NATIONAL EXAMS MAY 2014

04-GEOM-A4, PHOTOGRAMMETRY

3 HOURS DURATION

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.

2.
3. This is a CLOSED BOOK exam. Any non-communicating calculator is permitted.
4.
5. SEVEN (7) questions constitute a complete paper.
6.
7. Part A: Answer ALL questions from #1 through #5;
   Part B: Answer ONE of Questions #6 or #7;
   Part C: Answer ONE of Questions #8 or #9;

8. The marks assigned to each question are shown in brackets in the left margin.

PART A - PLEASE ANSWER ALL QUESTIONS FROM #1 THROUGH #5

(10)   **Question 1**

Compute the corrected image coordinates for an image point α located at x_a = 62.579 mm and y_a = -80.916 mm with respect to the photo fiducial axes, if the coordinates of the calibrated principal point are x_p = 0.008 mm and y_p = -0.001 mm and the radial distortion at this image location is Δr = -0.0021 mm.

(15)   **Question 2**

A pair of overlapping vertical photographs were taken from a flying height (H) 1230 m above mean sea level (MSL). The photo-coordinates of two points A and B were measured on both photographs, with the x-photo axis parallel to the flight axis. For the left photograph the photo-coordinates are x_A = 53.41 mm, y_A = 50.84 mm, x_B = 88.92 mm and y_B = -46.69 mm. For the right photograph the photo-coordinates are $x´_A$ = -38.26 mm, $y´_A$ = 50.84 mm, $x´_B$ = -7.06 mm and $y´_B$ = -46.69 mm. The x-coordinates of a point C along the flight line axis are x_c = 14.3 mm and $x´_c$ = -78.3 mm for the left and right photograph, respectively. If the elevation of point C is 590 m above mean sea level, determine the elevations of points A and B.

(15)   **Question 3**

A horizontal stereo-pair of photographs was captured with a terrestrial stereometric camera having a fixed base of 1.20 m and common focal length of 64 mm. The orthometric height of the perspective centers of both cameras is 100 m. The corrected photo-coordinates of two points a and b measured on the left photograph are: x_a=31.40 mm and y_a=23.75mm; x_b=5.10 mm and y_b= -4.25 mm. The x-coordinates measured on the right photograph are $x´_a$=28.00 mm and $x´_b$= -8.25 mm. If the camera base is parallel to the X ground-axis with its positive direction being from the left to right camera and the planimetric ground coordinates of the left perspective center are XL=YL=100 m, determine (a) which point is closer to the camera base and (b) the slope distance AB.

(20)   **Question 4**

Derive the parallax equations from the collinearity equations.

(20) **Question 5**

A simultaneous bundle adjustment aerotriangulation is to be performed for a block of four overlapping images shown in the adjacent figure. The control points are to be held fixed.
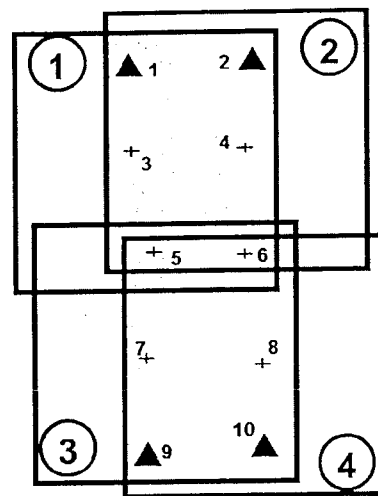
5.1) List the type and give the number of unknowns *(5)*
5.2) List the type and give the number of measurements *(6)*
5.3) Give the mathematical basis and give the number of equations *(6)*
5.4) Give the statistical degrees of freedom *(3)*.

▲   3D control points

+   Pass/tie points

PART B - PLEASE ANSWER ONLY ONE OF QUESTIONS #6 OR #7

(10) **Question 6**
    6.1) What is a true orthophoto? *(3)*
    6.2) What input data is required to generate a digital orthoimage? *(3)*
    6.3) Describe the approach for orthoimage generation. *(4)*

(10) **Question 7**
    7.1) What is image matching and where it is used in photogrammetric operations? *(5)*
    7.2) Describe two methods of image matching used in digital photogrammetry. *(5)*

PART C - PLEASE ANSWER ONLY ONE OF QUESTIONS #8 OR #9

(10) **Question 8**
    Define the following:
    8.1) Nodal points, *(2)*
    8.2) Relief displacement, *(2)*
    8.3) Interior orientation, *(2)*
    8.4) Exterior orientation, *(2)*
    8.5) Direct georeferenecing. *(2)*

(10)   **Question 9**
       Define the following:
       9.1) Depth of field, *(2)*
       9.2) Vanishing points, *(2)*
       9.3) Camera self-calibration, *(2)*
       9.4) Absolute orientation, *(2)*
       9.5) Space resection. *(2)*