**用tree的一页useerform，包括european，american的call和put, 再算greeks**

**Greeks**

**http://investexcel.net/black-scholes-greeks-vba/**

**Barrier 再一页userform，四个按键组合（down与up一组，in与out一组，以及要输入的变量空格）**

**Barrier option down out**

Function guassrand()

guassrand = Sqr(-2 \* Log(Rnd())) \* Cos(2 \* Application.WorksheetFunction.Pi \* Rnd())

End Function

红色部分是后面都用到的（barrier， lookback，Asia）

Function DOS(S0, K, r, Sigma, T, B, N, M)

Dim epsilon As Double: epsilon = T / N

Dim i As Integer, j As Integer

Dim intermS, intermM, intermP As Double

intermP = 0

For j = 1 To M

intermS = S0

intermM = S0

For i = 1 To N

intermS = intermS \* Exp((r - Sigma \* Sigma / 2) \* epsilon + Sigma \* Sqr(epsilon) \* gaussrand())

intermM = Application.WorksheetFunction.Min(intermM, intermS)

Next i

If intermM > B Then

intermP = intermP + Application.WorksheetFunction.Max(intermS - K, 0)

End If

Next j

Doc = intermP / M \* Exp(-r \* T)

End Function

**Barrier option down in**

Function DOS2(S0, K, r, Sigma, T, B, N, M)

Dim epsilon As Double: epsilon = T / N

Dim i As Integer, j As Integer

Dim intermS, intermM, intermP As Double

intermP = 0

For j = 1 To M

intermS = S0

intermM = S0

For i = 1 To N

intermS = intermS \* Exp((r - Sigma \* Sigma / 2) \* epsilon + Sigma \* Sqr(epsilon) \* gaussrand())

intermM = Application.WorksheetFunction.Min(intermM, intermS)

Next i

If intermM < B Then

intermP = intermP + Application.WorksheetFunction.Max(intermS - K, 0)

End If

Next j

DOC2 = intermP / M \* Exp(-r \* T)

End Function

**Barrier option up in**

Function DOS3(S0, K, r, Sigma, T, B, N, M)

Dim epsilon As Double: epsilon = T / N

Dim i As Integer, j As Integer

Dim intermS, intermM, intermP As Double

intermP = 0

For j = 1 To M

intermS = S0

intermM = S0

For i = 1 To N

intermS = intermS \* Exp((r - Sigma \* Sigma / 2) \* epsilon + Sigma \* Sqr(epsilon) \* gaussrand())

intermM = Application.WorksheetFunction.Max(intermM, intermS)

Next i

If intermM > B Then

intermP = intermP + Application.WorksheetFunction.Max(intermS - K, 0)

End If

Next j

DOC3 = intermP / M \* Exp(-r \* T)

End Function

**Barrier option up out**

Function DOS4(S0, K, r, Sigma, T, B, N, M)

Dim epsilon As Double: epsilon = T / N

Dim i As Integer, j As Integer

Dim intermS, intermM, intermP As Double

intermP = 0

For j = 1 To M

intermS = S0

intermM = S0

For i = 1 To N

intermS = intermS \* Exp((r - Sigma \* Sigma / 2) \* epsilon + Sigma \* Sqr(epsilon) \* gaussrand())

intermM = Application.WorksheetFunction.Max(intermM, intermS)

Next i

If intermM < B Then

intermP = intermP + Application.WorksheetFunction.Max(intermS - K, 0)

End If

Next j

DOC4 = intermP / M \* Exp(-r \* T)

End Function

**Asian option call（另起一页user form建立asian call 和put）**

Function asianC(S0, K, r, Sigma, T, B, N, M)

Dim epsilon As Double: epsilon = T / N

Dim i As Integer, j As Integer

Dim intermS, intermM, intermP As Double

intermP = 0

For j = 1 To M

intermS = S0

intermM = S0

For i = 1 To N

intermS = intermS \* Exp((r - Sigma \* Sigma / 2) \* epsilon + Sigma \* Sqr(epsilon) \* gaussrand())

intermM = intermM+intermS

Next i

intermP= intermM/N

intermP = intermP + Application.WorksheetFunction.Max(intermS - K, 0)

End If

Next j

asianC = intermP / M \* Exp(-r \* T)

End Function

**Asian option put**

Function asianP(S0, K, r, Sigma, T, B, N, M)

Dim epsilon As Double: epsilon = T / N

Dim i As Integer, j As Integer

Dim intermS, intermM, intermP As Double

intermP = 0

For j = 1 To M

intermS = S0

intermM = S0

For i = 1 To N

intermS = intermS \* Exp((r - Sigma \* Sigma / 2) \* epsilon + Sigma \* Sqr(epsilon) \* gaussrand())

intermM = intermM+intermS

Next i

intermP= intermM/N

intermP = intermP + Application.WorksheetFunction.Max(K-intermS, 0)

End If

Next j

asianP = intermP / M \* Exp(-r \* T)

End Function

**另起一页userform**

**Lookback（gauss rand中也用的到）**

**Pdf中有，这里没写**

**Implied volatility (Black scholes European option 用来算volatility)**

http://investexcel.net/implied-volatility-vba/