UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

SECOND SEMESTER EXAMINATIONS, MAY 2018

COURSE NO: GM 372
COURSE NAME: Survey Computation and Adjustment II
CLASS: GM III **TIME**: 3 HOURS

Name**:** _____Index Number: _____

SECTION A (A total mark of 20 is to be awarded)

Answer all questions in this section

1. State the condition under which geospatial professionals resort to the use of least squares. [1 mark]
2. State three advantages that the method of least squares offer to the geodetic community. [3 marks]
3. Provide a diagrammatic representation for the elements of least squares adjustment. [3 marks]
4. From a conceptual point of view, explain the difference between ordinary least squares and total least squares. [2 marks]
5. State three differences between generalised least squares and total least squares approach. [3 marks]
6. In least squares adjustment, explain the difference between stochastic and functional model. [2 marks]
7. Briefly describe the two basic forms of the functional model. [6 marks]

SECTION B (A total mark of 40 is to be awarded)

Answer Question 1 and any other one from this section.

Question 1 (Compulsory)

The following present the results of spirit levelling carried out in the field. From a known station A, at an elevation of 76.080 m, the reduced levels of unknown stations U, V and W were each determined using a level instrument. The reduced levels of the stations are given in Table 1. Figure 1 shows a schematic view of the level network.

Table 1: Reduced Levels of Stations (units in metres)

Stations	Spirit Levelling
A	76.080
U	73.355
V	73.831
W	72.966

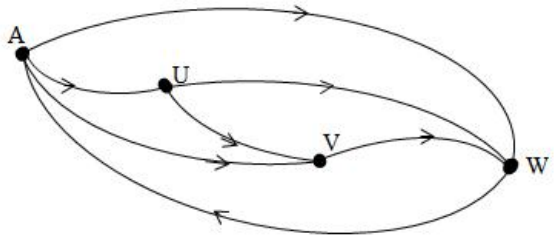

Figure 1: Schematic view of the network

(a) Provide the elevation differences among stations A, U, V and W. [6 marks]

(b) Deduce the observation equations. [6 marks]

(c) Express the observation equations in (b) in the ordinary least squares approach (OLS). Provide the design matrix, observational vector and the solution matrix. [4 marks]

(d) In survey computation and adjustment, explain what is meant by observation equation. [2 marks]

(e) Explain the meaning of an over determined system of equations. [2 marks]

[20 marks]

Question 2

(a) Discuss the advantages of error ellipse in survey computation and adjustment. [10 marks]

(b) Briefly explain the difference between standard error ellipse and standard error rectangle. [3 marks]

(c) With the aid of a diagram, explain why a positional error at a station is said to follow a bivariate normal distribution. [7 marks]

[20 marks]

Question 3

(a) Explain in detail with formulae the fundamental principle of least squares. [10 marks]

(b) The following (x, y) coordinates were obtained from field observations.

A (3.00, 4.50), B (4.25, 4.25), C (5.50, 5.50), D (8.00, 5.50)

(i) Formulate the observational equations from the coordinates based on the straight line equation ($y = mx + c$). [5 marks]

(ii) Provide both the matrices and vector values from the observational equations in (i) using the generalised least squares approach. [5 marks]

Dr Y. Y. Ziggah/ Dr C. B. Boye