1. Constructing Greek-Neutral Portfolios of European Stock Options
(This example is one of the demos of the Financial Toolbox, ftspex4.m)

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Filename FTSPEX4.M
% Financial Toolbox Solving Problems Example 4:
% Constructing Greek-Neutral Portfolios of European Stock Options
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Part I:  Create a delta-neutral portfolio of two options
% with a $1000 total value.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

optmat = [100      100  0.1   0.2  0.3   0       1
119.1    125  0.25  0.2  0.2   0.025   0
87.2     85  0.19  0.1  0.23  0       1
301.125  315  0.1   0.5  0.25  0.0333  0];

format bank
i = 1:2;

[temp1, temp2] = blsprice(optmat(i,1),optmat(i,2),...
                          optmat(i,3),optmat(i,4),optmat(i,5),optmat(i,6))

   temp1 =
       6.34
        4.04

   temp2 =
        4.36
        4.44

prices = diag([temp1, temp2])'

   prices =
       6.34          4.44

[temp1, temp2] = blsdelta(optmat(i,1),optmat(i,2),...
                          optmat(i,3),optmat(i,4),optmat(i,5),optmat(i,6))

   temp1 =
       0.59
        0.50

   temp2 =
         -0.41
deltas = diag([temp1, temp2])'
deltas =
    0.59    -0.49
A = [deltas
    prices]
    A =
    0.59    -0.49
    6.34    4.44
b = [0
    1000]
b =
    0
    1000.00
amounts = A\b
    amounts =
    86.24
    102.09
values = amounts .* prices'
    values =
    547.10
    452.90

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Part II: Construct a portfolio that is hedged
% locally against delta, gamma, and vega, and has a total value of
% $17,000.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
[temp1, temp2] = blsprice(optmat(:,1),optmat(:,2),
    optmat(:,3),optmat(:,4),optmat(:,5),optmat(:,6))
temp1 =
    6.34
    4.04
    4.82
    19.28
temp2 =
    4.36
    4.44
    1.02
    22.77
prices = [temp1(1) temp2(2) temp1(3) temp2(4)]
    prices =
    6.34
    4.44
    4.82
    22.77
\[
\text{[temp1, temp2] = blsdelta(optmat(:,1),optmat(:,2),...}
\quad \text{optmat(:,3),optmat(:,4),optmat(:,5),optmat(:,6))}
\]

\[
\text{temp1 =}
\begin{array}{c}
0.59 \\
0.50 \\
0.74 \\
0.50
\end{array}
\]

\[
\text{temp2 =}
\begin{array}{c}
-0.41 \\
-0.49 \\
-0.26 \\
-0.48
\end{array}
\]

\[
\text{deltas = [temp1(1) temp2(2) temp1(3) temp2(4)]}
\]

\[
\text{deltas =}
\begin{array}{cccc}
0.59 & -0.49 & 0.74 & -0.48
\end{array}
\]

\[
\text{gammas = blsgamma(optmat(:,1),optmat(:,2),...}
\quad \text{optmat(:,3),optmat(:,4),optmat(:,5),optmat(:,6))}
\]

\[
\text{gammas =}
\begin{array}{c}
0.03 \\
0.04 \\
0.05 \\
0.01
\end{array}
\]

\[
\text{vegas = blsvega(optmat(:,1),optmat(:,2),...}
\quad \text{optmat(:,3),optmat(:,4),optmat(:,5),optmat(:,6))}
\]

\[
\text{vegas =}
\begin{array}{c}
17.43 \\
21.14 \\
8.91 \\
83.52
\end{array}
\]

\[
A = [\text{deltas}
\quad \text{gammas'}
\quad \text{vegas'}
\quad \text{prices}]
\]

\[
A =
\begin{array}{cccc}
0.59 & -0.49 & 0.74 & -0.48 \\
0.03 & 0.04 & 0.05 & 0.01 \\
17.43 & 21.14 & 8.91 & 83.52 \\
6.34 & 4.44 & 4.82 & 22.77
\end{array}
\]

\[
b = [0
\quad 0
\quad 0
\quad 17000]
\]

\[
b =
\begin{array}{c}
0 \\
0 \\
0 \\
17000.00
\end{array}
\]
```
portf_amounts = [A\b]',
portf_amounts =
    -31828.60   -8583.28    23507.90    6306.25

portf_weights = portf_amounts .* prices / 17000
portf_weights =
    -11.88       -2.24       6.67        8.45

portf_values = portf_weights * 17000
portf_values =
    -201924.23  -38076.19   113411.08   143589.33

portf_infomat = [portf_weights
                portf_values
                portf_amounts]

portf_infomat =
    -11.88       -2.24       6.67        8.45
    -201924.23  -38076.19   113411.08   143589.33
    -31828.60   -8583.28    23507.90    6306.25

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% End of FTSPEX4.M
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

2. Plotting Sensitivities of a Portfolio of Options
(The following is one of the Financial Toolbox Graphics Examples, ftgex3.m)

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Filename FTGEX3.M
% Financial Toolbox Graphics Example 3:
% Plotting Sensitivities of a Portfolio of Options
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
range = 20:90;
plen = length(range);
exprice = [75 70 50 55 75 50 40 75 60 35];

rate = 0.1*ones(10,1);
time = [36 36 36 27 18 18 18 9 9 9];
sigma = 0.35*ones(10,1);
numopt = 1000*[4 8 3 5 5.5 2 4.8 3 4.8 2.5];
zval = zeros(36, plen);
color = zeros(36, plen);
```
for i = 1:10
    pad = ones(time(i),plen);
    newr = range(ones(time(i),1),:);

    t = (1:time(i))';
    newt = t(:,ones(plen,1));

    zval(36-time(i)+1:36,:) = zval(36-time(i)+1:36,:) ... 
        + numopt(i) * blsgamma(newr, exprice(i)*pad, ... 
        rate(i)*pad, newt/36, sigma(i)*pad);

    color(36-time(i)+1:36,:) = color(36-time(i)+1:36,:) ... 
        + numopt(i) * bldsdelta(newr, exprice(i)*pad, ... 
        rate(i)*pad, newt/36, sigma(i)*pad);
end

mesh(range, 1:36, zval, color);

view(60,60);
set(gca, 'xdir', 'reverse');
axis([20 90 0 36 -inf inf]);

title('Call Option Sensitivity Measures');
xlabel('Stock Price ($)');
ylabel('Time (months)');
zlabel('Gamma');
set(gca, 'box', 'on');
gcf = colorbar('horiz');
a = findobj(gcf, 'type', 'axes');
set(get(a, 'xlabel'), 'string', 'Delta');

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% End of FTGEX3.M
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%