

Contents

- [Task 2](#)
- [Task 3](#)
- [Task 4](#)

```

%%Problem 2 Harr
close all
clear all
A = imread('Meghan_Markle_BW.tif');

nbits = 8;
A = single(A);
%want white -127.5 black 127.5 from 255 0
%when A = 0, -(0-127.5) = 127.5
%when A = 255, -(255-127.5) = -127.5
A = -(A - (2^nbits-1)/2);

%column rastering is just top average, bottom 1/2 differences from each
%column vector

%practice with just one column then generalize
% B1 = A(:,1);

% B2 = 0.5 * (B1(1) + B1(2));
%next term is
% 0.5 * (B1(3) +B1(4));
% B3 = 0.5 * (B1(1) - B1(2));
%put the average in a new matrix

% b3 = [b2;b3];

%ok time to generalize
B2_int = [0;0];
B3_int = [0;0];

for ii = 1:512
    j = 1;
    B1 = A(:,ii);
    for i = 1:2:511

        B2_int(j,ii) = 0.5 * (B1(i) + B1(i+1));

        B3_int(j,ii) = 0.5 * (B1(i) - B1(i+1));

        j = j+1;
    end
    clear B1
end

B4 = [B2_int; B3_int];
B = B4;

B_mg = mat2gray(B);
f0 = figure('Name', 'J=9');

```

```
imshow(B_img)
%title later J=9, post-columns only
title("Proper J=9 post-columns only")
xlabel('pixels')
ylabel('pixels')
%okay for row we just need to transpose and do it again!
```



Task 2

```
B_t = B';
%repeat above process
B6_int = [0;0];
B7_int = [0;0];

for ii = 1:512
    j = 1;
    B5 = B_t(:,ii);
    for i = 1:2:511
```

```

B6_int(j,ii) = 0.5 * (B5(i) + B5(i+1));

B7_int(j,ii) = 0.5 * (B5(i) - B5(i+1));

j = j+1;
end
clear B5
end

B8 = [B6_int; B7_int];
C1 = B8';

C1_mg = mat2gray(C1);
f1 = figure('Name', 'J=8');
imshow(C1_mg)
title("Proper J=8 photo (upper-left corner)")
xlabel('pixels')
ylabel('pixels')

```



Task 3

```

C = B(1:256,1:256);

%repeat the above process just with 256 x 256
B10_int = [0;0];
B11_int = [0;0];
%column
for ii = 1:256
    j = 1;
    B9 = C(:,ii);
    for i = 1:2:255

        B10_int(j,ii) = 0.5 * (B9(i) + B9(i+1));

        B11_int(j,ii) = 0.5 * (B9(i) - B9(i+1));

        j = j+1;
    end
    clear B9
end

B12 = [B10_int; B11_int];

B13_int = [0;0];
B14_int = [0;0];

C2 = B12';

for ii = 1:256
    j = 1;
    B12 = C2(:,ii);
    for i = 1:2:255

        B13_int(j,ii) = 0.5 * (B12(i) + B12(i+1));

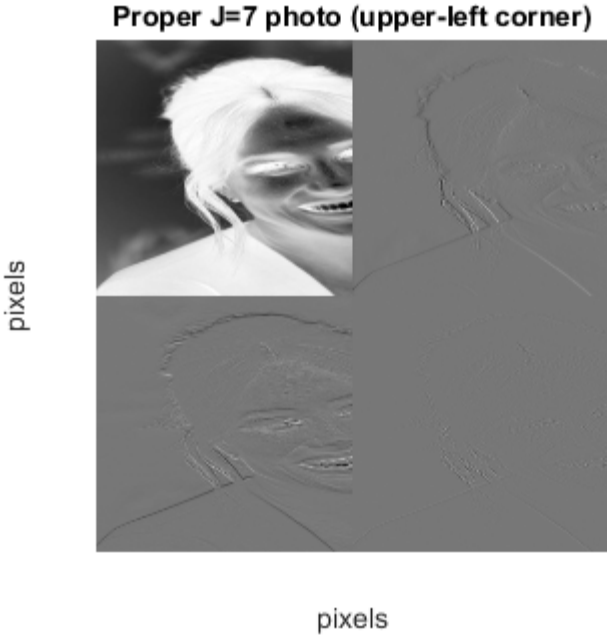
        B14_int(j,ii) = 0.5 * (B12(i) - B12(i+1));

        j = j+1;
    end
    clear B12
end

B15 = [B13_int; B14_int];
C3 = B15';

C3_mg = mat2gray(C3);
f2 = figure('Name', 'J=7');
imshow(C3_mg);
title("Proper J=7 photo (upper-left corner)")
xlabel('pixels')
ylabel('pixels')

```



Task 4

```
%J= 6
C4 = C3(1:128,1:128);

%i probably should make this a function

B17_int = [0;0];
B18_int = [0;0];
%column
for ii = 1:128
    j = 1;
    B16 = C4(:,ii);
    for i = 1:2:127

        B17_int(j,ii) = 0.5 * (B16(i) + B16(i+1));

        B18_int(j,ii) = 0.5 * (B16(i) - B16(i+1));

        j = j+1;
    end
    clear B16
end

B19 = [B17_int; B18_int];

B21_int = [0;0];
B22_int = [0;0];

C5 = B19';

for ii = 1:128
    j = 1;
    B20 = C5(:,ii);
    for i = 1:2:127
```

```

    B21_int(j,ii) = 0.5 * (B20(i) + B20(i+1));

    B22_int(j,ii) = 0.5 * (B20(i) - B20(i+1));

    j = j+1;
end
clear B20
end

B23 = [B21_int; B22_int];
C6 = B23';

C6_mg = mat2gray(C6);
f3 = figure('Name', 'J=6');
imshow(C6_mg);
title("Proper J=6 photo (upper-left corner)")
xlabel('pixels')
ylabel('pixels')
C7 = C3(1:64,1:64);

B24_int = [0;0];
B25_int = [0;0];
%column
for ii = 1:64
    j = 1;
    B23 = C7(:,ii);
    for i = 1:2:63

        B24_int(j,ii) = 0.5 * (B23(i) + B23(i+1));

        B25_int(j,ii) = 0.5 * (B23(i) - B23(i+1));

        j = j+1;
    end
    clear B23
end

B26 = [B24_int; B25_int];

B28_int = [0;0];
B29_int = [0;0];

C8 = B26';

for ii = 1:64
    j = 1;
    B27 = C8(:,ii);
    for i = 1:2:63

        B28_int(j,ii) = 0.5 * (B27(i) + B27(i+1));

        B29_int(j,ii) = 0.5 * (B27(i) - B27(i+1));

        j = j+1;
    end
    clear B27
end

B30 = [B28_int; B29_int];
C9 = B30';

```

```
C9_mg = mat2gray(C9);
f4 = figure('Name', 'J=5');
imshow(C9_mg);
title("Proper J=5 photo (upper-left corner)")
xlabel('pixels')
ylabel('pixels')

f5 = figure('Name', 'pcolor J=5');
C10 = C9(1:32, 1:32);

pcol = pcolor(C10);
colorbar
caxis([-127.5 127.5])
colormap gray
title('pcolor plot of 32x32 J = 5 submatrix')
diary vjHW4_p2.txt
echo on
C10
echo off
```

C10

C10 =

Columns 1 through 7

| | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|
| -38.6250 | -39.0313 | -39.8438 | -39.6563 | -37.3125 | -32.4688 | -25.6250 |
| -42.8438 | -42.1250 | -43.1250 | -44.0000 | -44.3125 | -43.4375 | -40.0625 |
| -45.1563 | -44.6875 | -45.1250 | -46.0938 | -46.9375 | -48.5000 | -48.2188 |
| -46.1875 | -45.8438 | -46.9688 | -47.2813 | -48.4375 | -49.6250 | -49.6563 |
| -46.5000 | -46.8125 | -48.1563 | -48.5938 | -49.2500 | -50.3750 | -51.0625 |
| -47.4063 | -47.2188 | -48.6250 | -49.1563 | -50.3125 | -50.9688 | -52.1563 |
| -49.0000 | -48.6875 | -49.3438 | -50.3750 | -51.3125 | -52.7500 | -53.6563 |
| -50.3750 | -49.8125 | -50.3125 | -52.1875 | -52.5313 | -53.6250 | -53.8750 |
| -50.3125 | -50.1563 | -51.1250 | -52.5313 | -53.3125 | -54.0938 | -54.6563 |
| -51.6563 | -51.4063 | -52.2188 | -53.0313 | -54.0625 | -55.0625 | -55.7813 |
| -52.5938 | -52.0938 | -52.7500 | -53.6250 | -54.7500 | -56.2500 | -56.7188 |
| -53.5000 | -52.9063 | -53.2188 | -54.7500 | -55.5625 | -56.5313 | -57.1250 |
| -53.5625 | -53.7813 | -54.8750 | -55.6563 | -55.9375 | -57.1563 | -57.3125 |
| -53.8125 | -53.8750 | -54.9688 | -56.1250 | -56.8125 | -57.1250 | -57.7188 |
| -54.7188 | -54.5938 | -55.7500 | -57.1250 | -56.9375 | -57.7188 | -58.2813 |
| -55.5938 | -55.0625 | -55.8125 | -57.1875 | -57.0625 | -58.0313 | -58.7188 |
| -55.9688 | -54.8125 | -56.2188 | -57.1875 | -57.1875 | -58.3438 | -58.9688 |
| -55.9063 | -55.6875 | -57.0625 | -56.9688 | -57.0625 | -58.4063 | -59.5313 |
| -55.8438 | -55.7813 | -57.0313 | -57.0938 | -57.3125 | -58.4063 | -59.6250 |
| -55.6875 | -55.3750 | -55.8438 | -57.0938 | -57.1563 | -57.5625 | -59.3125 |
| -55.8438 | -55.0625 | -55.7500 | -56.7188 | -57.3125 | -58.1563 | -58.9063 |
| -55.6563 | -55.1875 | -56.0000 | -57.3125 | -57.1563 | -57.9688 | -59.1875 |
| -55.9688 | -55.2188 | -56.6250 | -57.2500 | -57.5625 | -58.4063 | -58.4063 |
| -56.1875 | -55.6250 | -56.2813 | -57.2188 | -57.2188 | -57.5938 | -57.2188 |
| -55.3125 | -55.1875 | -56.6250 | -57.1563 | -57.2188 | -56.7500 | -56.5000 |
| -55.5313 | -54.7500 | -55.5625 | -56.1563 | -57.2500 | -57.6250 | -56.5938 |
| -53.7500 | -53.7188 | -54.0313 | -55.7500 | -55.8438 | -55.7500 | -55.6563 |
| -49.7500 | -47.7813 | -48.4375 | -47.9688 | -47.7813 | -47.1250 | -46.8125 |
| -42.9688 | -40.4688 | -41.8125 | -39.1250 | -37.3750 | -37.5313 | -35.9375 |
| -40.4063 | -36.2500 | -40.1875 | -38.8125 | -36.4688 | -38.7813 | -38.7813 |
| -44.9688 | -44.2188 | -44.8438 | -46.5313 | -46.5938 | -47.5000 | -48.6250 |
| -50.8750 | -50.1875 | -51.6563 | -52.6250 | -53.8125 | -55.3750 | -56.0313 |

Columns 8 through 14

| | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|
| -20.0625 | -17.5625 | -18.3125 | -24.0625 | -31.6875 | -40.5313 | -47.2500 |
| -35.5313 | -31.5000 | -31.5938 | -33.4688 | -38.3438 | -43.6875 | -50.1563 |
| -46.0313 | -42.0625 | -39.1875 | -36.9688 | -36.7500 | -39.3125 | -44.6250 |
| -46.9063 | -43.2813 | -38.6875 | -33.9375 | -31.0625 | -29.4375 | -32.6563 |
| -50.4063 | -47.1563 | -42.1875 | -35.8750 | -29.6875 | -26.3750 | -26.2500 |
| -52.8125 | -52.8438 | -49.9375 | -46.4063 | -40.3750 | -33.7188 | -29.7500 |
| -54.2500 | -54.5625 | -56.0938 | -54.2500 | -51.4688 | -47.1563 | -40.7188 |
| -55.5313 | -55.9688 | -56.9688 | -57.2188 | -57.7500 | -56.7188 | -52.7500 |
| -56.1250 | -56.6250 | -57.3125 | -57.9063 | -59.0000 | -60.0625 | -58.6563 |
| -56.6875 | -57.1250 | -58.1875 | -59.0313 | -60.7500 | -61.4688 | -62.0313 |
| -57.0000 | -57.6875 | -58.2813 | -59.9688 | -61.3750 | -62.4063 | -63.8125 |
| -57.4688 | -58.1563 | -59.5313 | -60.9063 | -62.0938 | -62.8750 | -63.9375 |
| -58.0000 | -58.8125 | -60.5625 | -61.2813 | -62.5313 | -64.2188 | -64.5938 |
| -59.0625 | -59.9063 | -60.4688 | -61.8750 | -62.9375 | -64.0625 | -64.9063 |
| -59.4063 | -60.5313 | -61.4688 | -62.6563 | -63.5000 | -64.5938 | -65.6563 |
| -59.4063 | -60.7813 | -62.2500 | -63.0938 | -64.2188 | -64.9375 | -66.2188 |
| -60.5000 | -60.8750 | -62.3750 | -63.4063 | -65.2188 | -65.5938 | -67.0938 |
| -60.6250 | -61.3125 | -63.3125 | -63.5000 | -65.2500 | -66.0000 | -67.6250 |
| -60.3750 | -61.4688 | -63.5000 | -63.6875 | -65.2500 | -65.5938 | -67.0313 |
| -60.6563 | -60.9688 | -62.5625 | -63.7188 | -64.7813 | -65.2813 | -66.6563 |
| -60.2813 | -61.1563 | -63.2188 | -63.7500 | -64.6563 | -65.5625 | -66.7813 |
| -59.8125 | -60.8125 | -61.5313 | -61.5938 | -63.0000 | -63.5625 | -64.1875 |
| -57.6875 | -56.8438 | -56.2813 | -55.6250 | -55.7813 | -56.3125 | -56.5938 |
| -55.2813 | -52.8750 | -49.2813 | -47.5313 | -47.4063 | -47.0938 | -48.3125 |
| -53.1250 | -50.0625 | -47.0000 | -43.8125 | -44.5313 | -45.9375 | -49.1563 |
| -55.4063 | -53.7813 | -52.3750 | -51.8750 | -52.7500 | -53.3125 | -55.9375 |
| -54.7500 | -53.8438 | -54.4063 | -54.9375 | -55.7500 | -57.0313 | -57.8750 |
| -46.6250 | -46.0938 | -46.4375 | -47.0938 | -48.0625 | -50.7188 | -50.9375 |
| -36.0625 | -34.5625 | -37.4375 | -40.5000 | -40.2500 | -44.1563 | -45.5000 |
| -38.5000 | -38.4375 | -41.6250 | -45.3125 | -47.0313 | -49.4375 | -53.0625 |
| -49.5625 | -51.0000 | -52.3750 | -52.7500 | -54.2188 | -55.4375 | -56.3750 |
| -56.6875 | -57.0625 | -55.8125 | -55.1563 | -53.1875 | -50.3438 | -49.1875 |

Columns 15 through 21

| | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|
| -50.5000 | -51.5000 | -52.4063 | -52.8750 | -52.9688 | -52.7813 | -48.4063 |
| -53.6563 | -55.0313 | -55.9375 | -56.2813 | -56.6250 | -55.2188 | -51.6250 |
| -49.8125 | -54.6875 | -56.8125 | -58.0938 | -56.9063 | -52.9063 | -46.9375 |
| -38.7813 | -45.5313 | -51.3750 | -52.3750 | -46.8125 | -39.5938 | -33.8438 |
| -28.1250 | -32.6875 | -33.0938 | -32.5313 | -31.1875 | -26.4375 | -26.5938 |
| -27.2500 | -21.2188 | -18.3750 | -17.9063 | -21.5313 | -28.9375 | -35.7500 |
| -33.1563 | -26.0625 | -22.3438 | -24.1875 | -29.3750 | -40.1563 | -51.8125 |
| -44.6250 | -41.1875 | -40.5625 | -40.1563 | -44.0625 | -51.1563 | -58.2188 |
| -56.1875 | -55.0313 | -55.3750 | -53.3438 | -56.5625 | -58.1875 | -58.4375 |
| -61.8750 | -62.4063 | -62.8125 | -59.6875 | -58.7500 | -56.2813 | -39.7500 |
| -64.3125 | -64.6563 | -64.6563 | -60.4688 | -52.2500 | -36.6875 | -13.1250 |
| -64.8750 | -64.4063 | -59.0000 | -48.2188 | -21.4688 | 16.6250 | 32.0938 |
| -65.6250 | -62.5000 | -43.8750 | -50.3438 | -19.0625 | 19.7500 | 69.0938 |
| -65.5938 | -62.9688 | -45.4688 | -53.7813 | -31.1250 | 46.9063 | 99.2500 |
| -66.9375 | -67.8125 | -54.4063 | -3.7500 | 10.0313 | 89.1250 | 101.6250 |
| -67.8438 | -67.5938 | -37.2500 | 7.0938 | 39.1563 | 97.4375 | 105.0625 |
| -67.8750 | -64.5625 | -42.3438 | 18.9688 | 85.3125 | 103.7500 | 107.1875 |
| -68.5625 | -63.9688 | -45.9063 | 47.6563 | 97.6875 | 106.6250 | 106.1250 |
| -65.6250 | -57.5000 | 0.1875 | 86.6875 | 103.9375 | 102.9688 | 103.7813 |
| -63.5000 | -49.5313 | -18.9375 | 28.0000 | 78.1250 | 99.7500 | 106.5938 |
| -66.6250 | -64.3438 | -66.5938 | -68.0938 | -19.1250 | 99.3125 | 107.5313 |
| -61.6563 | -64.5938 | -65.0938 | -62.9375 | 0.2500 | 104.7188 | 105.5625 |
| -55.1250 | -56.4063 | -56.8125 | -48.7813 | -5.3438 | 103.4063 | 104.4375 |

| | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|
| -48.6563 | -50.0000 | -50.3125 | -42.7188 | -12.5000 | 97.5625 | 104.3750 |
| -50.2500 | -52.5000 | -53.5000 | -46.0000 | -34.5938 | 81.8750 | 105.9375 |
| -57.4688 | -58.5938 | -58.0000 | -53.9688 | -40.7188 | 45.8750 | 104.8750 |
| -58.4375 | -58.5625 | -57.9375 | -51.1563 | -31.0938 | 20.2188 | 86.3438 |
| -51.7188 | -51.6250 | -48.1563 | -37.6563 | -25.9063 | -0.6563 | 62.4375 |
| -47.7500 | -50.3438 | -46.1875 | -46.0313 | -31.0313 | -5.9063 | 24.6875 |
| -54.4063 | -53.7500 | -54.8750 | -53.1875 | -42.3750 | -25.8438 | 15.9375 |
| -52.6563 | -53.7813 | -56.4375 | -53.6563 | -52.5938 | -32.5000 | -18.3125 |
| -48.4063 | -42.7813 | -45.5000 | -46.6250 | -43.7188 | -39.0625 | -35.0625 |

Columns 22 through 28

| | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|
| -42.3750 | -34.5313 | -29.9688 | -28.4063 | -29.4688 | -35.9063 | -45.1875 |
| -46.7188 | -42.4688 | -40.0313 | -40.6875 | -44.4688 | -51.6875 | -57.3750 |
| -42.0313 | -41.4375 | -44.5313 | -48.9063 | -54.3750 | -59.0938 | -62.9375 |
| -32.8750 | -36.5938 | -43.0313 | -49.9688 | -55.9375 | -61.2500 | -64.0313 |
| -31.7500 | -40.9688 | -51.2500 | -57.6875 | -61.8750 | -64.4063 | -66.0625 |
| -46.0000 | -54.5313 | -60.2813 | -65.5313 | -66.6250 | -64.7188 | -68.5625 |
| -58.9375 | -63.0625 | -64.2188 | -65.0000 | -62.2500 | -55.2188 | -48.8125 |
| -59.7188 | -51.1875 | -41.2813 | -45.5000 | -42.6250 | -40.6875 | -27.3125 |
| -45.4375 | -42.9063 | -39.7500 | -29.0313 | -8.9063 | 24.1250 | 60.4688 |
| -10.3125 | 42.2188 | 34.4375 | 21.1250 | 73.9375 | 96.5000 | 106.8438 |
| 22.5313 | 74.5313 | 96.5938 | 93.0625 | 102.2813 | 106.7188 | 107.6563 |
| 82.9063 | 98.3438 | 101.4375 | 104.6875 | 107.0938 | 107.4063 | 107.9688 |
| 97.0625 | 100.2188 | 102.3125 | 105.3125 | 107.7813 | 109.4063 | 110.1563 |
| 103.0000 | 102.4063 | 104.6563 | 107.1563 | 108.2500 | 107.2813 | 106.8750 |
| 105.6250 | 106.0625 | 107.4688 | 107.6875 | 107.8438 | 108.9688 | 109.2188 |
| 106.0313 | 106.8125 | 108.9063 | 108.5000 | 108.0625 | 107.1875 | 105.9375 |
| 107.5000 | 105.8750 | 106.2188 | 107.0938 | 107.6250 | 108.3125 | 109.1563 |
| 105.0938 | 106.6250 | 108.7188 | 108.9688 | 109.0625 | 107.6875 | 107.1250 |
| 106.6875 | 109.2188 | 109.0000 | 108.7500 | 106.9688 | 106.9688 | 107.0938 |
| 108.5313 | 108.3125 | 107.1563 | 105.2188 | 107.8438 | 107.9063 | 104.2813 |
| 107.1563 | 106.9063 | 106.2813 | 108.7500 | 106.2188 | 104.4063 | 99.1875 |
| 105.8438 | 105.6563 | 107.3750 | 106.7813 | 107.2813 | 104.4063 | 98.9375 |
| 106.2813 | 108.5625 | 108.6250 | 106.8438 | 107.3438 | 102.3125 | 101.5938 |
| 109.0625 | 110.9063 | 106.8125 | 106.0938 | 107.4063 | 107.2188 | 102.6563 |
| 109.5000 | 107.7188 | 103.9375 | 109.1563 | 109.0313 | 108.8438 | 101.5000 |
| 108.2188 | 103.5000 | 108.2188 | 110.2813 | 111.5313 | 103.5000 | 98.8125 |
| 104.7813 | 104.3125 | 111.0938 | 109.6250 | 108.0313 | 101.6250 | 100.9688 |
| 103.5000 | 107.0625 | 109.8125 | 107.7500 | 107.7500 | 101.7813 | 103.0625 |
| 93.6250 | 105.5313 | 106.2188 | 108.9063 | 105.0938 | 102.9375 | 105.2500 |
| 78.5625 | 104.9375 | 105.6563 | 105.8438 | 104.9063 | 102.7188 | 102.3750 |
| 48.8125 | 91.0000 | 104.1250 | 103.7813 | 101.7813 | 102.5000 | 104.6250 |
| 14.6250 | 58.0938 | 95.0000 | 103.0938 | 103.7500 | 105.7500 | 104.0000 |

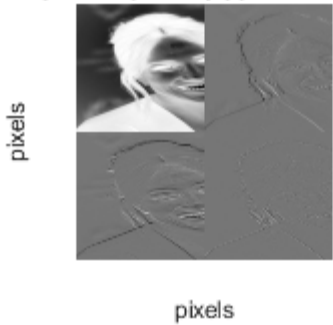
Columns 29 through 32

| | | | |
|----------|----------|----------|----------|
| -53.1250 | -57.9375 | -60.0313 | -60.8750 |
| -61.7188 | -62.8125 | -63.7813 | -64.6563 |
| -64.9688 | -65.3750 | -65.8750 | -66.6875 |
| -65.9375 | -65.6563 | -66.8125 | -67.8438 |
| -66.6250 | -66.6563 | -65.0625 | -65.5938 |
| -67.3125 | -62.9688 | -59.4688 | -39.0625 |
| -50.6250 | -22.6250 | 26.8125 | 51.5938 |
| 13.7188 | 84.2813 | 100.2188 | 104.8438 |
| 94.2813 | 101.5313 | 103.8125 | 104.2188 |
| 109.7813 | 110.4688 | 111.1250 | 110.7813 |
| 108.8750 | 107.9063 | 108.2500 | 109.6875 |
| 108.2500 | 108.4375 | 108.4688 | 109.0313 |
| 110.5000 | 109.4063 | 108.9375 | 108.1563 |
| 106.3125 | 107.7500 | 107.4688 | 107.7188 |

| | | | |
|----------|----------|----------|----------|
| 108.1563 | 108.9063 | 108.2500 | 106.2500 |
| 107.0625 | 107.0000 | 108.2813 | 108.0938 |
| 108.1563 | 107.1250 | 108.0313 | 100.5938 |
| 106.0938 | 105.0000 | 92.1875 | 87.4063 |
| 102.1563 | 93.5000 | 93.2813 | 94.6563 |
| 94.8750 | 96.2813 | 97.6563 | 98.7813 |
| 101.6875 | 100.3125 | 102.0313 | 103.9375 |
| 103.2813 | 101.1250 | 107.5938 | 104.0313 |
| 103.1875 | 103.9375 | 105.7813 | 104.3750 |
| 100.9375 | 105.3125 | 103.2188 | 102.7188 |
| 101.1875 | 107.0000 | 104.4375 | 100.6563 |
| 103.5938 | 106.9063 | 105.5313 | 97.7188 |
| 106.4063 | 105.6563 | 102.3125 | 95.2500 |
| 106.3125 | 102.3438 | 95.9063 | 99.5625 |
| 102.5625 | 99.9375 | 100.1875 | 97.3438 |
| 101.4375 | 101.1250 | 98.0625 | 95.8438 |
| 102.6563 | 99.4375 | 97.0625 | 93.8125 |
| 100.3750 | 97.4688 | 93.4688 | 94.3438 |

echo off

Proper J=6 photo (upper-left corner)



Proper J=5 photo (upper-left corner)

