```
restart;
```

a)

```
with(ImageTools) :
```

c)

```
org := Read("d:/IMS_tmp/Image1.jpg");
```

```
[ 1..324 x 1..432 x 1..3 Array ]
[ Data Type: float8            ]
[ Storage: rectangular         ]        (2.1)
[ Order: C_order               ]
```

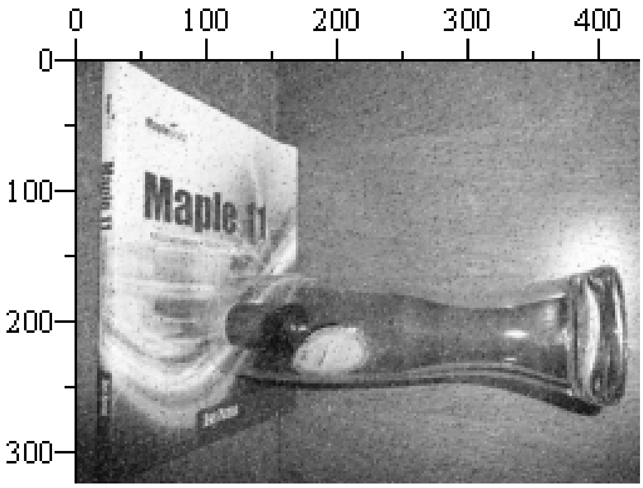
d)

```
gray := ToGrayscale(org);
```

```
[ 1..324 x 1..432 Array ]
[ Data Type: float8     ]
[ Storage: rectangular  ]        (3.1)
[ Order: C_order        ]
```

e)

```
Preview(gray);
```

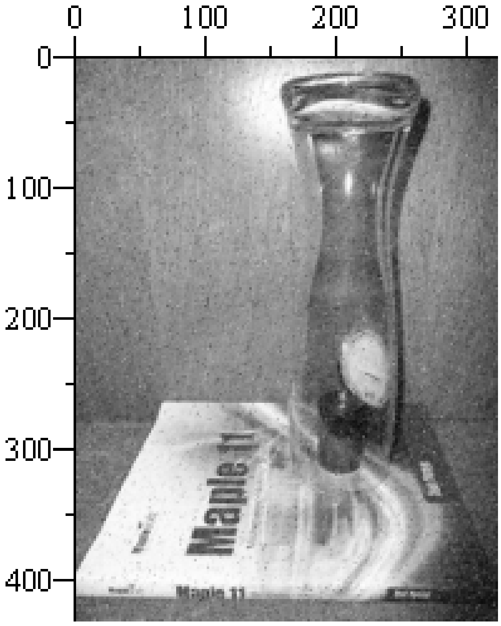


g)

```
rot := Rotate(gray, -90);
```

```
                    [ 1..432 x 1..324 Array ]
                    [  Data Type: float8    ]
                    [ Storage: rectangular  ]                    (5.1)
                    [    Order: C_order     ]
```

```
Preview(rot);
```



h)

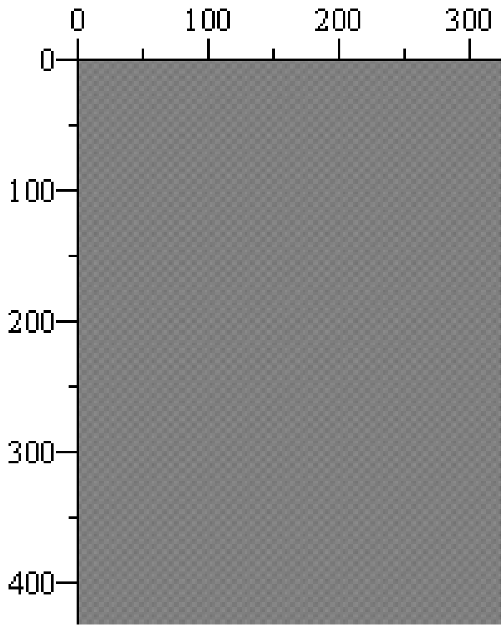
```
chess := Create(Height(rot), Width(rot));
```

```
1..432 x 1..324 Array
Data Type: float8
Storage: rectangular
Order: C_order
```

(6.1)

```
for i to Height(chess) do
 for ii to Width(chess) do
  if i + ii mod 2 = 0 then
   chess[i, ii] := 1;
  else
   chess[i, ii] := 0;
  fi;
 od:
od:
```

```
Preview(chess); # Schöner: View(chess);
```



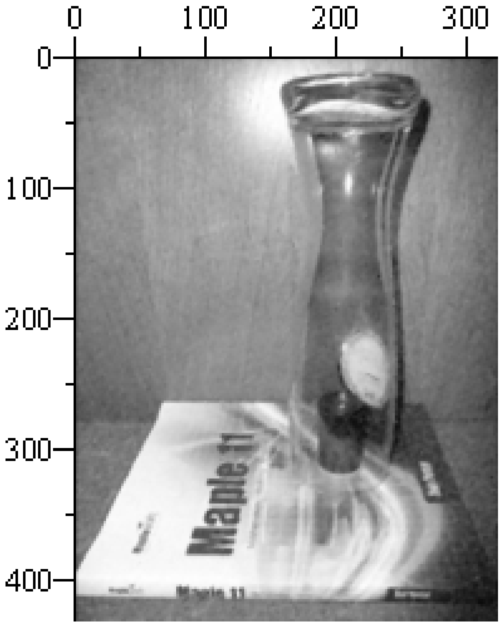
i)

```
filtered := Create(Height(rot), Width(rot));
```

```
1..432 x 1..324 Array
Data Type: float8
Storage: rectangular
Order: C_order                                                    (7.1)
```

```
for i from 2 to Height(filtered) − 1 do
 for ii from 2 to Width(filtered) − 1 do
  filtered[i, ii] := Statistics[Median]([rot[i − 1, ii − 1], rot[i − 1, ii], rot[i − 1, ii + 1], rot[i, ii
    − 1], rot[i, ii], rot[i, ii + 1], rot[i + 1, ii − 1], rot[i + 1, ii], rot[i + 1, ii + 1]]) :
 od:
od:
```

$Preview(\mathit{filtered});$


0
100
200
300
0
100
200
300
400
Maple 11

l)

$$SobelX := \begin{bmatrix} 1 & 0 & -1 \\ 2 & 0 & -2 \\ 1 & 0 & -1 \end{bmatrix};$$

$$\begin{bmatrix} 1 & 0 & -1 \\ 2 & 0 & -2 \\ 1 & 0 & -1 \end{bmatrix} \tag{8.1}$$

$SobelY := LinearAlgebra[Transpose](SobelX);$

$$\begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix} \tag{8.2}$$

$GX := Convolution(filtered, SobelX);$

$$\left[\begin{array}{c} \mathit{1..432\ x\ 1..324\ Array} \\ \mathit{Data\ Type:\ float}_8 \\ \mathit{Storage:\ rectangular} \\ \mathit{Order:\ C\_order} \end{array}\right] \tag{8.3}$$

$GY := Convolution(filtered, SobelY);$

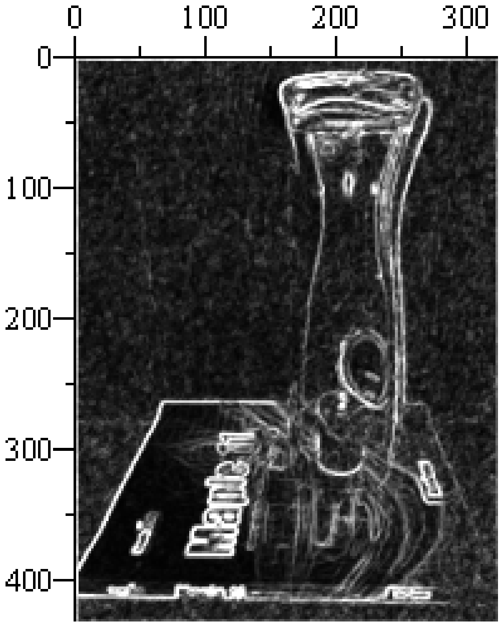
$$\left[\begin{array}{c} \mathit{1..432\ x\ 1..324\ Array} \\ \mathit{Data\ Type:\ float}_8 \\ \mathit{Storage:\ rectangular} \\ \mathit{Order:\ C\_order} \end{array}\right] \tag{8.4}$$

m)

$GS := \mathrm{sqrt}\sim(GX^2 + GY^2);$

$$\left[\begin{array}{c} \mathit{1..432\ x\ 1..324\ Array} \\ \mathit{Data\ Type:\ float}_8 \\ \mathit{Storage:\ rectangular} \\ \mathit{Order:\ C\_order} \end{array}\right] \tag{9.1}$$

$Preview(GS);$


0
100
200
300
0
100
200
300
400