1



2.

Mean = 36.3404

standard deviaton = 3.7258

median = 37.0000

inter-quartile-range = 3.7500

3.

sv(:,:,1) =

0 NaN NaN

0 NaN NaN

36.0000 100.0000 1.4583

33.0000 200.0000 3.3030

27.0000 300.0000 4.3148

23.0000 400.0000 6.6957

sv(:,:,2) =

0 0 0

0 0 0

36.0000 100.0000 5.3472

27.0000 200.0000 9.8704

21.0000 300.0000 18.8810

13.0000 400.0000 27.5385





4.

Variance of a linear combination of stochastic variables looks like:

Var[aX+b] = E[(aX+b)^2] - E[aX+b]^2

= E[a^2 X^2 + b^2 + 2abX] - (E[aX] + E[b])^2

= E[a^2 X^2] + E[b^2] + E[2abX] - E[aX]^2 - E[b]^2 - 2E[abX]

= a^2 E[X^2] - (aE[X])^2

= a^2 E[X^2] - a^2 E[X]^2

=  a^2 (E[X^2] - E[X]^2)

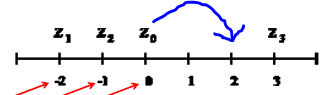
=  a^2 Var[X]

The requirements of covariance matrix are:

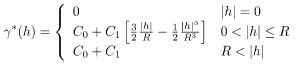
1. larger the sample size,
2. normality,
3. homoscedasticity (homogeneity of variance)

5.

Point estimation is a technique where the value of an unknown point is estimated using known point values around it. There are many different methods that can be used, such as triangulation, the inverse distribution method, or nearest neighbor. In this lab exercise though, we will not worry about finding the actual value of the unknown point, but simply find the weights, Lagrange multiplier and kriging variance of the unknown point, or Z0, using ordinary kriging. The example we are working with is shown below, where Z0 has been moved 2 places to the right, and we know three points around it:



Ordinary kriging involves assigning weights to known values around an unknown point value you want to estimate, based on their distance to the unknown value but also to each other. We know range R, sill C0, C1 and lag h, which is the distance between the two points we are focusing on, so by using the spherical model we can calculate the semi-variogram model. The γ(h) value can be calculated for the spherical model with the equation and parameters shown below:



The equation was completed using 3 different sill values, with C0, C1 respectively being (0,1), (0.5,0.5), and (1,0), with this last case being the example of a full nugget effect. Covariance was derived from this for each h-value by doing 1 – γ. The larger the covariance value, then the closer the points are to each other and therefore the more similar they are.

A 4x4 matrix comparing the covariances between the three points in relation to each other must be created. A 4x1 vector must also be made, with covariance values of each one of the three points in relation to the unknown point value. If matrix A is divided by vector B, we can establish the weight value in each scenario. The kriging variance can then be found by doing 1 – the dotproduct of the weight value and the vector. For each case, starting with C0, C1 being (0,1), the kriging error variance values were found to be 0.3949, 0.9450, and 1.3333, respectively. This value shows that for the first case that was run, the error variance is much lower than the other two, especially from the last scenario were a full nugget effect was observed.

C1=[0,1]

A1 =

1.0000 0.7523 0.0394 1.0000

0.7523 1.0000 0.1481 1.0000

0.0394 0.1481 1.0000 1.0000

1.0000 1.0000 1.0000 0

b1 = [0.1481; 0.3125; 0.7523; 1]

w1 = A\b1;

var = 1 - dot(w1,b1)=0.3949

c2 = [0.5 0.5];

A2 =

1.0000 0.3762 0.0197 1.0000

0.3762 1.0000 0.0740 1.0000

0.0197 0.0741 1.0000 1.0000

1.0000 1.0000 1.0000 0

b2 = [0.0741;0.1563;0.3762;1];

w2 = A2\b2;

var2 = 1-dot(w2,b2)= 0.9450

c3 = [1,0];

A3 =

1 0 0 1

0 1 0 1

0 0 1 1

1 1 1 0

b3 = [0;0;0;1];

w3 = A3\b3;

var3 = 1-dot(w3,b3) =1.3333