatements**

**First (FunBody) = First (Declarations) U First (OtherStatements)= {TK\_KEY\_VAR, e, TK\_KEY\_LET, TK\_KEY\_IF, TK\_KEY\_WHILE, TK\_KEY\_RETURN, TK\_KEY\_PRINT, TK\_KEY\_GET, TK\_KEY\_FUN, TK\_SEMI}**

**Follow (FunBody} = {TK\_KEY\_END}**

**17) Declarations 🡪 Declaration Declarations**

**18) Declarations 🡪 ε**

**First (Declarations) = First (Declaration) U {e} = {TK\_KEY\_VAR, e}**

**Follow (Declarations) = First (OtherStatements) = {TK\_KEY\_LET, TK\_KEY\_IF, TK\_KEY\_WHILE, TK\_KEY\_RETURN, TK\_KEY\_PRINT, TK\_KEY\_GET, TK\_KEY\_FUN, TK\_SEMI}**

**19) Declaration 🡪 TK\_KEY\_VAR IDList TK\_SEMI**

**First (Declaration) = {TK\_KEY\_VAR}**

**Follow (Declaration) = First (Declarations) U Follow (Declarations)**

**= {TK\_KEY\_VAR, e, TK\_KEY\_LET, TK\_KEY\_IF, TK\_KEY\_WHILE, TK\_KEY\_RETURN, TK\_KEY\_PRINT, TK\_KEY\_GET, TK\_KEY\_FUN, TK\_SEMI}**

**20) OtherStatements 🡪 Statement OtherStatements**

**21) OtherStatements 🡪 Statement**

**First (OtherStatements) = First (Statement) = {TK\_KEY\_LET, TK\_KEY\_IF, TK\_KEY\_WHILE, TK\_KEY\_RETURN, TK\_KEY\_PRINT, TK\_KEY\_GET, TK\_KEY\_FUN, TK\_SEMI}**

**Follow (OtherStatements) = Follow (FunBody) = {TK\_KEY\_END}**

**22) Statement 🡪 AssignmentStmt**

**23) Statement 🡪 ConditionalStmt**

**24) Statement 🡪| RepetitiveStmt**

**25) Statement 🡪 ReturnStmt**

**26) Statement 🡪 FunctionCall**

**27) Statement 🡪 IO\_Stmt**

**28) Statement 🡪 TK\_SEMI**

**First (Statement) = {TK\_KEY\_LET, TK\_KEY\_IF, TK\_KEY\_WHILE, TK\_KEY\_RETURN, TK\_KEY\_PRINT, TK\_KEY\_GET, TK\_KEY\_FUN, TK\_SEMI}**

**Follow (Statement) = First (OtherStatements) U Follow (OtherStatements) = {TK\_KEY\_LET, TK\_KEY\_IF, TK\_KEY\_WHILE, TK\_KEY\_RETURN, TK\_KEY\_PRINT, TK\_KEY\_GET, TK\_KEY\_FUN, TK\_SEMI, TK\_KEY\_END}**

**29) AssignmentStmt 🡪 TK\_KEY\_LET TK\_ID TK\_KEY\_BE Expression TK\_SEMI**

**30) AssignmentStmt 🡪TK\_KEY\_LET TK\_ID TK\_KEY\_BE FunctionCall TK\_SEMI**

**First (AssignmentStmt) = {TK\_KEY\_LET}**

**Follow (AssignmentStmt) = {TK\_KEY\_LET, TK\_KEY\_IF, TK\_KEY\_WHILE, TK\_KEY\_RETURN, TK\_KEY\_PRINT, TK\_KEY\_GET, TK\_KEY\_FUN, TK\_SEMI}**

**31) Expression 🡪 TK\_ID**

**32) Expression 🡪 TK\_NUM**

**33) Expression 🡪 TK\_KEY\_PLUS TK\_OPEN Expression TK\_COMMA Expression TK\_CLOSE**

**34) Expression 🡪 TK\_KEY\_MINUS TK\_OPEN Expression TK\_COMMA Expression TK\_CLOSE**

**35) Expression 🡪 TK\_KEY\_MUL TK\_OPEN Expression TK\_COMMA Expression TK\_CLOSE**

**36) Expression 🡪 TK\_KEY\_DIV TK\_OPEN Expression TK\_COMMA Expression TK\_CLOSE**

**37) Expression 🡪 TK\_KEY\_MODULO TK\_OPEN Expression TK\_COMMA TK\_NUM TK\_CLOSE**

**38) Expression 🡪 TK\_OPEN Expression TK\_CLOSE**

**First (Expression) = {TK\_ID, TK\_NUM, TK\_KEY\_PLUS, TK\_KEY\_MINUS, TK\_KEY\_MUL, TK\_KEY\_DIV, TK\_KEY\_MODULO, TK\_OPEN}**

**Follow (Expression) = {TK\_CLOSE, TK\_COMMA, TK\_SEMI}**

**39) FunctionCall 🡪 TK\_KEY\_FUN TK\_ID TK\_OPEN IDList TK\_CLOSE**

**First (FunctionCall) = {TK\_KEY\_FUN}**

**Follow (FunctionCall) = {TK\_KEY\_LET, TK\_KEY\_IF, TK\_KEY\_WHILE, TK\_KEY\_RETURN, TK\_KEY\_PRINT, TK\_KEY\_GET, TK\_KEY\_FUN, TK\_SEMI, TK\_KEY\_END}**

**40) ConditionalStmt 🡪 TK\_KEY\_IF TK\_OPEN BoolExp TK\_CLOSE TK\_KEY\_BEGIN OtherStatements TK\_KEY\_END**

**First (ConditionalStmt) = {TK\_KEY\_IF}**

**Follow (ConditionalStmt) = {TK\_KEY\_LET, TK\_KEY\_IF, TK\_KEY\_WHILE, TK\_KEY\_RETURN, TK\_KEY\_PRINT, TK\_KEY\_GET, TK\_KEY\_FUN, TK\_SEMI, TK\_KEY\_END}**

**41) BoolExp 🡪 TK\_ID TK\_EQUI TK\_ID**

**42) BoolExp 🡪 TK\_ID TK\_NOTEQUAL TK\_ID**

**43) BoolExp 🡪 TK\_ID TK\_LT TK\_ID**

**44) BoolExp 🡪 TK\_ID TK\_GT TK\_ID**

**45) BoolExp 🡪 TK\_ID TK\_LEQ TK\_ID**

**46) BoolExp 🡪 TK\_ID TK\_GEQ TK\_ID**

**47) BoolExp 🡪 TK\_ID**

**First (BoolExp) = {TK\_ID}**

**Follow (BoolExp) {TK\_CLOSE}**

**48) RepetitiveStmt 🡪 TK\_KEY\_WHILE TK\_OPEN BoolExp TK\_CLOSE TK\_KEY\_BEGIN OtherStatements TK\_KEY\_END**

**First (RepetitiveStmt) = {TK\_KEY\_WHILE}**

**Follow (RepetitiveStmt) = {TK\_KEY\_LET, TK\_KEY\_IF, TK\_KEY\_WHILE, TK\_KEY\_RETURN, TK\_KEY\_PRINT, TK\_KEY\_GET, TK\_KEY\_FUN, TK\_SEMI, TK\_KEY\_END}**

**49) ReturnStmt 🡪 TK\_KEY\_RETURN TK\_ID TK\_SEMI**

**First (ReturnStmt) = {TK\_KEY\_RETURN}**

**Follow (ReturnStmt) = {TK\_KEY\_LET, TK\_KEY\_IF, TK\_KEY\_WHILE, TK\_KEY\_RETURN, TK\_KEY\_PRINT, TK\_KEY\_GET, TK\_KEY\_FUN, TK\_SEMI, TK\_KEY\_END}**

**50) IO\_Stmt 🡪 TK\_KEY\_PRINT TK\_ID TK\_SEMI**

**51) IO\_Stmt 🡪 TK\_KEY\_GET TK\_ID TK\_SEMI**

**First (IO\_Stmt) = {TK\_KEY\_PRINT, TK\_KEY\_GET}**

**Follow (IO\_Stmt) = {TK\_KEY\_LET, TK\_KEY\_IF, TK\_KEY\_WHILE, TK\_KEY\_RETURN, TK\_KEY\_PRINT, TK\_KEY\_GET, TK\_KEY\_FUN, TK\_SEMI, TK\_KEY\_END}**

Note: Requested to verify the LL(1) conversion of the natural grammar (from file natural.doc), and compute first and follow sets. You can do it once LL(1) parsing is taught in the class. End note