1. What is "normal distribution"?　Please describe the definition and properties.　(10%)

2. Please describe "least squares adjustment" with an example, and its relation with normal distribution. (20%)

3. What is conditional adjustment? Please give an example. (10%)

4. Given a set of control points between two coordinate systems in a local area. These control points are $(E67_1, N67_1, E97_1, N97_1)$, $(E67_2, N67_2, E97_2, N97_2)$,…, $(E67_m, N67_m, E97_m, N97_m)$. When the number of m is larger than 2, please provide a procedure to calculate the coefficients of conformal transformation between these two systems. (20%)

5. In a network adjustment, the error covariance matrix of the estimated coordinates of points A and B is

$$\Sigma_z = \begin{bmatrix} 4 & 1 & 0 & 1 \\ 1 & 9 & 3 & 2 \\ 0 & 3 & 4 & 2 \\ 1 & 2 & 2 & 9 \end{bmatrix} \times 10^{-4}\,\mathrm{m}^2, \quad z = \begin{bmatrix} X_A \\ Y_A \\ X_B \\ Y_B \end{bmatrix} \mathrm{m}$$

(a) What is the standard error of the distance between A and B? (10%)

(b) What is the standard error of the azimuth from A to B? (10%)

6. A set of (x,y) pairs is given in the table:

x	y
1	8.21
2	11.96
3	17.86
4	22.81
5	27.11

The pairs are to be fitted by a line using least-squares as:

$y = ax + b$ 。

(1) Compute the estimates of a and b and their error covariance matrix.　(10%)

(2) Compute the value of y at $x=8$ and its standard error. (10%)