Chapter 2

Some symbolic programming

2.1 Symbolic program 1

```
% This program illustrates some basic symbolic processing with Matlab.
% It is aimed at the material in the beginning of chapter 2.

% First we define some symbolic variables.
x = sym('x');  % x = number of 19 inch sets
y = sym('y');  % y = number of 21 inch sets
px = sym('px');
py = sym('py');
% Now define the function p which is the profit.
p = (339- .01*x -.003*y)*x + (399-.004*x-.01*y)*y - (4e5+195*x+225*y);

% To display the graph, use the following command.
ezsurf(p,[0,1e4,0,1e4]);
% The toolbar has a 'rotate figure' icon in the middle, next to the hand.
% Try using it to get a better display of the maximum.

% Compute symbolically the partial derivatives of p with respect to x and y.
px = diff(p,x)
py = diff(p,y)

% Now we want to solve the system of equations px = 0, py = 0.
% The solve command will do this - I suggest you check the online
```

```
% documentation.  The expressions px and py are already strings,
% so it is a mistake to put them in single quotes.
% The answer is initially saved as a 'structure' called 'S',
% and the x,y values of the solution are in the components S.x and S.y.
%They are printed as rational numbers unless you force conversion
%to decimal form, which is done with the 'double' command.

S = solve(px,py,x,y)
S.x
S.y

double(S.x)
double(S.y)
```

2.2 Symbolic program 1 output

```
px =

-1/50*x+144-7/1000*y



py =

-7/1000*x-1/50*y+174



S =

    x: [1x1 sym]
    y: [1x1 sym]


ans =

554000/117
```

```
ans =

824000/117


ans =

  4.7350e+003


ans =

  7.0427e+003
```

2.3 Symbolic program 2

```
% This program continues illustrating symbolic processing with Matlab.
% It is aimed at the material in the beginning of chapter 2.
% The TV pricing problem is analyzed for sensitivity of the 19 inch set
% price to the price elasticity, which was .01.  Now we introduce the
% symbolic variable 'a'.

% First we define some symbolic variables, adding the new variable 'a'.
x = sym('x');  % x = number of 19 inch sets
y = sym('y');  % y = number of 21 inch sets
a = sym('a');
px = sym('px');
py = sym('py');
% Now define the function p which is the profit.
p = (339- a*x -.003*y)*x + (399-.004*x-.01*y)*y - (4e5+195*x+225*y);

% Compute symbolically the partial derivatives of p with respect to x and y.
```

```
px = diff(p,x)
py = diff(p,y)

% Now we want to solve the system of equations px = 0, py = 0.
% If we don't specify a value for px and py, the value is assumed to be 0.
% We solve for the maximum profit as a function of 'a'.

S = solve(px,py,x,y)
S.x
S.y
% Since the answer contains the variable 'a', we can't simply convert
% to decimal form.

% Let's plot the solutions as a function of 'a'.  The easiest way is
% using ezplot.  The 'hold command' allows multiple plots on the same
% graph.
% The 'legend' command helps with documention.

ezplot(S.x,[0 .02]);
hold on;
ezplot(S.y, [0 .02]);
hold off;
legend('Price 19 inch', 'Price 21 inch');

s_19 = diff(S.x,a)*a/S.x;
s_21 = diff(S.y,a)*a/S.y;

ezplot(s_19,[.008 .02]);
legend('Sensitivity 19 inch');

control = input('Hit return');

ezplot(s_21,[.008 .02]);
legend('Sensitivity 21 inch');

% The subs function will evaluate the expressions
% s_19 and s_21 at a = .01.
subs(s_19,a,.01)
```

```
subs(s_21,a,.01)
```