GWANDA STATE UNIVERSITY

FACULTY OF ENGINEERING AND ENVIRONMENT

DEPARTMENT OF GEOMATICS AND SURVEYING

ADJUSTMENT COMPUTATIONS 1

ESG 2209

Examination Paper

September 2024

This examination paper consists of 4 pages

Time Allowed: **3 hours**

Total Marks: 100

Examiner: F. Shumba

INSTRUCTIONS

Calculator is required

Answer all questions

QUESTION 1

Define the following terms include formulas and diagrams.

i. Standard deviation
ii. Absolute Error
iii. Direct Measurement
iv. Residual
v. Most probable value
vi. Covariance
vii. Precision
viii. Indirect Measurement
ix. Accuracy
x. Confidence Interval 25 Marks.

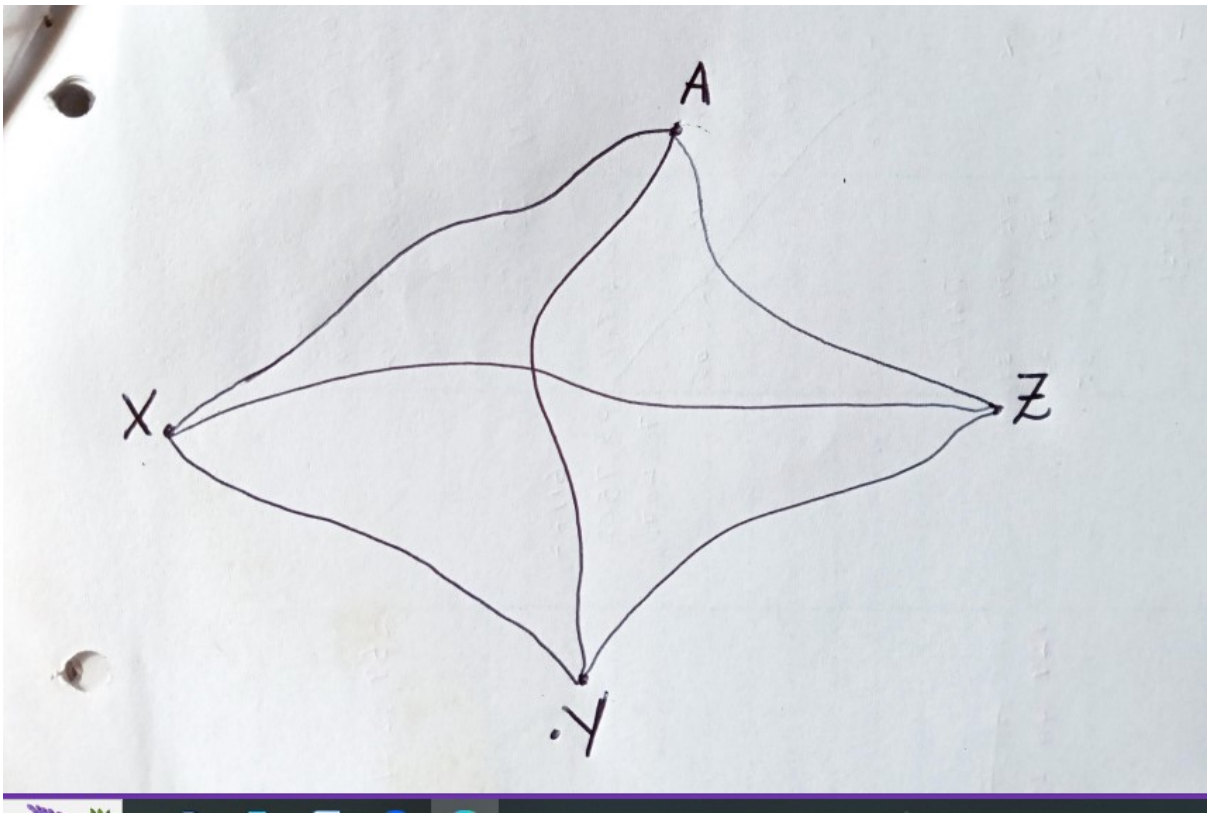
QUESTION 2

Derive the variance covariance matrix of y where $y = a_1x_1 - a_2x_2 + a_3x_3$.

Show for GLOPOV and SLOPOV 25 Marks

QUESTION 3

In the levelling network shown below point A is a benchmark and has an assumed height of 100.00 m and levelling has been undertaken along the lines as shown. The observed height differences were:



Levelling Network

Line	Observed height difference	Approximate line length
AX	12.483 m	5 km
AY	48.351 m	10 km
AZ	5.492 m	7 km
XY	35.883 m	7 km
XZ	-7.093 m	12 km
YZ	-42.956 m	9 km

The standard errors of the observed difference heights are believed to be: $\sigma_h = 0.017\sqrt{K}$ m, where K is the line length in km Find the best estimate of the heights of points X, Y and Z?

25 Marks

QUESTION 4

i. An angle was measured at four different times, with the following results:

Day	Angle	Standard Error
1	$134^0$14'34"	$\pm$12.2"
2	$134^0$14'36"	$\pm$6.7"
3	$134^0$14'28"	$\pm$8.9"
4	$134^0$14'26"	$\pm$9.5"

What is the mpv for the angle and the standard deviation in the mean?

15 Marks

ii. Show from first principles that the Least Squares solution is equal to the most probable value? 10 Marks

THE END