* 1. Polynomial Transformations

>> f=mat2gray(imread(‘fig0327.tif’));

>>x=0:1/255:1;

>>y1=x.^2;y2=x.^4;y3=x.^.5;y4=x.^.25;

>>figure;plot(x,y1,x,y2,x,y3,x,y4);

* + See class notes for MATLAB plot

>>g1=y1(round(f\*255)+1); --- PRODUCE DARKER IMAGE

>>g2=y2(round(f\*255)+1); --- PRODUCE DARKER IMAGE

>>g3=y3(round(f\*255)+1); --- PRODUCE LIGHTER IMAGE

>>g4=y4(round(f\*255)+1); --- PRODUCE LIGHTER IMAGE

>>figure;imshow(cat(2,f,g1,g2,g3,g4));

* + See class nodes for imshow
* 2. Histogram Equalization
  + Theoretical Foundation: the transformation of random variables
    - Assume continuous random variable
    - x ~ pdf:p(x) and y = T(x) as 1-1 transform, the pdf of the new random variable y is q(y) = p(T^-1(y)) |J| where J is the jacobian of the Transform
      * Jacobian:
        + J = dT-1/dy(y)
    - Import random variable transformations:
      * X = Uniform(0,1) and Y=-m\*ln(X) then Y ~ exponential with mean = m.
        + pdf(X) = 1 when 0<X<1 and 0 else.
        + See class notes for sketch.
        + This is used as a random number generator.
        + Y=-2lnX => q(y) = ½ e^-(y/2)
      * X=N(0,1) with variance of 1.
        + N means standard normal
        + p(X) = (1/sqrt(2pi)) \* e^-((x^2)/2)
        + Consider the transformation Y=X^2.
        + The new distribution Y is Chi-square with single degree of freedom.
        + q(y)=1/sqrt(2pi) \* y^-(1/2)\*e^-(y/2)
      * If X ~ p(X) and Y=P(X); where P(X) is the cumulative distribution of the input random variable X.
        + The output random variable Y has the uniform distribution between 0 and 1.
    - Numerical Example
      * Let an input image f with 3 bits-per-pixel (bpp) resolution have the following histogram:

f | 0 1 2 3 4 5 6 7

h(f) | 790 1023 830 656 329 245 122 81

p(f) | 0.19 0.25 0.21 0.16 0.08 0.06 0.03 0.02

P(f) | 0.19 0.44 0.64 0.81 0.89 0.95 0.98 1.00

g | 1 3 5 6 6 7 7 7

* + - * + TOTAL: h(f) = 4096
        + TOTAL: p(f) = 1.00
        + g = Round(7\*P)

See class notes for graph

* + - * + f has 64 rows and 64 columns

g | 0 1 2 3 4 5 6 7

h(g) | 0 790 0 1023 0 850 985 448