2. a) Describe two different conditions that are commonly enforced in analytical photogrammetry.

b) Distinguish between **Space Resection** by collinearity and **Space intersection** by collinearity.

c) Aerial photography is to be taken from a flying height of 1830 m above average ground with a camera having a 152.4-mm focal length and a 23cm format. End lap will be 60 percent, and side lap will be 30 percent. What is the ground area covered by a single photograph and by the stereoscopic neat model?

(6+8+11 marks)

3. a) Mention **Three** (3) basic sensor hardware for laser mapping systems.

b) A laser mounted on an airplane emits a pulse that reflects off a target and returns to the sensor in 0.0066000 millisecond. Assume that the pulse is aimed directly down to the datum surface, that the speed of light is 299,792,458 m/s, and that the laser is at exactly 1 km above the datum. What is the object's height above datum?

c) Evaluate the contrasts between airborne laser scanning and (stereo-) photogrammetry from an application perspective.

(6+7+12 marks)

SECTION B

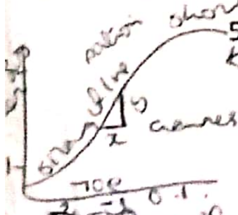
4. a) Briefly, explain what is meant by aerial triangulation.

b) Outline at least three (3) advantages of control extension by aerial triangulation

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

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

(6+9+5+5 marks)



5. a) The relationship between density and exposure of a photographic emulsion can be described by the characteristic curve called *D-log(H)* curve. With the help of a sketch diagram, explain the main components of the curve.

b) State the difference between contact printing and projection printing

c) Explain the five steps involved in processing black and white emulsion.

(10+6+9 marks)

STOP: GO BACK AND CHECK YOUR WORK!

Sharon Chelombo Chepsom

GEE 3622

Example: **Flight Planning**

A study area is 10 km wide in the east-west direction and 16 km long in the north-south direction. A camera having a 152.4-mm-focal-length lens and a 230-mm format is to be used. The desired photo scale is 1:25, 000 and the nominal endlap and sidelap are to be 60 and 30 percent. Beginning and ending flight lines are to be positioned along the boundaries of the study area. The only map available for the area is at a scale of 1: 62,500. This map indicates that the average terrain elevation is 300 m above datum. Perform the computations necessary to develop a flight plan and draw a flight map.

SOLUTION

a) Use north-south flight lines. Note that using north-south flight lines minimizes the number of lines required and consequently the number of aircraft turns and realignments necessary. (Also , flying in a cardinal direction often facilitates the identification of roads, section lines, and other features that can be used for aligning the flight lines.)

b) Find the flying height above terrain (H' =f/S) and add the mean site elevation to find flying height above mean sea level:

$H = f/S + h_{avg} = (0.1524\ m)/(1/25{,}000) + 300\ m = 4110\ m$

c) Determine ground coverage per image from film format size and photo scale:

Coverage per photo = 0.23m/(1/25,000) = 5750 m on a side

d) Determine ground separation between photos on a line for 40 percent advance per photo (i.e., 60 percent endlap):

0.40 x 5750 m = 2300 m between photo centers

e) Assuming an aircraft speed of 160 km/hr, the time between exposures is

(2300m/photo)/160 km/hr x (3600 sec/hr)/ 1000m/km = 51.75 sec (use 51 sec)

f) Because the intervalometer can only be set in even seconds (this varies between models), the number is rounded off. By rounding down, at least 60 percent coverage is ensured. Recalculate the distance between photo centers using the reverse of the above equation:

51 sec/photo x 160 km/hr x (1000 m/km)/ 3600 sec/hr = 2267 m

g) Compute the average number of photos per 16-km line by dividing this length by the photo advance. Add one photo to each end and round the number up to ensure coverage:

(16,000 m/line)/2267 m/photo + 1 + 1 = 9.1 photos/line (use 10)

h) If the flight lines are to have a sidelap of 30 percent of the coverage, they must be separated by 70 percent of the coverage:

0.70 x 5750 m coverage = 4025 m between flight lines

i) Find the number of flight lines required to cover the 10-km study area width by dividing this width by distance between flight lines (note: this division gives number of spaces between flight lines; add 1 to arrive at the number of lines):

(10,000 m width)/ 4025 m/flight line + 1 = 3.48 (use 4)

The adjusted spacing between lines for using four lines is

10,000 m/(4-1 spaces) = 3333 m/space

j) Find the spacing of flight lines on the map (1: 62,500 scale):

3333 m x 1/62500 = 53.3 mm

k) Find the total number of photos needed:

10 photos/line x 4 lines = 40 photos

(NOTE: The first and last flight lines in this example were positioned coincident with the boundaries of the study area. This provision ensures complete coverage of the area under the "better safe than sorry" philosophy. Often, a savings in film, flight lines, and money is realized by experienced flight crews by moving the first and last lines in toward the middle of the study area.)

The University of Zambia
School of Engineering
Department of Geomatic Engineering
2015/6 ACADEMIC YEAR
MID-TERM TEST - JULY 2016

COURSE NAME: **PRINCIPLES OF DATA ACQUISITION AND PROCESSING**
COURSE CODE: GEE 3622
TIME: TWO (2) HOURS
TOTAL MARKS: 100

INSTRUCTIONS

1. **Answer: ALL THREE** (3) QUESTIONS from SECTION A and **ONE** QUESTION from SECTION B
2. This TEST is Closed Book
3. Calculators are permitted
4. Show all the work leading to the solution

SECTION A

1. a) Explain the following terms:

   i. **Depth of field** of a lens

   ii. **Illuminance** of any photographic exposure

   iii. **Panchromatic** emulsion

   iv. **Crab** angle

   v. **Y-Pallax**

b) A vertical aerial photograph was taken with a 152.4-mm-focal-length camera from a flying height of 1385 m above datum. Images *a* and *b* of two ground points A and B appear on the photograph, and their measured photo coordinates (corrected for shrinkage and distortions) are x_a=-52.35 mm, y_a=-48.27 mm, x_b=40.64 mm, and y_b=43.88 mm. Determine the horizontal length of line AB if the elevations of points A and B are 204 and 148 m above datum, respectively.

(2+2+2+2+2+15 marks)

PART B

5. a) Outline briefly atleast **ten (10)** steps involved in the map compilation procedure

b) What range in map scales is possible for a wild A-8 stereoplotter for photography taken with 152 mm focal length camera at a flying height of 3040 meters above mean terrain? Assume that the A-8 is equipped with a coordinatograph capable of 4X reduction or enlargement from model scale and that a projection distance range of A-8 is from 175mm to 350mm.

c) Discuss two (2) main categories of *automation* in photogrammetric instruments.

(10+7+8)

6. a) What kind of viewing systems are used in different types of stereoplotters?

b) What is the purpose of using aerial triangulation?

c) Describe the procedure of aerial triangulation by the independent models method, in two cases:
i) - using a full analytical approach
ii)- using a semi analytical approach

d) Describe the main principles of image correlation.

e) What are the main differences between electronic and digital image correlators?

(4+2+8+6+5)