**Context-Free Grammar**

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|  | PRODUCTION | → | PRODUCTION SETS |
| 1 | <program> | → | <global> !START <statement> END! |
| 2 | <global> | → | <fixed\_dec><global> |
| 3 | <global> | → | <vardec><global> |
| 4 | <global> | → | <file><global> |
| 5 | <global> | → | <funct><global> |
| 6 | <global> | → | <array><global> |
| 7 | <global> | → | λ |
| 8 | <fixed\_dec> | → | fixed <fdata\_type> . |
| 9 | <data\_type> | → | number id <values\_num> . |
| 10 | <data\_type> | → | decimal id <values\_dec> . |
| 11 | <data\_type> | → | string id <values\_str> . |
| 12 | <data\_type> | → | boolean id <values\_bool> . |
| 13 | <vardec> | → | <data\_type> |
| 14 | <values\_num> | → | = numberlit <more\_num> |
| 15 | <values\_num> | → | <more\_num> |
| 16 | <values\_num> | → | λ |
| 17 | <more\_num> | → | , id <values\_num> |
| 18 | <more\_num> | → | λ |
| 19 | <values\_dec> | → | = decimallit <more\_dec> |
| 20 | <values\_dec> | → | <more\_dec> |
| 21 | <values\_dec> | → | λ |
| 22 | <more\_dec> | → | , id <values\_dec> |
| 23 | <more\_dec> | → | λ |
| 24 | <values\_str> | → | = stringlit <more\_str> |
| 25 | <values\_str> | → | <more\_str> |
| 26 | <values\_str> | → | λ |
| 27 | <more\_str> | → | , id <values\_str> |
| 28 | <more\_str> | → | λ |
| 29 | <values\_bool> | → | = booleanlit <more\_bool> |
| 30 | <values\_bool> | → | <more\_bool> |
| 31 | <values\_bool> | → | λ |
| 32 | <more\_bool> | → | , id <values\_bool> |
| 33 | <more\_bool> | → | λ |
| 34 | <fdata\_type> | → | number id <fvalues\_num> |
| 35 | <fdata\_type> | → | decimal id <fvalues\_dec> |
| 36 | <fdata\_type> | → | string id <fvalues\_str> |
| 37 | <fdata\_type> | → | boolean id <fvalues\_bool> |
| 38 | <fvalues\_num> | → | = numberlit <fmore\_num> |
| 39 | <fmore\_num> | → | , id <fvalues\_num> |
| 40 | <fmore\_num> | → | λ |
| 41 | <fvalues\_dec> | → | = decimallit <fmore\_dec> |
| 42 | <fmore\_dec> | → | , id <fvalues\_dec> |
| 43 | <fmore\_dec> | → | λ |
| 44 | <fvalues\_str> | → | = stringlit <fmore\_str> |
| 45 | <fmore\_str> | → | , id <fvalues\_str> |
| 46 | <fmore\_str> | → | λ |
| 47 | <fvalues\_bool> | → | = booleanlit <fmore\_bool> |
| 48 | <fmore\_bool> | → | , id <fvalues\_bool> |
| 49 | <fmore\_bool> | → | λ |
| 54 | <file> | → | file id start <file\_elem> end. <file\_id> |
| 55 | <file\_elem> | → | <dtype>. <file\_tail> |
| 56 | <file\_elem> | → | id id. <file\_tail> |
| 57 | <dtype> | → | number id |
| 58 | <dtype> | → | decimal id |
| 59 | <dtype> | → | string id |
| 60 | <dtype> | → | boolean id |
| 61 | <file\_tail> | → | <file\_elem> |
| 62 | <file\_tail> | → | λ |
| 63 | <file\_id> | → | id <file\_id\_tail>. |
| 64 | <file\_id> | → | λ |
| 65 | <file\_id\_tail> | → | , id <file\_id\_tail> |
| 66 | <file\_id\_tail> | → | λ |
| 67 | <funct> | → | number id (<param>) start <statements> return <returnNum> end. |
| 68 | <funct> | → | decimal id (<param>) start <statements> return <returnDec> end. |
| 69 | <funct> | → | string id (<param>) start <statements> return <returnStr> end. |
| 70 | <funct> | → | boolean id (<param>) start <statements> return <returnBool> end. |
| 71 | <funct> | → | null id (<param>) start <statements> end. |
| 72 | <param> | → | <dtype> <param\_tail> |
| 73 | <param> | → | λ |
| 74 | <param\_tail> | → | , <dtype> <param\_tail> |
| 75 | <param\_tail> | → | λ |
| 76 | <dtype> | → | number id |
| 77 | <dtype> | → | decimal id |
| 78 | <dtype> | → | string id |
| 79 | <dtype> | → | boolean id |
| 80 | <returnNum> | → | numberlit |
| 81 | <returnNum> | → | id <returnTail> |
| 82 | <returnDec> | → | decimallit |
| 83 | <returnDec> | → | id <returnTail> |
| 84 | <returnStr> | → | stringlit |
| 85 | <returnStr> | → | id <returnTail> |
| 86 | <returnBool> | → | booleanlit |
| 87 | <returnBool> | → | id <returnTail> |
| 88 | <returnTail> | → | (<funct\_param>) |
| 89 | <returnTail> | → | <elem> |
| 90 | <returnTail> | → | λ |
| 91 | <funct\_param> | → | <value> <funct\_paramTail> |
| 92 | <funct\_paramTail> | → | , <funct\_param> |
| 93 | <funct\_paramTail> | → | λ |
| 94 | <value> | → | <values> |
| 95 | <value> | → | <elem\_tail> |
| 96 | <values> | → | numberlit |
| 97 | <values> | → | decimallit |
| 98 | <values> | → | stringlit |
| 99 | <values> | → | booleanlit |
| 100 | <elem> | → | @ <elem\_tail> |
| 101 | <elem> | → | λ |
| 102 | <elem\_tail> | → | id <elem> |
| 103 | <numb\_array> | → | number id <number\_array> <more\_numberArray>. |
| 104 | <number\_array> | → | <number\_array1> |
| 105 | <number\_array> | → | <number\_array2> |
| 106 | <more\_numberArray> | → | , id <number\_array> <more\_numberArray> |
| 107 | <more\_numberArray> | → | λ |
| 108 | <number\_array1> | → | [<array\_choice>] <number\_array1Tail> |
| 109 | <number\_array1Tail> | → | = { numberlit <moreNumber> } |
| 110 | <number\_array1Tail> | → | λ |
| 111 | <moreNumber> | → | , numberlit <moreNumber> |
| 112 | <moreNumber> | → | λ |
| 113 | <number\_array2> | → | [<array\_choice>][<array\_choice>]<number\_array2Tail> |
| 114 | <number\_array2Tail> | → | = {<number\_array2Val> <number\_array2Val\_tail> |
| 115 | <number\_array2Tail> | → | λ |
| 116 | <number\_array2Val> | → | {numberlit <moreNumber>} |
| 117 | <number\_array2Val\_tail> | → | , <number\_array2Val> <number\_array2Val\_tail> |
| 118 | <number\_array2Val\_tail> | → | λ |
| 119 | <array\_choice> | → | id <ops> |
| 120 | <array\_choice> | → | numberlit<ops> |
| 121 | <ops> | → | <mathop> <array\_choice> |
| 122 | <ops> | → | λ |
| 123 | <mathop> | → | + |
| 124 | <mathop> | → | - |
| 125 | <mathop> | → | \* |
| 126 | <mathop> | → | / |
| 127 | <mathop> | → | % |
| 128 | <dec\_array> | → | decimal id <decimal\_array> <more\_decimalArray>. |
| 129 | <decimal\_array> | → | <decimal\_array1> |
| 130 | <decimal\_array> | → | <decimal\_array2> |
| 131 | <more\_ decimalArray> | → | , id <decimal\_array> <more\_ decimalArray> |
| 132 | <more\_ decimalArray> | → | λ |
| 133 | <decimal\_array1> | → | [<array\_choice>] <decimal\_array1Tail> |
| 134 | <decimal\_array1Tail> | → | = { decimallit <moreDecimal> } |
| 135 | <decimal\_array1Tail> | → | λ |
| 136 | <moreDecimal> | → | , decimallit <moreDecimal> |
| 137 | <moreDecimal> | → | λ |
| 138 | <decimal\_array2> | → | [<array\_choice>][<array\_choice>]<decimal\_array2Tail> |
| 139 | <decimal\_array2Tail> | → | = {<decimal\_array2Val> <decimal\_array2Val\_tail> |
| 140 | <decimal\_array2Tail> | → | λ |
| 141 | <decimal\_array2Val> | → | {decimallit <moreDecimal>} |
| 142 | <decimal\_array2Val\_tail> | → | , <decimal\_array2Val> <decimal\_array2Val\_tail> |
| 143 | <decimal\_array2Val\_tail> | → | λ |
| 144 | <str\_array> | → | string id < string \_array> <more\_ stringArray>. |
| 145 | <string\_array> | → | <string\_array1> |
| 146 | <string\_array> | → | <string\_array2> |
| 147 | <more\_ stringArray> | → | , id <string\_array> <more\_ stringArray> |
| 148 | <more\_ stringArray> | → | λ |
| 149 | <string\_array1> | → | [<array\_choice>] <string\_array1Tail> |
| 150 | <string\_array1Tail> | → | = { stringlit <moreString> } |
| 151 | <string\_array1Tail> | → | λ |
| 152 | <moreString> | → | , stringlit <moreString> |
| 153 | <moreString> | → | λ |
| 154 | <string\_array2> | → | [<array\_choice>][<array\_choice>]<string\_array2Tail> |
| 155 | <string\_array2Tail> | → | = {<string\_array2Val> <string\_array2Val\_tail> |
| 156 | <string\_array2Tail> | → | λ |
| 157 | <string\_array2Val> | → | {stringlit <moreString>} |
| 158 | <string\_array2Val\_tail> | → | , <string\_array2Val> <string\_array2Val\_tail> |
| 159 | <string\_array2Val\_tail> | → | λ |
| 160 | <bool\_array> | → | boolean id <boolean\_array> <more\_booleanArray>. |
| 161 | <boolean\_array> | → | <boolean\_array1> |
| 162 | <boolean\_array> | → | <boolean\_array2> |
| 163 | <more\_booleanArray> | → | , id <boolean\_array> <more\_ booleanArray> |
| 164 | <more\_booleanArray> | → | λ |
| 165 | <boolean\_array1> | → | [<array\_choice>] <boolean\_array1Tail> |
| 166 | <boolean\_array1Tail> | → | = { booleanlit <moreBoolean> } |
| 167 | <boolean\_array1Tail> | → | λ |
| 168 | <moreBoolean> | → | , booleanlit <moreBoolean> |
| 169 | <moreBoolean> | → | λ |
| 170 | <boolean\_array2> | → | [<array\_choice>][<array\_choice>]<boolean\_array2Tail> |
| 171 | <boolean\_array2Tail> | → | = {<boolean\_array2Val> <boolean\_array2Val\_tail> |
| 172 | <boolean\_array2Tail> | → | λ |
| 173 | <boolean\_array2Val> | → | {booleanlit <moreBoolean>} |
| 174 | <boolean\_array2Val\_tail> | → | , <boolean\_array2Val> <boolean\_array2Val\_tail> |
| 175 | <boolean\_array2Val\_tail> | → | λ |
| 176 | <statement> | → | <function> <statement> |
| 177 | <statement> | → | λ |
| 178 | <function> | → | <vardec> |
| 179 | <function> | → | file id id. |
| 180 | <function> | → | <inc\_dec> |
| 181 | <function> | → | <id\_func> |
| 182 | <function> | → | <array> |
| 183 | <function> | → | <io\_statement> |
| 184 | <function> | → | <if\_statement> |
| 185 | <function> | → | <switch> |
| 186 | <function> | → | <looping> |
| 187 | <io\_statement> | → | write <output> . |
| 188 | <io\_statement> | → | read id <ids\_tail>. |
| 189 | <output> | → | stringlit <output\_tail> |
| 190 | <output> | → | id <ids\_tail> <output\_tail> |
| 191 | <output\_tail> | → | , <output> |
| 192 | <output\_tail> | → | λ |
| 193 | <ids\_tail> | → | <id\_choices> |
| 194 | <ids\_tail> | → | λ |
| 195 | <id\_choices> | → | <elem> |
| 196 | <id\_choices> | → | [<array\_choice>] <more\_array> |
| 197 | <more\_array> | → | [<array\_choice>] |
| 198 | <more\_array> | → | λ |
| 199 | <inc\_dec> | → | id <inc\_decOp>. |
| 200 | <inc\_dec> | → | <inc\_decOp> id. |
| 201 | <inc\_decOp> | → | ++ |
| 202 | <inc\_decOp> | → | -- |
| 203 | <id\_func> | → | id <id\_funcTail> |
| 204 | <id\_funcTail> | → | <ids\_tail> = <ass\_values> |
| 205 | <id\_funcTail> | → | <ids\_tail> <ass\_op> = <ass\_opValues> |
| 206 | <id\_funcTail> | → | (<funct\_param>) |
| 207 | <ass\_op> | → | = |
| 208 | <ass\_op> | → | += |
| 209 | <ass\_op> | → | -= |
| 210 | <ass\_op> | → | \*= |
| 211 | <ass\_op> | → | /= |
| 212 | <ass\_values> | → | booleanlit |
| 213 | <ass\_values> | → | stringlit |
| 214 | <ass\_values> | → | <ass\_opValues> |
| 215 | <ass\_opValues> | → | numberlit |
| 216 | <ass\_opValues> | → | decimallit |
| 217 | <ass\_opValues> | → | <num\_op> |
| 218 | <ass\_opValues> | → | <dec\_op> |
| 219 | <ass\_opValues> | → | <digit\_op> |
| 220 | <if\_statement> | → | if ( <condition> ) <states> <elseif\_statement> <else\_statement> |
| 221 | <condition> | → | <conditional> |
| 222 | <condition> | → | <not> ( <conditional> ) <logop\_end> |
| 223 | <conditional> | → | <compares> <relop> <compares> |
| 224 | <compares> | → | id<id\_compares> |
| 225 | <compares> | → | (<num\_op>) |
| 226 | <compares> | → | (<dec\_op>) |
| 227 | <compares> | → | (<digit\_op>) |
| 228 | <compares> | → | <values> |
| 229 | <id\_compares> | → | <ids\_tail> |
| 230 | <id\_compares> | → | (<funct\_param> ) |
| 231 | <id\_compares> | → | λ |
| 232 | <relop> | → | == |
| 233 | <relop> | → | != |
| 234 | <relop> | → | > |
| 235 | <relop> | → | < |
| 236 | <relop> | → | >= |
| 237 | <relop> | → | <= |
| 238 | <not> | → | ! |
| 239 | <not> | → | λ |
| 240 | <logop\_end> | → | <logop> <logop\_more> <logop\_end> |
| 241 | <logop\_end> | → | λ |
| 242 | <logop> | → | and |
| 243 | <logop> | → | or |
| 244 | <logop\_more> | → | <not> ( <conditional> ) |
| 245 | <logop\_more> | → | booleanlit <logop\_end> |
| 246 | <states> | → | <function> <control> <states> |
| 247 | <control> | → | Jump . |
| 248 | <control> | → | Stop. |
| 249 | <control> | → | λ |
| 250 | <elseif\_statement> | → | elseif ( <condition> ) start <states> end. <elseif\_statement> |
| 251 | <elseif\_statement> | → | else start <states> end. |
| 252 | <elseif\_statement> | → | λ |
| 253 | <exp\_num> | → | id<id\_compares > |
| 254 | <exp\_num> | → | numberlit |
| 255 | <exp\_numTail> | → | <mathop><exp\_num><exp\_numTail> |
| 256 | <exp\_numTail> | → | λ |
| 257 | <exp\_dec> | → | id <id\_compares > |
| 258 | <exp\_dec> | → | decimallit |
| 259 | <exp\_decTail> | → | <mathop><exp\_dec><exp\_decTail> |
| 260 | <exp\_decTail> | → | λ |
| 261 | <num\_op> | → | <exp\_num> <mathop> <exp\_num> <exp\_numTail> |
| 262 | <num\_op> | → | ( num\_op ) <num\_opTail> |
| 263 | <num\_opTail> | → | <mathop> <num\_op> |
| 264 | <num\_opTail> | → | λ |
| 265 | <dec\_op> | → | <exp\_dec> <mathop> <exp\_dec> <exp\_decTail> |
| 266 | <dec\_op> | → | ( dec\_op ) <dec\_opTail> |
| 267 | <dec\_opTail> | → | <mathop> <dec\_op> |
| 268 | <dec\_opTail> | → | λ |
| 269 | <digit> | → | numberlit |
| 270 | <digit> | → | decimallit |
| 271 | <digit> | → | id<id\_compares> |
| 272 | <digit\_tail> | → | <mathop><digit><digit\_tail> |
| 273 | <digit\_tail> | → | λ |
| 274 | <digit\_op> | → | <digit> <mathop> <digit> <exp\_decTail> |
| 275 | <digit\_op> | → | ( dec\_op ) <dec\_opTail> |
| 276 | <digit\_opTail> | → | <mathop> <dec\_op> |
| 277 | <digit\_opTail> | → | λ |
| 278 | <switch> | → | switch id start choice <choices> end. |
| 279 | <choices> | → | <choice\_num> |
| 280 | <choices> | → | <choice\_str> |
| 281 | <choice\_num> | → | numberlit: <statement> Stop. <choice\_numtail> <default> |
| 282 | <choice\_numtail> | → | choice numlit: <statement> Stop. <choice\_numtail> |
| 283 | <choice\_numtail> | → | λ |
| 284 | <choice\_str> | → | stringlit: <statement> Stop. <choice\_strtail> <default> |
| 285 | <choice\_strtail> | → | choice stringlit: <statement> Stop. <choice\_strtail> |
| 286 | <choice\_strtail> | → | λ |
| 287 | <default> | → | default: <statement> Stop. |
| 288 | <looping> | → | for ( <init> , <cond\_for> , <for\_inc> ) start <states> end. |
| 289 | <for\_dec> | → | number |
| 290 | <for\_dec> | → | λ |
| 291 | <init> | → | <for\_dec> id = <for\_init> |
| 292 | <init> | → | λ |
| 293 | <for\_init> | → | numberlit <ops> |
| 294 | <for\_init> | → | id <ops> |
| 295 | <cond\_for> | → | <for\_init> <rel\_op> <for\_init> |
| 296 | <cond\_for> | → | λ |
| 297 | <for\_inc> | → | id <inc\_op> |
| 298 | <for\_inc> | → | <inc\_op> id |
| 299 | <inc\_op> | → | ++ |
| 300 | <inc\_op> | → | -- |
| 301 | <inc\_op> | → | λ |
| 302 | <looping> | → | while ( <condition> ) start <states> end. |
| 303 | <looping> | → | do start <states> end. while ( <condition> ). |