Приложение 1
Макросы

П1.1. Построение трехмерных информаций

```
Sub Информации3()
'
Dim n As Integer, nn As Integer, tau As Integer
Dim id(150, 450), idn(150, 450), ro(450, 450), ind(450), nnn(450), im(50)
Dim h1(150), h2(150, 150), h3(150, 150, 150)
Dim i2(5, 150), ii2(5, 150), i3(5, 150, 150), ii3(5, 150, 150)
Sheets("Данные").Select
tau = 12
nn = 101
eps = 0.025
n1 = n * (tau + 1)
'Подготовка данных
For i = 1 To n
   im(i) = Cells(1, 1 + i).Value
   For j = 1 To nn
      id(i, j) = Cells(1 + j, 1 + i).Value
   Next
Next
For i = 1 To n
   idmax = id(i, 1)
   idmin = id(i, 1)
   For j = 2 To nn
      If id(i, j) > idmax Then
         idmax = id(i, j)
      End If
      If id(i, j) < idmin Then
         idmin = id(i, j)
      End If
   Next
   For j = 1 To nn
      idn(i, j) = (id(i, j) - idmin) / (idmax - idmin)
   Next
Next
```

```
If tau <> 0 Then
   For tau1 = 1 To tau
      For i = 1 To n
         im(n * tau1 + i) = im(i) + Str(tau1)
         For j = tau1 To nn
            idn(n * tau1 + i, j) = idn(n * (tau1 - 1) + i, j - 1)
         Next
      Next
   Next
End If
'Одномерные энтропии
For i = 1 To n1
   For j1 = 1 To nn - 1
      For j2 = j1 + 1 To nn
         ro(j1, j2) = Abs(idn(i, j1) - idn(i, j2))
      Next
   Next
   h1(i) = Log(nn)
   For t = 1 To nn
      ind(t) = 1
      nnn(t) = 1
   Next
   For t = 1 To nn - 1
      If ind(t) <> 0 Then
         ind(t) = 0
         For t1 = t + 1 To nn
            If ind(t1) <> 0 Then
               If ro(t, t1) <= eps Then
                  ind(t1) = 0
                  nnn(t) = nnn(t) + 1
                  nnn(t1) = 0
               End If
            End If
         Next
      End If
      If nnn(t) <> 0 Then
         h1(i) = h1(i) - nnn(t) * Log(nnn(t)) / nn
      End If
```

```
   Next
   h1(i) = h1(i) / Log(2)
   For tau1 = 1 To tau
      h1(i + tau1) = h1(i)
   Next
Next
'Двухмерные энтропии
For i = 1 To n1 - 1
   For tau1 = 0 To tau
      For j = 1 To n
         i1 = n * tau1 + j
         For j1 = tau1 + 1 To nn - 1
            For j2 = j1 + 1 To nn
               ro(j1, j2) = ((idn(i, j1) - idn(i, j2)) ^ 2 + (idn(i1, j1) - idn(i1, j2)) ^ 2)
               ^ 0.5
            Next
         Next
         h2(i, i1) = Log(nn)
         For t = tau1 + 1 To nn
            ind(t) = 1
            nnn(t) = 1
         Next
         For t = tau1 + 1 To nn - 1
            If ind(t) <> 0 Then
               ind(t) = 0
               For t1 = t + 1 To nn
                  If ind(t1) <> 0 Then
                     If ro(t, t1) <= eps Then
                        ind(t1) = 0
                        nnn(t) = nnn(t) + 1
                        nnn(t1) = 0
                     End If
                  End If
               Next
            End If
            If nnn(t) <> 0 Then
               h2(i, i1) = h2(i, i1) - nnn(t) * Log(nnn(t)) / (nn - tau1)
            End If
```

```
            Next
            h2(i, i1) = h2(i, i1) / Log(2)
            h2(i1, i) = h2(i, i1)
        Next
    Next
Next
'Трехмерные энтропии
For i = 1 To n1 - 2
    For i1 = i + 1 To n1 - 1
        For tau1 = 0 To tau
            For j = 1 To n
                ii = n * tau1 + j
                For j1 = tau1 + 1 To nn - 1
                    For j2 = j1 + 1 To nn
                        ro(j1, j2) = ((idn(i, j1) - idn(i, j2)) ^ 2 + (idn(i1, j1) - idn(i1, j2)) ^
                        2 + (idn(ii, j1) - idn(ii, j2)) ^ 2) ^ 0.5
                    Next
                Next
                h3(i, i1, ii) = Log(nn)
                For t = tau1 + 1 To nn
                    ind(t) = 1
                    nnn(t) = 1
                Next
                For t = tau1 + 1 To nn - 1
                    If ind(t) <> 0 Then
                        ind(t) = 0
                        For t1 = t + 1 To nn
                            If ind(t1) <> 0 Then
                                If ro(t, t1) <= eps Then
                                    ind(t1) = 0
                                    nnn(t) = nnn(t) + 1
                                    nnn(t1) = 0
                                End If
                            End If
                        Next
                    End If
                    If nnn(t) <> 0 Then
                        h3(i, i1, ii) = h3(i, i1, ii) - nnn(t) * Log(nnn(t)) / (nn - tau1)
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            End If
        Next
        h3(i, i1, ii) = h3(i, i1, ii) / Log(2)
        h3(i, ii, i1) = h3(i, i1, ii)
        h3(i1, i, ii) = h3(i, i1, ii)
        h3(i1, ii, i) = h3(i, i1, ii)
        h3(ii, i, i1) = h3(i, i1, ii)
        h3(ii, i1, i) = h3(i, i1, ii)
      Next
    Next
  Next
Next
'Двухмерные информации и коэффициенты информативности
For i = 1 To n
  For j = 1 To n1
    i2(i, j) = h1(i) + h1(j) - h2(i, j)
    ii2(i, j) = i2(i, j) / h1(i)
  Next
Next
'Трехмерные информации и коэффициенты информативности
For i = 1 To n
  For j = 1 To n1 - 1
    For j1 = j + 1 To n1
      i3(i, j, j1) = h1(i) + h2(j, j1) - h3(i, j, j1)
      ii3(i, j, j1) = i3(i, j, j1) / h1(i)
    Next
  Next
Next
Sheets("3").Select
For i = 1 To n
  Cells(1, 1 + i).Value = im(i)
  Cells(1, 2 + n + i).Value = im(i)
  Cells(1, 3 + 2 * n + i).Value = im(i)
  Cells(2, 1 + i).Value = h1(i)
  For j = 1 To n1
    If i = 1 Then
      Cells(2 + j, 1).Value = im(j)
    End If
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      If j = i Then
         Cells(2 + j, 1 + i).Value = "*"
         Cells(2 + j, 2 + n + i).Value = "*"
         Cells(2 + j, 3 + 2 * n + i).Value = "*"
      Else
         Cells(2 + j, 1 + i).Value = h2(i, j)
         Cells(2 + j, 2 + n + i).Value = i2(i, j)
         Cells(2 + j, 3 + 2 * n + i).Value = ii2(i, j)
      End If
   Next
   k = 0
   For j = 1 To n1 - 1
      For j1 = j + 1 To n1
         k = k + 1
         If i = 1 Then
            Cells(2 + n + k, 1).Value = im(j) + "," + im(j1)
         End If
         If j = i Then
            Cells(2 + n + k, 1 + i).Value = "*"
            Cells(2 + n + k, 2 + n + i).Value = "*"
            Cells(2 + n + k, 3 + 2 * n + i).Value = "*"
         Else
            If j1 = i Then
               Cells(2 + n + k, 1 + i).Value = "*"
               Cells(2 + n + k, 2 + n + i).Value = "*"
               Cells(2 + n + k, 3 + 2 * n + i).Value = "*"
            Else
               Cells(2 + n + k, 1 + i).Value = h3(i, j, j1)
               Cells(2 + n + k, 2 + n + i).Value = i3(i, j, j1)
               Cells(2 + n + k, 3 + 2 * n + i).Value = ii3(i, j, j1)
            End If
         End If
      Next
   Next
Next
End Sub
```

П1.2. Построение прогнозов

```
Sub Прогноз3()
'
Dim id(1000), idn(1000), pr(1000)
Dim dat As Date
Sheets("Данные").Select
tau1 = 1
tau2 = 7
t = 101
tt = 13
ttt = 120
eps = 0.005
For t1 = 1 To ttt
   id(t1) = Cells(1 + t1, 2).Value
Next
idmax = id(tau2)
idmin = id(tau2)
For t1 = tau2 + 1 To t
   If id(t1) > idmax Then
      idmax = id(t1)
   End If
   If id(t1) < idmin Then
      idmin = id(t1)
   End If
Next
For t1 = 1 To ttt
   idn(t1) = (id(t1) - idmin) / (idmax - idmin)
Next
For t2 = tt To ttt
   pr(t2 + 1 - tt) = 0
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```
            pr1 = 0
            eps1 = eps
            While pr1 = 0
               For t1 = tau2 + 1 To t
                  ro = ((idn(t1 - tau1) - idn(t2 - tau1)) ^ 2 + (idn(t1 - tau2) - idn(t2 -
tau2)) ^ 2) ^ 0.5
                  If ro <= eps1 Then
                     pr(t2 + 1 - tt) = pr(t2 + 1 - tt) + id(t1)
                     pr1 = pr1 + 1
                  End If
               Next
               eps1 = eps1 + 0.1 * eps
            Wend
            pr(t2 + 1 - tt) = pr(t2 + 1 - tt) / pr1
         Next
         'Печать результата
         Sheets("Прогноз3").Select
         For t2 = tt To ttt
            Cells(t2 + 2 - tt, 2).Value = id(t2)
            Cells(t2 + 2 - tt, 3).Value = pr(t2 - tt + 1)
            Cells(t2 + 2 - tt, 4).Value = pr(t2 - tt + 1) - id(t2)
         Next
         End Sub
```