The University of Zambia

School Of Engineering

Department of Geomatic Engineering

20162017 Academic Year Second Half Year

FINAL EXAMINATIONS

GEE 3622: Principles of Data Acquisition and Processing

Monday 28th August 2017

TIME:Three (3) Hours

INSTRUCTIONS:

1. This examination is Closed Book
2. Calculators are permitted
3. ANSWER **ALL** questions from **SECTION A** and one (1) question from **SECTION B**
4. Show all the work leading to the solution
5. Total marks for this examination paper is 100
6. **[ ]** indicates allocated marks for the question

Question 1 (25 marks)

a) Outline **THREE (3)** types of scattering that occur in the earth's atmosphere, giving any possible wavelength dependency of each scattering type.

b) State whether true or false:

i. Active Remote – detect only reflected sunlight or thermal IR and microwaves

ii. Passive Remote – beam own artificially produced energy to a target and record reflected component

iii. The entire range of EMR comprises the electromagnetic spectrum subdivided in divisions called wavelengths that share common characteristics.

iv. Three forms of energy transfer include: absorption, reflection and transmittance

v. The Sun is the major supplier of EM energy incident on the Earth – providing energy needed for terrestrial life and the natural processes operating in the atmosphere, water and upper layers of solid Earth.

vi. EMR travels in a straight path at the speed of light – postulated by Albert Einstein in 1905 as ~ 300,000 km/sec

vii. Electromagnetic Radiation (EMR) is light energy detected when it comes into contact with an object

viii. The visible portion of the EM Spectrum ranges from 0.4m to 0.70m

ix. The most common bands of the EM spectrum used for remote sensing are cosmic, gamma and x-rays.

x. Remote sensing depends upon operation in wavelength regions of spectrum where spectral signatures occur for identification purposes.

Question 2 (25 marks)

1. A mapping project is designed to use aerial photography at a scale of 1:10000 for a preliminary design of a development project covering an area of 20 x 15km. If a 15/23 camera is used with end and side overlaps of 60% and 30% respectively, calculate the following parameters if a flight plan along the longer side of the project boundary is to be prepared at a map scale of 1:20,000;

   i. total number of flight lines

   ii. total number of photographs to cover the project area

Question 3 (25 marks)

a. Explain the term **depth of perception** with respect to stereoscopic viewing.

b. Given that the shortest distance of clear stereoscopic depth perception for an average eye base of 65mm is 250mm, calculate the maximum Parallactic angle.

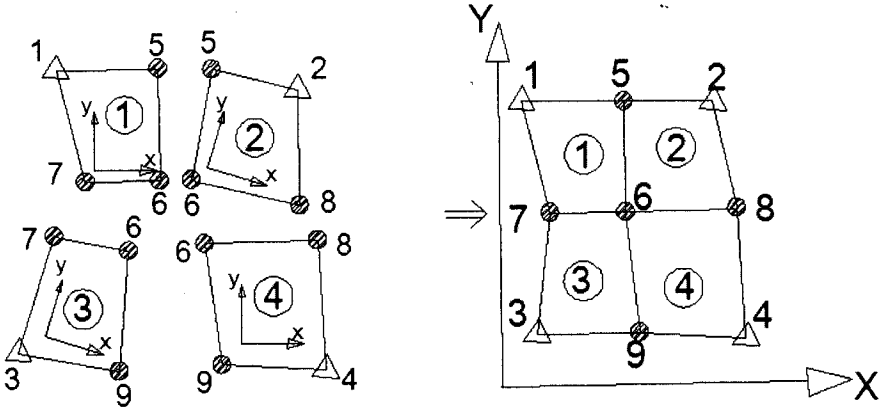
c. Given that the maximum distance at which the stereoscopic depth perception is possible is approximately 600m, calculate the minimum Parallactic angle.

d. Name **THREE (3)** instruments used to measure image coordinates and briefly outline the measurement process involved.

SECTION B

Question 4 (25 marks)

1. The figure below shows four models (1-4) which are observed independently.



a. Briefly, define the adjustment involved in these models?

b. Calculate,
   i. Total number of observation
   ii. Total number of Unknowns
   iii. Number of redundant observations
   iv. Which points represent the tie-points?
   v. Which points represent the control points?

c. Why is the similarity (conformal) transformation used in the Block adjustment by independent models?

d. Mention at least five (5) sources of errors that are normally taken into account in aerial triangulation.

Question 5 (25 marks)

The figure below shows an overlapping pair of truly vertical aerial photographs taken at equal flying height H above mean sea level (MSL) and having equal focal length f. The corresponding images of the ground point P are P_L on the left photo and P_R on the right photograph, respectively. The ground coordinate system XYZ has its origin at the MSL level location O of the left photo camera exposure station, i.e. the **X** and **Y** axes are parallel to the x and y axes of the photo system.

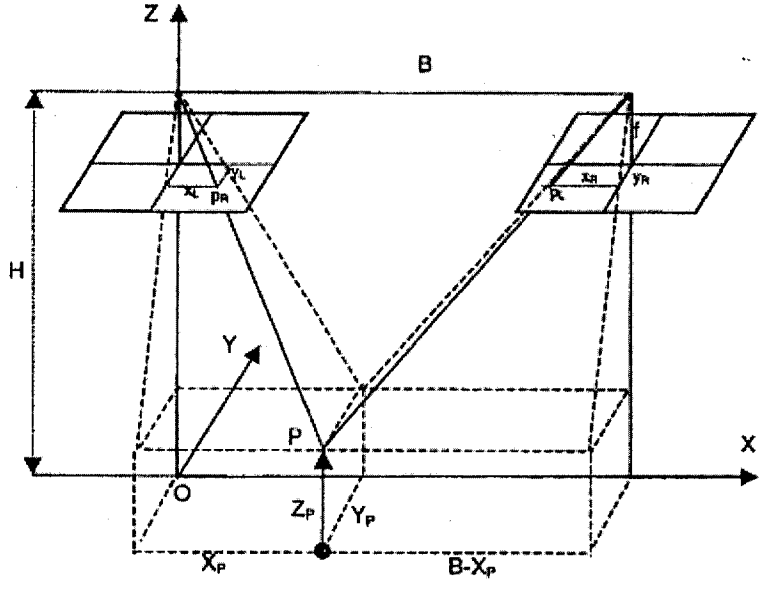
a) Derive the basic parallax equations for the ground coordinates of point P based on the illustrated geometry of the overlapping truly vertical photos.

b) Compute the ground coordinates $\mathbf{X_p Y_p Z_p}$ of point **P** using the previously derived parallax equations for the photo stereo pair, whose Focal length **f**=152mm, the air base **B**=1815m and the flying height **H**=3000m;

and the photo-coordinates of point **P** are:

for the left photo: x_L = +80.00mm y_L = -50.00mm, and

for the right photo: x_R = -20.00mm, y_R = -50.00



END OF EXAMINATION

******GOOD LUCK ******