Notice: Choose 1 out of 2 Problems.

1. **Wiener Filter**
   Assume an object \( u(x, y) \) being imaged moved uniformly in the \( y \) direction at a constant speed \( b \). Assume the exposure time is \( T \) second, and the opening and closing of shutter are instantaneous. If we also know that the object \( u(x,y) \) has a correlation function, \( r_x(x, y) = \sigma^2 \exp\{-0.05 |x| -0.05 |y|\} \), and there is an additive random noise of average power \( \sigma_e^2 \).

   (1) Find the Wiener Filter for the system.
   (2) What’s the power spectral density of the Wiener Filter estimator?

2. Given the two scanned images available online --- “coin” and “text document”, we want to design some image enhancement algorithms. The “coin” image has low contrast while the “document” image has some shading problem.

   Consider four options:
   (1) histogram stretching
   (2) unsharp masking
   (3) median filtering
   (4) linear spatial filtering (LP, BP or HP)

   (a) Choose the best option for each image. Explain why you make such a choice.
   (b) Determine the adequate parameters for each algorithm, write a program to simulate the method. Submit the program, input image, and output image.
   Discuss the quality difference between the input and output.
   (c) Use your own image to replace “coin” and/or “document” (Optional)