Tutorial

1. Show that a process with the phase represented by a random variable uniformly distributed in the range 0 to π, is not wide sense stationary.

   Assume the process is $A\cos(\omega t + \theta)$ where θ is randomly distributed in the range 0 to π.

   If the process is not wide sense stationary, can it be modelled using its first and second order statistics?

   Demonstrate that this process is wide sense stationary if the phase is uniformly distributed in the range 0 to 2π.

2. Given a first order autobinomial MRF with parameters $\beta_1 = 1.9$ $\beta_2 = -0.5$ and a bias parameter of -1.4, calculate the values of the pixels in figure 1 below after one application of the model. Consider the pixels at the edges of the image to wrap around and the pixels are visited in the order given in figure 2.

0	0	1	1
0	1	0	0
1	1	0	1
0	1	0	1

12	16	11	4
6	2	8	3
14	5	1	10
15	13	9	7

3. Explain the basic idea behind modelling textures using fractals.

   What types of images can be modelled using these techniques?

4. Obtain the grey level co-occurrence matrix of a 5×5 image composed of a checkerboard of alternating 1's and 0's if

   (a) the position operator is defined as one pixel to the right

   (b) the position operator is defined as two pixels to the right

   Assume the top left pixel has the value 0.