**Context Free Grammar**

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| # | Expression |
| 1 | <program> → <global> Lead : Start <body> End . <taskdef> |
| 2 | <global> → <global\_choice> . <global> |
| 3 | <global> → λ |
| 4 | <global\_choice> → <varlet> |
| 5 | <global\_choice> → <array> |
| 6 | <global\_choice> → <task> |
| 7 | <global\_choice> → <object> |
| 8 | <dtype> → Int |
| 9 | <dtype> → Double |
| 10 | <dtype> → Char |
| 11 | <dtype> → String |
| 12 | <dtype> → Boolean |
| 13 | <object> → Object id Start Var <dtype> id . <objdec\_choice> End <varname> |
| 14 | <objdec\_choice> → <objvar> . <objdec\_choice> |
| 15 | <objdec\_choice> → <var> . <objdec\_choice> |
| 16 | <objdec\_choice> → λ |
| 17 | <var> → Var <dtype> id |
| 18 | <objvar> → Object id id |
| 19 | <varname> → id <varnames> |
| 20 | <varname> → λ |
| 21 | <varnames> → ; <varname> |
| 22 | <varnames> → λ |
| 23 | <task> → Task <return> id <tparam> |
| 24 | <return> → Null |
| 25 | <return> → <dtype> |
| 26 | <tparam> → ( Var <dtype> id <tparams> ) |
| 27 | <tparam> → λ |
| 28 | <tparams> → ; Var <dtype> id <tparams> |
| 29 | <tparams> → λ |
| 30 | <array> → Array <dtype> id of <size> |
| 31 | <size> → intlit <sizes> |
| 32 | <sizes> → by intlit |
| 33 | <sizes> → λ |
| 34 | <varlet> → Let <vardec> |
| 35 | <varlet> → Var <vardec> |
| 36 | <vardec> → <varINT> |
| 37 | <vardec> → <varDOUBLE> |
| 38 | <vardec> → <varCHAR> |
| 39 | <vardec> → <varSTRING> |
| 40 | <vardec> → <varBOOLEAN> |
| 41 | <varINT> → Int id <initINT> |
| 42 | <initINT> → is <value1> <ids1> |
| 43 | <initINT> → <ids1> |
| 44 | <varDOUBLE> → Double id <initDOUBLE> |
| 45 | <initDOUBLE> → is <value2> <ids2> |
| 46 | <initDOUBLE> → <ids2> |
| 47 | <varCHAR> → Char id <initCHAR> |
| 48 | <initCHAR> → is <value3> <ids3> |
| 49 | <initCHAR> → <ids3> |
| 50 | <varSTRING> → String id <initSTRING> |
| 51 | <initSTRING> → is <value4> <ids4> |
| 52 | <initSTRING> → <ids4> |
| 53 | <varBOOLEAN> → Boolean id <initBOOLEAN> |
| 54 | <initBOOLEAN> → is <value5> <ids5> |
| 55 | <initBOOLEAN> → <ids5> |
| 56 | <ids1> → ; id is <value1> <ids1> |
| 57 | <ids1> → λ |
| 58 | <ids2> → ; id is <value2> <ids2> |
| 59 | <ids2> → λ |
| 60 | <ids3> → ; id is <value3> <ids3> |
| 61 | <ids3> → λ |
| 62 | <ids4> → ; id is <value4> <ids4> |
| 63 | <ids4> → λ |
| 64 | <ids5> → ; id is <value5> <ids5> |
| 65 | <ids5> → λ |
| 66 | <value1> → <numvalue> <Operations1> |
| 67 | <value1> → ( <value1> ) <Op1> |
| 68 | <value2> → <doublevalue> <Operations2> |
| 69 | <value2> → ( <value2> ) <Op2> |
| 70 | <value3> → charlit |
| 71 | <value4> → stringlit |
| 72 | <value5> → boollit |
| 73 | <numvalue> → intlit |
| 74 | <numvalue> → <numelement> |
| 75 | <numelement> → <incdec\_null> id <subelement> <incdec\_null> ; |
| 76 | <incdec\_null> → <incdec> |
| 77 | <incdec\_null> → λ |
| 78 | <Operations1> → <mathOp> <value1> |
| 79 | <Operations1> → λ |
| 80 | <OpInt> → <numvalue> <Operations1> |
| 81 | <OpInt> → ( <value1> ) <Op1> ; |
| 82 | <Op1> → <mathOp> <OpInt> |
| 83 | <Op1> → λ |
| 84 | <doublevalue> → doublelit |
| 85 | <doublevalue> → <numelement> |
| 86 | <Operations2> → <mathOp> <value2> |
| 87 | <Operations2> → λ |
| 88 | <OpDouble> → <doublevalue> <Operations2> |
| 89 | <OpDouble> → ( <value2> ) <Op2> |
| 90 | <Op2> → <mathOp> <OpDouble> |
| 91 | <Op2> → λ |
| 92 | <mathOp> → + |
| 93 | <mathOp> → - |
| 94 | <mathOp> → \* |
| 95 | <mathOp> → / |
| 96 | <mathOp> → % |
| 97 | <incdec> → ++ |
| 98 | <incdec> → -- |
| 99 | <relop1> → == |
| 100 | <relop1> → != |
| 101 | <relop1> → > |
| 102 | <relop1> → < |
| 103 | <relop1> → >= |
| 104 | <relop1> → <= |
| 105 | <logop1> → && |
| 106 | <logop1> → || |
| 107 | <logop2> → ! |
| 108 | <logop2> → λ |
| 109 | <body> → <statements> |
| 110 | <statements> → <functions> . <statements> |
| 111 | <statements> → λ |
| 112 | <functions> → Var <vardec> |
| 113 | <functions> → <varinit> |
| 114 | <functions> → <array> |
| 115 | <functions> → Clear |
| 116 | <functions> → id <id\_choices> |
| 117 | <functions> → <incdec> id <subelement> |
| 118 | <functions> → <io\_statement> |
| 119 | <functions> → <objvar> |
| 120 | <functions> → <IfOtherwise> |
| 121 | <functions> → <loopstate> |
| 122 | <functions> → <option> |
| 123 | <varinit> → <varinitINT> |
| 124 | <varinit> → <varinitDOUBLE> |
| 125 | <varinit> → <varinitCHAR> |
| 126 | <varinit> → <varinitSTRING> |
| 127 | <varinit> → <varinitBOOLEAN> |
| 128 | <varinitINT> → Int id = <INT> |
| 129 | <varinitDOUBLE> → Double id = <DOUBLE> |
| 130 | <varinitCHAR> → Char id = <CHAR> |
| 131 | <varinitSTRING> → String id = <STRING> |
| 132 | <varinitBOOLEAN> → Boolean id = <BOOLEAN> |
| 133 | <INT> → <value1> |
| 134 | <INT> → <task\_id> |
| 135 | <DOUBLE> → <value2> |
| 136 | <DOUBLE> → <task\_id> |
| 137 | <CHAR> → <value3> |
| 138 | <CHAR> → <task\_id> |
| 139 | <STRING> → <value4> |
| 140 | <STRING> → <task\_id> |
| 141 | <BOOLEAN> → <value5> |
| 142 | <BOOLEAN> → <task\_id> |
| 143 | <task\_id> → id ( <param> ) |
| 144 | <param> → <value> <params> |
| 145 | <param> → λ |
| 146 | <params> → ; <param> |
| 147 | <params> → λ |
| 148 | <value> → intlit |
| 149 | <value> → doublelit |
| 150 | <value> → charlit |
| 151 | <value> → stringlit |
| 152 | <value> → boollit |
| 153 | <value> → <input\_id> |
| 154 | <io\_statement> → <input> |
| 155 | <io\_statement> → <output> |
| 156 | <input> → Read id |
| 157 | <output> → Say <input\_statement> |
| 158 | <input\_statement> → stringlit <concat> |
| 159 | <input\_statement> → <input\_id> <concat> |
| 160 | <concat> → , <concat\_value> <concat> |
| 161 | <concat> → λ |
| 162 | <concat\_value> → stringlit |
| 163 | <concat\_value> → <input\_id> |
| 164 | <subelement> → @ id <subelement> |
| 165 | <subelement> → λ |
| 166 | <input\_id> → id <subelement> |
| 167 | <multi> → [ <index> ] |
| 168 | <multi> → λ |
| 169 | <index> → intlit |
| 170 | <index> → id |
| 171 | <IfOtherwise> → If ( <conditions> ) <cond\_loop> <or> <otherwise> EndIf |
| 172 | <or> → Or ( <conditions> ) <cond\_loop> <or> |
| 173 | <or> → λ |
| 174 | <otherwise> → Otherwise <cond\_loop> <control> |
| 175 | <otherwise> → λ |
| 176 | <cond\_loop> → <functions> . <control> <cond\_loop> |
| 177 | <cond\_loop> → λ |
| 178 | <control> → Skip . |
| 179 | <control> → Stop . |
| 180 | <control> → λ |
| 181 | <conditions> → <ids> <condsTail> |
| 182 | <conditions> → <logop2> <multiconds> |
| 183 | <multiconds> → ( <conditions> ) <condsTail> |
| 184 | <ids> → <input\_id> |
| 185 | <ids> → <logop2> <ids\_null> |
| 186 | <ids\_null> → <value5> |
| 187 | <ids\_null> → <task\_id> |
| 188 | <condsTail> → <logOps> |
| 189 | <condsTail> → <relOps> |
| 190 | <condsTail> → λ |
| 191 | <logOps> → <logop1> <conditions> |
| 192 | <logOps> → λ |
| 193 | <relOps> → <relopNum> <numval> |
| 194 | <relOps> → <relopText> <value> |
| 195 | <relopNum> → >= |
| 196 | <relopNum> → <= |
| 197 | <relopNum> → < |
| 198 | <relopNum> → > |
| 199 | <relopText> → == |
| 200 | <relopText> → != |
| 201 | <numval> → intlit |
| 202 | <numval> → doublelit |
| 203 | <option> → Option <input\_id> Start State <optiontails> |
| 204 | <optiontails> → <optiontail1> |
| 205 | <optiontails> → <optiontail2> |
| 206 | <optiontails> → <optiontail3> |
| 207 | <optiontail1> → intlit : <statements> Stop . <state1> <default> End |
| 208 | <optiontail2> → charlit : <statements> Stop . <state2> <default> End |
| 209 | <optiontail3> → stringlit : <statements> Stop . <state3> <default> End |
| 210 | <state1> → State intlit : <statements> Stop . <state1> |
| 211 | <state1> → λ |
| 212 | <state2> → State charlit : <statements> Stop . <state2> |
| 213 | <state2> → λ |
| 214 | <state3> → State stringlit : <statements> Stop . <state3> |
| 215 | <state3> → λ |
| 216 | <default> → Default : <statements> |
| 217 | <default> → λ |
| 218 | <incdecvar> → <incdec> id |
| 219 | <incdecvar> → id <incdec> |
| 220 | <incdecvar> → λ |
| 221 | <loopstate> → Until ( <conditions> ) <cond\_loop> Loop |
| 222 | <loopstate> → Do <cond\_loop> LoopIf ( <conditions> ) |
| 223 | <loopstate> → For ( <initialize> ; <cond> ; <incdecvar> ) <cond\_loop> Loop |
| 224 | <initialize> → id = intlit |
| 225 | <initialize> → λ |
| 226 | <cond> → id <relop1> intlit |
| 227 | <cond> → λ |
| 228 | <taskdef> → Task <returntype> End . <taskdef> |
| 229 | <taskdef> → λ |
| 230 | <returntype> → Int id : <taskbody> . Response <returnINT> . |
| 231 | <returntype> → Double id : <taskbody> . Response <returnDOUBLE> . |
| 232 | <returntype> → Char id : <taskbody> . Response <returnCHAR> . |
| 233 | <returntype> → String id : <taskbody> . Response <returnSTRING> . |
| 234 | <returntype> → Boolean id : <taskbody> . Response <returnBOOLEAN> . |
| 235 | <returntype> → Null id : <taskbody> . |
| 236 | <taskbody> → Start <statements> |
| 237 | <returnINT> → intlit |
| 238 | <returnINT> → id <returntail> |
| 239 | <returnDOUBLE> → doublelit |
| 240 | <returnDOUBLE> → id <returntail> |
| 241 | <returnCHAR> → charlit |
| 242 | <returnCHAR> → id <returntail> |
| 243 | <returnSTRING> → stringlit |
| 244 | <returnSTRING> → id <returntail> |
| 245 | <returnBOOLEAN> → boollit |
| 246 | <returnBOOLEAN> → id <returntail> |
| 247 | <returntail> → ( <param> ) |
| 248 | <returntail> → <subelement> |
| 249 | <returntail> → λ |
| 250 | <StartProgram> → <program> # |