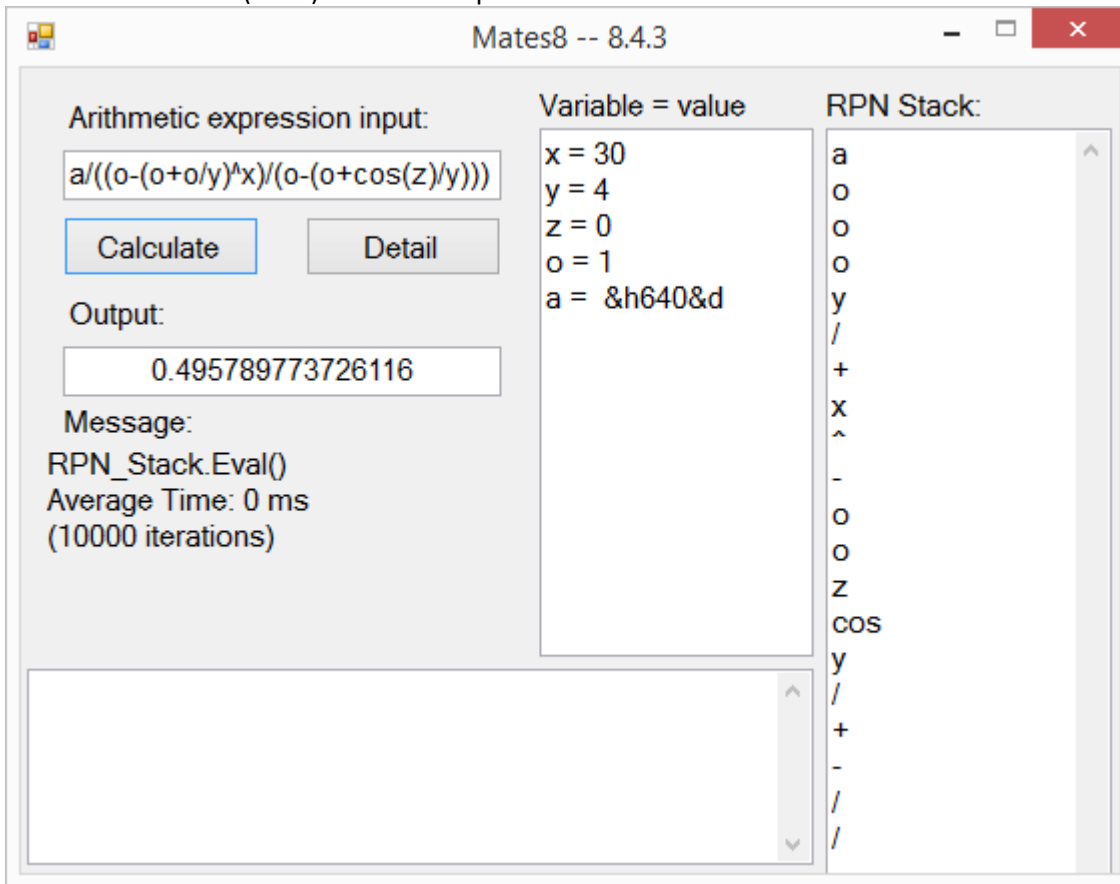
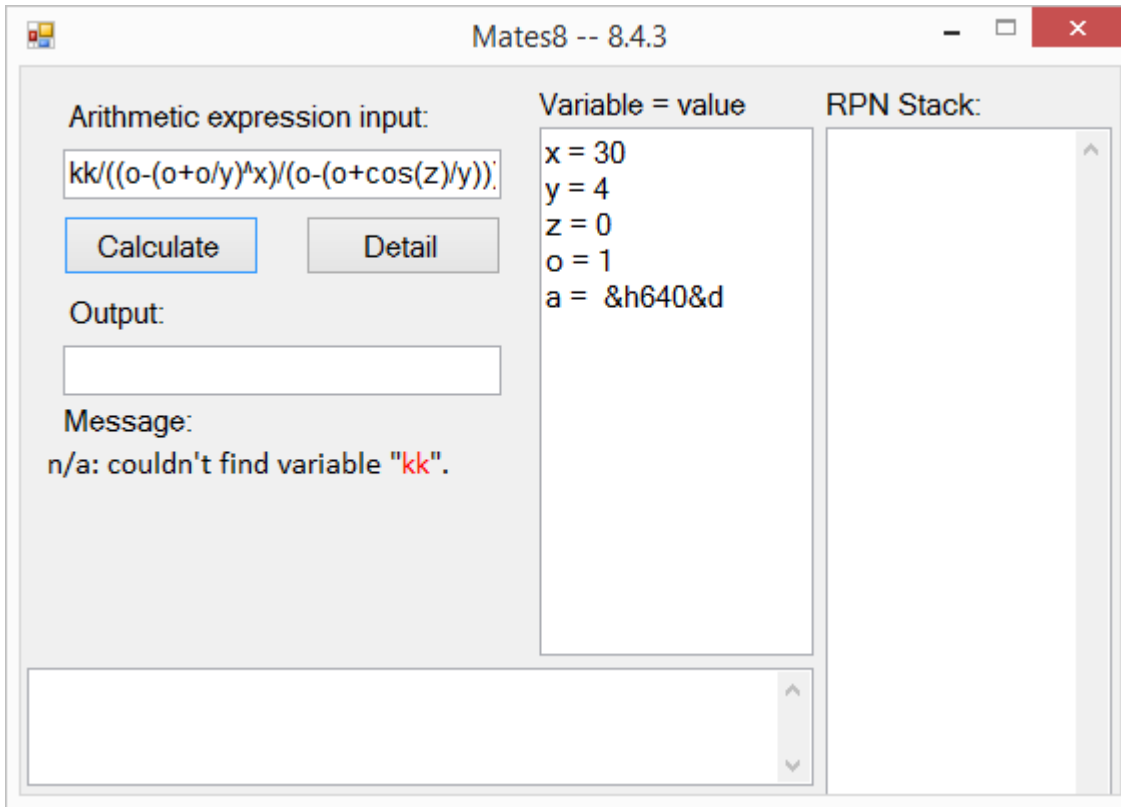


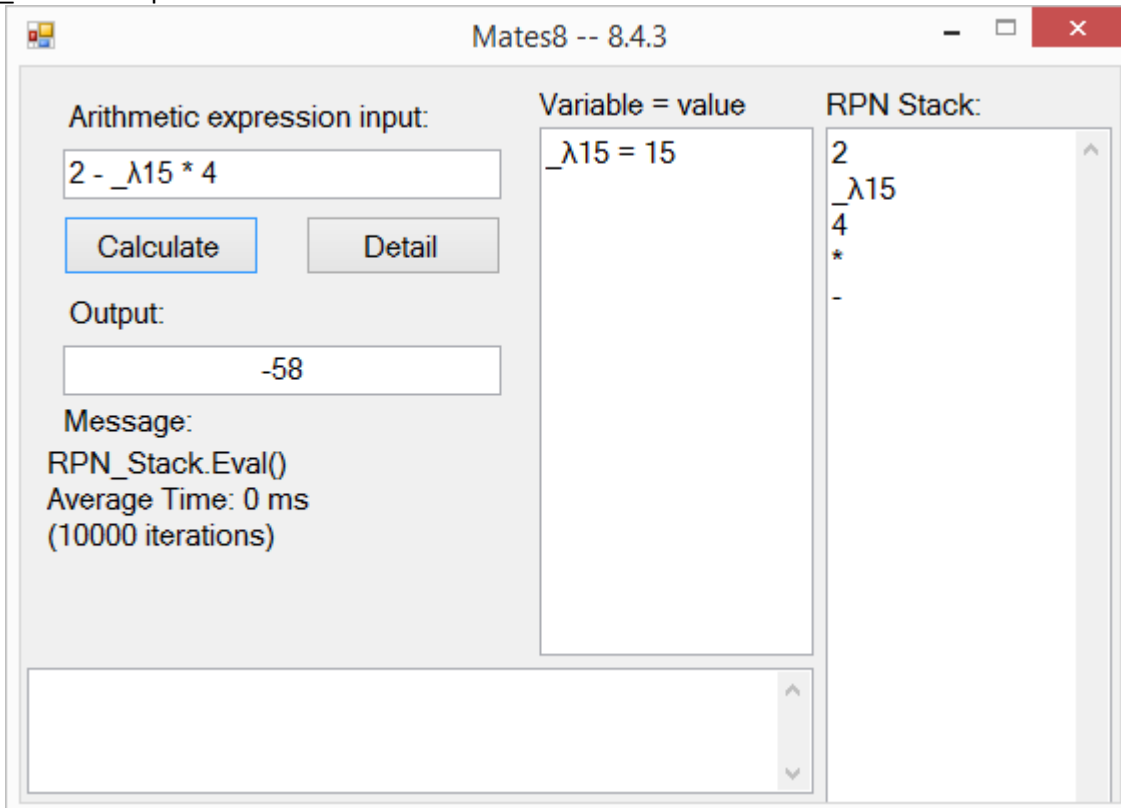
This time classes remain the same four: exprParser, RPN\_Stack, Config and msg8.  
 But current version (8.4.3) has some improvements and new functionalities.



A. Client side.



As you may see, now, variables may be one or more characters long. Names may not contain numbers; if there is the need to include numbers or Greek letters, then the name should be preceded by an underscore “\_”. For example:



Also (you may skip this paragraph if you will be entering all numbers in decimal base) it is possible to enter numbers in hexadecimal, octal or binary base. To do so, the default decimal base may be overridden by the key word &h for hexadecimal, or &o and &b, for octal and binary respectively. Once a base is overridden, the new base prevails for any number, until another token &h, &d, &o or &b is found.

The screenshot shows the Mates8 v8.4.3 interface. The 'Arithmetic expression input' field contains the expression `10 + &h10+10.8+ &d 10 &b + 10`. The 'Calculate' button is highlighted with a red arrow pointing to it, and another red arrow points to the 'Detail' button. The 'Output' field shows the result `54.5` with radio buttons for 'HEXA', 'DECIMAL', and 'BINARY', where 'DECIMAL' is selected. The 'RPN Stack' panel shows the sequence of operations: `10`, `16`, `+`, `16.5`, `+`, `10`, `+`, `2`, `+`. A message at the bottom of the stack panel states: `All stack values are in decimal base.`

The screenshot shows the Mates8 v8.4.3 interface. The 'Arithmetic expression input' field contains the expression `2+ &k 35+3`. The 'Calculate' button is highlighted. The 'Output' field is empty. The 'Message' field displays an error: `n/a, token "&k" is unknown or not allowed.` The 'Variable = value' panel shows the current state of variables: `x = 30`, `y = 4`, `z = 0`, `o = 1`, and `a = &h640&d`. The 'RPN Stack' panel is empty.

## B. The insides

### 1. Class 'exprParser'

```

Private Sub nextExpr() ' - +
Try
  nextTerm()
  Do While curOptor = optor.add OrElse curOptor = optor.substract
    Dim oStk As New StackTkn(tokenType.optor, curOptor, _
      0.0, optorPos, optoriTkn, Chr(curOptor))
    nextTerm()
    rpn1.Add(oStk) ' Add the operator to the stack
  Loop
Catch ex As Exception
  err = ex
End Try
End Sub

Private Sub nextTerm() ' * /
Try
  nextPow()
  Do While curOptor = optor.multiply OrElse curOptor = optor.divide
    Dim oStk As New StackTkn(tokenType.optor, curOptor, _
      0.0, optorPos, optoriTkn, Chr(curOptor))
    nextPow()
    rpn1.Add(oStk) ' Add the operator to the stack
  Loop
Catch ex As Exception
  err = ex
End Try
End Sub

Private Sub nextPow() ' ^ !
Dim sgn As Int32
Try
  nextToken(sgn)
  Do While curOptor = optor.power OrElse curOptor = optor.modulo
    Dim oStk() As StackTkn = _
      {New StackTkn(tokenType.optor, curOptor, _
        0.0, optorPos, optoriTkn, Chr(curOptor))
    }
    If curOptor = optor.power Then ' ^
      .....
    Else
      '%
      nextToken(sgn)
      rpn1.Add(oStk(0)) ' Add operator "%" power to the stack:
      sgn = 1
    End If
    nOpnd -= 1
  Loop
  If sgn = -1 Then
    rpn1.Add(New StackTkn( _
      tokenType.chgSgn, 0, 0.0, chgSgnPos, _
      chgSgniTkn, "-"))
  End If
Catch ex As Exception
  err = ex
End Try
End Sub

```

As you may know from previous documents, or see in the code snippet, 'nextExpr()' calls 'nextTerm()', 'nextTerm()' calls 'nextPow()', and 'nextPow()' calls 'nextToken()'. The execution only exits nextToken under 4 circumstances: the end of tokens has been reached; or an operator, a right parenthesis or an error has been found.

Schematically, nextToken() sub is:

```

Private Sub nextToken(ByRef sgn As Int32, _
    Optional bHasFn As Boolean = False)
    Dim c As Int32
    Dim bNotUnary As Boolean
    Try
        sgn = 1
        Do
            If iRe < sbExpr.Length Then
                iToken += 1
                c = AscW(sbExpr.Chars(iRe))
                If c = 32 Then
                    sbExpr = sbExpr.Remove(iRe, 1) : GoTo retry
                ElseIf c = 45 OrElse c = 43 OrElse c = 42 OrElse c = 47 _
                    OrElse c = 94 OrElse c = 37 OrElse c = 33 Then ' OPERATOR
                    ' OPERATOR
                    .....
                ElseIf curBase = numBase.decimal AndAlso _
                    ((48 <= c AndAlso c <= 57) OrElse c = 46) Then ' N U M B E R
                    .....
                ElseIf ...
                    ..... ' BASE <> DECIMAL ( HEXA, OCTAL, BINARY )
                Else
                    .... ' Is a function?
                    If iRe < iRe2 Then
                        Dim sFnOrVar As String = LCase(sbExpr.ToString.Substring(iRe, iRe2 - iRe))
                        Dim iFn As Int32 = Array.IndexOf(Config.vFn, sFnOrVar)
                        If iFn > -1 Then
                            ' FUNCTION
                        ElseIf Array.IndexOf(vLogOp, sFnOrVar) > -1 Then
                            ' LOGICAL OPERATOR
                        Else
                            Dim posConst As Int32 = Array.IndexOf(Config.vConst, sFnOrVar)
                            If posConst >= 0 Then
                                ' CONSTANT
                            Else
                                ' VARIABLE
                            End If
                        End If
                    End If
                    ElseIf c = 91 OrElse c = 40 OrElse c = 123 Then ' LP
                        .....
                    ElseIf c = 93 OrElse c = 41 OrElse c = 125 Then ' RP
                        .....
                    ElseIf c = 960 Then
                        .... ' (PI)
                    ElseIf c = 38 Then ' 38="&"
                        ..... ' change default numeric base
                    ElseIf c = 39 Then ' 39=""" a comment
                        Exit Do ' end of tokens
                    ElseIf c = 95 Then ' " _ "
                        Dim m As Match = reVar2.Match(sbExpr.ToString, iRe)
                        .....
                    ElseIf c = 58 OrElse c = 247 Then ' division :÷ OPERATORS
                    Else ..... ' error
                End If
            End If
            bNotUnary = True
        End Do
        Loop While iRe < sbExpr.Length
        If bValidate AndAlso err Is Nothing Then
            Validate(tknGnralType.EOTokens, Chr(c))
        End If
        curOptor = -4 ' End Of Tokens
    Catch ex As Exception
        err = ex
    End Try
End Sub

```

In words, nextToken() extracts the next token contained in the input string, i.e. in the stringbuilder sbExpr. The integer iRe holds the current position from which sbExpr has to be analyzed and when a token is extracted, iRe is incremented as much as the length of the token.

When there is an omitted operator, for instance sbExpr.toString = "2x", a first token "2" is extracted and added to the stack, "rpn1.Add(New StackTkn(tokenType.oprnd, ...))". The second token "x" is extracted and, then, a call to exprParser.Validate() will determine operator "\*" is missing. So, "\*" will be inserted in sbExpr ("2\*x") and, without modifying iRe, execution will branch to label "retry:" making "\*" being the current token been analyzed. The same stands for a missing power "^" operator, for example "2x2" will be read as "2\*x^2" and the sequences of tokens will be {"2", "\*", "x", "^", "2"}.

If operands, as numbers, constants and variables are immediately added to the stack; operators defer this.

For input "2+3\*x":

```
Private Sub nextExpr() ' - +
```

```
Try
```

```
nextTerm() ← in the course of this call token "2" is added to the stack (1)
```

(3) returns and curOptor is equal to optor.add, so execution enters the loop

```
Do While curOptor = optor.add OrElse curOptor = optor.substract
```

(4) an instance of StackTkn, oStk, of the operator "+" is generated:

```
Dim oStk As New StackTkn(tokenType.optor, curOptor, _
    0.0, optorPos, optoriTkn, Chr(curOptor))
```

```
nextTerm() ← (5) token "3" is added to the stack, and curOptor contains optor.multiply
rpn1.Add(oStk) ' (8) Add the operator "+" to the stack
```

```
Loop ' (9) exits the loop (curOptor = - 4) and returns back to the initial caller: exprParse.Parse()
```

```
Catch ex As Exception
```

```
err = ex
```

```
End Try
```

```
End Sub
```

```
Private Sub nextTerm() ' * /
```

```
Try
```

```
nextPow() ← in the course of this call token "2" is added to the stack (1); in a second call (5) token "3" is added to the stack, and curOptor contains optor.multiply
```

(2) curOptor is equal to optor.add, so the loop is skipped:

(5) token "3" is added to the stack, and curOptor contains optor.multiply, so execution enters the loop

```
Do While curOptor = optor.multiply OrElse curOptor = optor.divide
```

(6) an instance of StackTkn, oStk, of the operator "\*" is generated:

```
Dim oStk As New StackTkn(tokenType.optor, curOptor, _
    0.0, optorPos, optoriTkn, Chr(curOptor))
```

```
nextPow() ← (5) token "x" is added to the stack, and curOptor contains -4 (end of tokens)
rpn1.Add(oStk) ' (6) Add the operator "*" to the stack
```

```
Loop ' (7) exits the loop (curOptor = - 4) and returns to (8) in nextExpr()
```

```
Catch ex As Exception
```

```
err = ex
```

```
End Try
```

```
End Sub
```

```
Private Sub nextPow() ' ^ !
```

```
Dim sgn As Int32
```

```
Try
```

```
nextToken(sgn)
```

```
Do While curOptor = optor.power OrElse curOptor = optor.modulo
```

.... FOR "2+3\*x" ALWAYS SKIPS THIS LOOP BECAUSE THERE ARE NO POWER OR MODULO OPERATORS

```
Loop
```

```
Catch ex As Exception
```

```
err = ex
```

```
End Try
```

```
End Sub
```