

**UNIVERSITY OF SOUTH AUSTRALIA**

DIVISION OF INFORMATION TECHNOLOGY, ENGINEERING AND THE  
ENVIRONMENT

School OF Geoinformatics, Planning and Building  
Semester 1, 1999

**Analysis of Observations N : 10213**

Time Allowed : 3 hours + 10 minutes reading time

**General Instructions to Candidates:**

Total Marks = 100

Attempt ALL questions.

All questions are of equal value.

Please ensure front of answer book is completed with your name, student I.D. number and course.

### QUESTION 1

Discuss :

- a) the major objectives of a least squares adjustment of surveying observations;
- b) the properties of observation equations; and
- c) the method used to allow correct emphasis to be placed on the observed quantities.

### QUESTION 2

The normal equation in the surveying context is generally of the form:

$$N x = d$$

Describe an inversion method for solving the above equation.

### QUESTION 3

The coordinates of two points A and B are as given below. Determine the bearing and the distance of the line AB and the estimates of the errors in those quantities using the data given.

Station	Eastings	Std. Dev.	Northings	Std. Dev.
A	1075.306	0.020	4972.886	0.020
B	3475.209	0.030	5266.113	0.030

### QUESTION 4

The principle of least squares is based on the assumption that if a number of measurements of a quantity are taken, the most probable value is the mean of the individual measurements.

Show that the sum of squares of the residuals from the mean is always less than the sum of squares of the residuals from any other value.