***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 id |
| **9** | <dtype> → Double id |
| **10** | <dtype> → Char id |
| **11** | <dtype> → String id |
| **12** | <dtype> → Boolean id |
| **13** | <object> → Object id Start Var <dtype> . <objdec\_choice> End <varname> |
| **14** | <objdec\_choice> → <objvar> . <objdec\_choice> |
| **15** | <objdec\_choice> → <var> . <objdec\_choice> |
| **16** | <objdec\_choice> → λ |
| **17** | <var> → Var <dtype> |
| **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> <tparams> ) |
| **27** | <tparam> → λ |
| **28** | <tparams> → ; Var <dtype> <tparams> |
| **29** | <tparams> → λ |
| **30** | <array> → Array <dtype> 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> → λ |
| **44** | <varDOUBLE> → Double id <initDOUBLE> |
| **45** | <initDOUBLE> → is <value2> <ids2> |
| **46** | <initDOUBLE> → λ |
| **47** | <varCHAR> → Char id <initCHAR> |
| **48** | <initCHAR> → is <value3> <ids3> |
| **49** | <initCHAR> → λ |
| **50** | <varSTRING> → String id <initSTRING> |
| **51** | <initSTRING> → is <value4> <ids4> |
| **52** | <initSTRING> → λ |
| **53** | <varBOOLEAN> → Boolean id <initBOOLEAN> |
| **54** | <initBOOLEAN> → is <value5> <ids5> |
| **55** | <initBOOLEAN> → λ |
| **56** | <ids1> → ; id <initINT> |
| **57** | <ids1> → λ |
| **58** | <ids2> → ; id <initDOUBLE> |
| **59** | <ids2> → λ |
| **60** | <ids3> → ; id <initCHAR> |
| **61** | <ids3> → λ |
| **62** | <ids4> → ; id <initSTRING> |
| **63** | <ids4> → λ |
| **64** | <ids5> → ; id <initBOOLEAN> |
| **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> → <numelement> |
| **74** | <numvalue> → intlit |
| **75** | <numelement> → <incdec\_null> id <subelement> <incdec\_null> |
| **76** | <Operations1> → <mathOp> <value1> |
| **77** | <Operations1> → λ |
| **78** | <OpInt> → <numvalue> <Operations1> |
| **79** | <OpInt> → ( <value1> ) <Op1> |
| **80** | <Op1> → <mathOp> <OpInt> |
| **81** | <Op1> → λ |
| **82** | <doublevalue> → <numelement> |
| **83** | <doublevalue> → doublelit |
| **84** | <Operations2> → <mathOp> <value2> |
| **85** | <Operations2> → λ |
| **86** | <OpDouble> → <doublevalue> <Operations2> |
| **87** | <OpDouble> → ( <value2> ) <Op2> |
| **88** | <Op2> → <mathOp> <OpDouble> |
| **89** | <Op2> → λ |
| **90** | <mathOp> → + |
| **91** | <mathOp> → - |
| **92** | <mathOp> → \* |
| **93** | <mathOp> → / |
| **94** | <mathOp> → % |
| **95** | <incdec> → ++ |
| **96** | <incdec> → -- |
| **97** | <relop1> → == |
| **98** | <relop1> → != |
| **99** | <relop1> → > |
| **100** | <relop1> → < |
| **101** | <relop1> → >= |
| **102** | <relop1> → <= |
| **103** | <logop1> → && |
| **104** | <logop1> → || |
| **105** | <logop2> → ! |
| **106** | <logop2> → λ |
| **107** | <body> → <statements> |
| **108** | <statements> → <functions> . <statements> |
| **109** | <statements> → λ |
| **110** | <functions> → Var <vardec> |
| **111** | <functions> → <varinit> |
| **112** | <functions> → <array> |
| **113** | <functions> → Clear |
| **114** | <functions> → id <id\_choices> |
| **115** | <functions> → <incdec> id <subelement> |
| **116** | <functions> → <io\_statement> |
| **117** | <functions> → <objvar> |
| **118** | <functions> → <IfOtherwise> |
| **119** | <functions> → <loopstate> |
| **120** | <functions> → <option> |
| **121** | <id\_choices> → [ <index> ] <multi> = <value> |
| **122** | <subelement\_choice> → <incdec> |
| **123** | <subelement\_choice> → = <value>; |
| **124** | <varinit> → <varinitINT> |
| **125** | <varinit> → <varinitDOUBLE> |
| **126** | <varinit> → <varinitCHAR> |
| **127** | <varinit> → <varinitSTRING> |
| **128** | <varinit> → <varinitBOOLEAN> |
| **129** | <varinitINT> → Int id = <INT> |
| **130** | <varinitDOUBLE> → Double id = <DOUBLE> |
| **131** | <varinitCHAR> → Char id = <CHAR> |
| **132** | <varinitSTRING> → String id = <STRING> |
| **133** | <varinitBOOLEAN> → Boolean id = <BOOLEAN> |
| **134** | <INT> → intlit <Operations1> |
| **135** | <INT> → id <intchoices> |
| **136** | <INT> → ( <value1> ) [<Op1>] |
| **137** | <INT> → <incdec> id <subelement> <incdec\_null> <Operations1> |
| **138** | <intchoices> → <intchoice1> |
| **139** | <intchoices> → <intchoice2> |
| **140** | <intchoices> → λ |
| **141** | <intchoice1> → <subelement> <incdec> <Operations1> |
| **142** | <intchoice2> → ( <param> ) |
| **143** | <incdec\_null> → <incdec> |
| **144** | <incdec\_null> → λ |
| **145** | <DOUBLE> → doublelit <Operations2> |
| **146** | <DOUBLE> → id <doublechoices> |
| **147** | <DOUBLE> → ( <value2> ) <Op2> |
| **148** | <DOUBLE> → <incdec> id <subelement> <incdec\_null> <Operations2> |
| **149** | <doublechoices> → <doublechoice1> |
| **150** | <doublechoices> → <doublechoice2> |
| **151** | <doublechoices> → λ |
| **152** | <doublechoice1> → <subelement> <incdec> <Operations2> |
| **153** | <doublechoice2> → ( <param> ) |
| **154** | <CHAR> → <value3> |
| **155** | <CHAR> → <task\_id> |
| **156** | <STRING> → <value4> |
| **157** | <STRING> → <task\_id> |
| **158** | <BOOLEAN> → <value5> |
| **159** | <BOOLEAN> → <task\_id> |
| **160** | <task\_id> → id ( <param> ) |
| **161** | <param> → <value> <params> |
| **162** | <param> → λ |
| **163** | <params> → ; <param> |
| **164** | <params> → λ |
| **165** | <value> → intlit |
| **166** | <value> → doublelit |
| **167** | <value> → charlit |
| **168** | <value> → stringlit |
| **169** | <value> → boollit |
| **170** | <value> → <input\_id> |
| **171** | <io\_statement> → <input> |
| **172** | <io\_statement> → <output> |
| **173** | <input> → Read id |
| **174** | <output> → Say <input\_statement> |
| **175** | <input\_statement> → stringlit <concat> |
| **176** | <input\_statement> → <input\_id> <concat> |
| **177** | <concat> → , <concat\_value> <concat> |
| **178** | <concat> → λ |
| **179** | <concat\_value> → stringlit |
| **180** | <concat\_value> → <input\_id> |
| **181** | <incdecvar> → <incdec> id |
| **182** | <incdecvar> → id <incdec> |
| **183** | <subelement> → @ id <subelement> |
| **184** | <subelement> → λ |
| **185** | <input\_id> → id <subelement> |
| **186** | <multi> → [ <index> ] |
| **187** | <multi> → λ |
| **188** | <index> → intlit |
| **189** | <index> → id |
| **190** | <index> → λ |
| **191** | <IfOtherwise> → If ( <conditions> ) <cond\_loop> <or> <otherwise> EndIf |
| **192** | <or> → Or ( <conditions> ) <cond\_loop> <or> |
| **193** | <or> → λ |
| **194** | <otherwise> → Otherwise <cond\_loop> <control> |
| **195** | <otherwise> → λ |
| **196** | <cond\_loop> → <functions> . <control> <cond\_loop> |
| **197** | <cond\_loop> → λ |
| **198** | <control> → Skip . |
| **199** | <control> → Stop . |
| **200** | <control> → λ |
| **201** | <conditions> → <conditionschoice> |
| **202** | <conditions> → <ids> <condsTail> |
| **203** | <conditions> → <logop2> <multiconds> |
| **204** | <conditionschoice> → <idschoice> <condsTail> |
| **205** | <conditionschoice> → <multiconds> |
| **206** | <multiconds> → ( <conditions> ) <condsTail> |
| **207** | <idschoice> → <logop2> <idschoice1> |
| **208** | <idschoice> → intlit |
| **209** | <idschoice> → doublelit |
| **210** | <idschoice> → charlit |
| **211** | <idschoice> → stringlit |
| **212** | <idschoice1> → id <idsbody> |
| **213** | <idschoice1> → boollit |
| **214** | <idsbody> → <subelement> |
| **215** | <idsbody> → ( <param> ) |
| **216** | <idsbody> → λ |
| **217** | <condsTail> → <logOps> |
| **218** | <condsTail> → <relOps> |
| **219** | <condsTail> → λ |
| **220** | <logOps> → <logop1> <conditions> |
| **221** | <logOps> → λ |
| **222** | <relOps> → <relopNum> <numval> |
| **223** | <relOps> → <relopText> <idschoice> |
| **224** | <relOps> → <relopText> <value> |
| **225** | <relopNum> → >= |
| **226** | <relopNum> → <= |
| **227** | <relopNum> → < |
| **228** | <relopNum> → > |
| **229** | <relopText> → == |
| **230** | <relopText> → != |
| **231** | <numval> → intlit |
| **232** | <numval> → doublelit |
| **233** | <numval> → id <idsbody> |
| **234** | <ids> → <input\_id> |
| **235** | <ids> → <logop2> <ids\_null> |
| **236** | <ids\_null> → <value5> |
| **237** | <ids\_null> → <task\_id> |
| **238** | <option> → Option <input\_id> Start State <optiontails> |
| **239** | <optiontails> → <optiontail1> |
| **240** | <optiontails> → <optiontail2> |
| **241** | <optiontails> → <optiontail3> |
| **242** | <optiontail1> → intlit : <statements> Stop . <state1> <default> End |
| **243** | <optiontail2> → charlit : <statements> Stop . <state2> <default> End |
| **244** | <optiontail3> → stringlit : <statements> Stop . <state3> <default> End |
| **245** | <state1> → State intlit : <statements> Stop . <state1> |
| **246** | <state1> → λ |
| **247** | <state2> → State charlit : <statements> Stop . <state2> |
| **248** | <state2> → λ |
| **249** | <state3> → State stringlit : <statements> Stop . <state3> |
| **250** | <state3> → λ |
| **251** | <default> → Default : <statements> |
| **252** | <default> → λ |
| **253** | <loopstate> → Until ( <conditions> ) <cond\_loop> Loop |
| **254** | <loopstate> → Do <cond\_loop> LoopIf ( <conditions> ) |
| **255** | <loopstate> → For ( <initialize> ; <cond> ; <incdecvar> ) <cond\_loop> Loop |
| **256** | <initialize> → id = intlit |
| **257** | <initialize> → λ |
| **258** | <cond> → id <relop1> intlit |
| **259** | <cond> → λ |
| **260** | <taskdef> → Task <returntype> End . <taskdef> |
| **261** | <taskdef> → λ |
| **262** | <returntype> → Int id : <taskbody> Response <returnINT> . |
| **263** | <returntype> → Double id : <taskbody> Response <returnDOUBLE> . |
| **264** | <returntype> → Char id : <taskbody> Response <returnCHAR> . |
| **265** | <returntype> → String id : <taskbody> Response <returnSTRING> . |
| **266** | <returntype> → Boolean id : <taskbody> Response <returnBOOLEAN> . |
| **267** | <returntype> → Null id : <taskbody> |
| **268** | <taskbody> → Start <taskbodytail> |
| **269** | <taskbodytail> → <statements> . |
| **270** | <returnINT> → intlit |
| **271** | <returnINT> → id <returntail> |
| **272** | <returnDOUBLE> → doublelit |
| **273** | <returnDOUBLE> → id <returntail> |
| **274** | <returnCHAR> → charlit |
| **275** | <returnCHAR> → id <returntail> |
| **276** | <returnSTRING> → stringlit |
| **277** | <returnSTRING> → id <returntail> |
| **278** | <returnBOOLEAN> → boollit |
| **279** | <returnBOOLEAN> → id <returntail> |
| **280** | <returntail> → ( <param> ) |
| **281** | <returntail> → <subelement> |
| **282** | <returntail> → λ |
| **283** | <StartProgram> → <program> # |