

STA 4103/5107: Homework Assignment #5

(Thursday, February 9)

Due: Thursday, February 16

1. Write a matlab program implementing a Gibbs sampler to sample from the Markov Random Field model for binary images introduced in the class. Choose the image size to be 10×10 . Use a random image of 1s and (-1)s to initialize the program. Study the following cases:

a) $H = -1, 0, 1$, and $J = 0$.

b) $H = 0$, and $J = -1, 1$.

c) $H = 4$, and $J = -1, -2$.

Show a sequence (up to 9) of images in each combination of H and J .

Help on image plotting: Assume XX is a 3-dimensional array with size $N \times N \times K$, which denotes a sequence of K $N \times N$ binary images. Then this sequence of images can be plotted as:

```
for k = 1:K
    figure(k);
    if (sum(sum(XX(:,:,k)))==N^2)
        image(255*ones(N,N));
    elseif (sum(sum(XX(:,:,k)))==-N^2)
        image(zeros(N,N));
    else
        imagesc(XX(:,:,k));
    end
    colormap(gray);
    title(sprintf('%d-th run', k));
end
```

Help on neighborhood definition: We define the neighborhoods in an $N \times N$ grid as follows:

```
for i = 1:N
    for j = 1:N
        temp = [i-1,j; i+1,j; i,j-1; i,j+1];
        ngh{i,j} = temp(min(temp, [], 2) >= 1 & max(temp, [], 2) <= N,:);
    end
end
```