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CS355  
turtle grammar changes

Semantics changes (also grammar changes highlighted in red):

Variables must be declared at the beginning of the program like so: X OTHERVAR Y Z (etc.) \*before\* they can be assigned a value. Also, two identifiers of the same name cannot be initialized within the same scope. Initialization of variables gives them a default value of 0 (like in the data structure for assignment 1 turtle) so that action statements called in a turtle source file with assignment will still work and run (but obviously won't do anything because they have a value of 0). Variables declared at the beginning of a program are global and can be used in inner scopes, and variables declared above a local scope (an outer scope) can also be used.

*program* -> *stmt\_seq* \$

*stmt\_seq* -> {*funct\_dec*} | *stmt* {*stmt*}

*stmt* -> *assign* | *while\_stmt* | *if\_stmt* | *action*

*assign* -> IDENT ASSIGN *expr*

*block* -> {*funct\_dec*} | *stmt* {*stmt*}

*funct\_dec* -> IDENT

*while\_stmt* -> WHILE *bool* DO *block* OD

*if\_stmt* -> IF *bool* THEN *block* {ELSIF *bool* THEN *block*} [ELSE *block*] FI

*action* -> HOME | PENUP | PENDOWN | FORWARD *expr*

-> LEFT *expr* | RIGHT *expr* | PUSHSTATE | POPSTATE

*expr* -> *term* {+ *term* | - *term*}

*term* -> *factor* {\* *factor* | / *factor*}

*factor* -> - *factor* | + *factor* | ( *expr* ) | IDENT | REAL

*bool* -> *bool\_term* {OR *bool\_term*}

*bool\_term* -> *bool\_factor* {AND *bool\_factor*}

*bool\_factor* -> NOT *bool\_factor* | ( *bool* ) | *cmp*

*cmp* -> *expr* *cmp\_op* *expr*

*cmp\_op* -> = | NE | < | LE | > | GE