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Question 7

create 3, 4 shaped matrix.

```
three = zeros(7,5); three(1, 1:5) = 1; three(2, 4) = 1;
three(3,3) = 1; three(4,4) = 1; three(5, 5) = 1;
three(6, [1 5]) = 1; three(7,2:4) = 1;
four = zeros(7,5); four(1,4) = 1; four(2,[3,4]) = 1;
four(3,[2,4]) = 1; four(4,[1,4]) = 1; four(5,:) = 1;
four([6,7],4) = 1;
moments = [ 0,0; 0,1; 1,0; 1,1; 0,2; 2,0 ]'; % moments matrix.
```

A:

3 and 4 figures Moments calculations.

```
fprintf("For 3 the moments are:\n");
for ij = moments
        M = getMoment(three, ij(1), ij(2));
        fprintf("M(%g,%g) = %g\n", ij(1),ij(2),M);
end
fprintf("For 4 the moments are:\n");
for ij = moments
        M = getMoment(four, ij(1), ij(2));
        fprintf("M(%g,%g) = %g\n", ij(1),ij(2),M);
end
```

```
For 3 the moments are:
M(0,0) = 14
M(0,1) = -4
M(1,0) = 4
M(1,1) = 0
M(0,2) = 86
M(2,0) = 26
For 4 the moments are:
M(0,0) = 14
M(0,1) = 1
M(1,0) = 3
M(1,1) = 0
M(0,2) = 37
M(2,0) = 21
```

B:

Centers Calculation.

```
x3Center = getMoment(three, 1,0)/getMoment(three, 0,0);
y3Center = getMoment(three, 0,1)/getMoment(three, 0,0);

fprintf("For 3 (xCenter, yCenter) is:(%.3g,%.3g)\n", ...
    x3Center,y3Center);

x4Center = getMoment(four, 1,0)/getMoment(four, 0,0);
y4Center = getMoment(four, 0,1)/getMoment(four, 0,0);

fprintf("For 4 (xCenter, yCenter) is:(%.3g,%.3g)\n", ...
    x4Center,y4Center);
```

```
For 3 (xCenter, yCenter) is:(0.286,-0.286)
For 4 (xCenter, yCenter) is:(0.214,0.0714)
```

C:

Calculate moments with centralization.

```
fprintf("For 3 the centralized moments are:\n");
for ij = moments
        M = getMoment(three, ij(1), ij(2), 'center');
        fprintf("M(%g,%g) = %.3g\n", ij(1),ij(2),M);
end

fprintf("\nFor 4 the centralized moments are:\n");
for ij = moments
        M = getMoment(four, ij(1), ij(2), 'center');
        fprintf("M(%g,%g) = %.3g\n", ij(1),ij(2),M);
end
```

```
For 3 the centralized moments are:
M(0,0) = 14
M(0,1) = -1.78e-15
M(1,0) = 1.78e-15
M(1,1) = 1.14
M(0,2) = 84.9
M(2,0) = 24.9

For 4 the centralized moments are:
M(0,0) = 14
M(0,1) = 1.11e-15
M(1,0) = -1.55e-15
M(1,1) = -0.214
M(0,2) = 36.9
M(2,0) = 20.4
```

Moment Calculation Function:

```
function [ M ] = getMoment(mat,i, j, center)
Calculate matrix i,j Moment considering center of mat as (0,0)
mat - Input Matrix
i - x degree of moment
j - y degree of moment
centralize - optinal default false.
if ~exist('center','var')
  xCenter = 0;
  yCenter = 0;
else
  M00 = getMoment(mat, 0, 0);
  M01 = getMoment(mat, 0, 1);
  M10 = getMoment(mat, 1, 0);
  xCenter = M10/M00;
  yCenter = M01/M00;
end
  center = floor( size(mat) /2);
  Xaxis = -center(2):center(2);
  Yaxis = -center(1):center(1);
  M = 0;
  for x = Xaxis
     for y = Yaxis
         x_mat = x + center(2) + 1;
         y_mat = y + center(1) + 1;
         M = M + mat(y_mat,x_mat) * (x - xCenter)^i * (y - yCenter)^j;
     end
  end
end
```

Published with MATLAB® R2017b