**Problem 11.1** The following code will plot 20 realizations of the wiener process:

```matlab
hold on;
for i=1:20;
    x=randn(10000,1);
    w=cumsum(x);
    plot(w,'Color',rand(3,1));
end
```

As you can see, the variance grows but the mean remains 0.

We want to estimate the autocorrelation of this process. This will require us to perform an ensemble average.

Initialize a 2-dimensional array (200X200) to zero:

```matlab
acor=zeros(200,200);
```

For a large number of iterations (1000 or more) perform the following steps:

Generate a segment of white noise by using the randn function in matlab:

```matlab
x=randn(1,200);
```

Using this, generate a realization of the “Brownian motion process” using:

```matlab
w(1)=x(1);
for i=1:200
    w(i)=w(i-1)+x(i);
end
```

Then, compute the correlations:

```matlab
for j=1:200
    for k=1:200
        acor(j,k)=acor(j,k)+w(j)*w(k);
    end
end
```

(You can also use the cumsum to shorten the above code. It will still take a fair amount of time.)

After the above steps have been done iterations times, you can now compute and display the autocorrelation for the w process by normalizing:

```matlab
for i=1:200
    for j=1:200
        acor(i,j)=acor(i,j)/iterations;
    end
end
mesh(acor);
```
For reference, you might want to also compute and display the function $f(i,j) = \min(i,j)$:

```matlab
for i=1:200
    for j=1:200
        fun(i,j)=min(i,j);
    end
end
mesh(fun);
```

**Problem 11.2** Repeat for the following process. First, choose an $r$ between 0 and 1. Then generate realizations of the process by:

```matlab
hold on;
for i=1:10;
    x=randn(1000,1);
    w(1) = x(1);
    for j = 1:1000;
        w(j) = sqrt(1-r) * w(j-1) + r * x(j);
    end;
    plot(w,'Color',rand(3,1));
end;
```