

Unit 6 - Week 4: Error, Accuracy, and Adjustments Computations

Course outline

How does an NPTEL online course work?

Week 0: Prerequisite

Week 1: Introduction to Higher Surveying and Coordinate System & Reference Frame

Week 2: Coordinate System and Reference Frame & Time and Astronomy

Week 3: Time and Astronomy & Error, Accuracy, and Adjustments Computations

Week 4: Error, Accuracy, and Adjustments Computations

Quiz : Assignment 4

Lec 1: Applications of error propagation

Lec 2: Observation Equation Method of adjustments

Lec 3: Condition Equation Method and Combined Method of adjustments

Weekly feedback form for week 4

Assignment 4: solutions

Week 5: Error, Accuracy, and Adjustments Computations, GPS & Photogrammetry

Week 6: Photogrammetry

Week 7: Photogrammetry

Week 8: Photogrammetry & LIDAR (LIDARgrammetry)

Week 9: RADAR (RADARgrammetry)

Week 10: RADAR (RADARgrammetry)

Week 11: RADAR (RADARgrammetry) & Hydrographic Survey

Week 12: Hydrographic Survey & Navigation

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Assignment 4

The due date for submitting this assignment has passed. **Due on 2020-02-26, 23:59 IST.**
As per our records you have not submitted this assignment.

1) Calculate the variance of area of right angled triangle if the base and height of the triangle are b and h, respectively. Variance of base and height are σ_b and σ_h , respectively.

a. $\sigma_b^2 h^2/4 + \sigma_h^2 b^2/4$

b. $\sigma_b^2 h^2/2 + \sigma_h^2 b^2/2$

c. $\sigma_b h^2/4 + \sigma_h b^2/4$

d. $\sigma_b^2 h^2/4 + \sigma_h^2 b^2/4$

No, the answer is incorrect. Score: 0

Accepted Answers: a. $\sigma_b^2 h^2/4 + \sigma_h^2 b^2/4$

2) Vector $Y = \begin{bmatrix} y_1 \\ y_2 \end{bmatrix}$ is a function of $X = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$ such that

$$y_1 = 3x_1^2 + 2x_2 + x_3$$

$$y_2 = 5x_2^2 - 4x_1^2$$

Evaluate the Jacobian matrix of Y with respect to X at $x_1 = 2, x_2 = 3, x_3 = 4$

a. $\begin{bmatrix} 12 & 2 & 1 \\ 135 & -16 & 0 \end{bmatrix}$

b. $\begin{bmatrix} 2 & 12 & 1 \\ -16 & 135 & 0 \end{bmatrix}$

c. $\begin{bmatrix} 12 & 2 & 1 \\ -16 & 135 & 0 \end{bmatrix}$

d. $\begin{bmatrix} 1 & 2 & 12 \\ -16 & 135 & 0 \end{bmatrix}$

No, the answer is incorrect. Score: 0

Accepted Answers: c. $\begin{bmatrix} 12 & 2 & 1 \\ -16 & 135 & 0 \end{bmatrix}$

3) For a set of observations, the standard deviation of the mean and the standard deviation of each observation are 0.2 and 0.6, respectively. If mean of the observations is 52, find the total sum of the observations.

a. 567

b. 980

c. 520

d. 468

No, the answer is incorrect. Score: 0

Accepted Answers: d. 468

Read following observations and answer questions 4 and 5:
A distance is measured using different apparatus. The data obtained are tabulated below:

Observed distance(m)	Standard deviation(m)
200.233	0.02
200.231	0.04
200.234	0.03

4) Determine the weighted mean of the observed distances. Assume a unit reference variance.

a. 200.231

b. 200.234

c. 200.230

d. 200.233

No, the answer is incorrect. Score: 0

Accepted Answers: d. 200.233

5) Determine the standard deviation of the weighted mean.

a. 0.0254

b. 0.0154

c. 0.154

d. 0.254

No, the answer is incorrect. Score: 0

Accepted Answers: b. 0.0154

6) Given the length of the survey line equal to 2m and the angle made by the survey line with East axis in clockwise direction is given by 30°. Find the covariance of the latitude and departure of the survey line if the standard deviation of the length and the angle are 0.1 m and 0.2° respectively.

a. -0.08647

b. -0.04687

c. -0.06487

d. -0.07648

No, the answer is incorrect. Score: 0

Accepted Answers: c. -0.06487

7) If measurement is made from the ground to calculate the height of the tower above the datum. The observer is (5 ± 0.02) m above datum. Neglect the height of the observer above the ground. The height of the tower above datum is (50 ± 0.10) m. Calculate the standard deviation of the height of the tower above ground surface.

a. 0.078 m

b. 0.068 m

c. 0.089 m

d. 0.098 m

No, the answer is incorrect. Score: 0

Accepted Answers: d. 0.098 m

8) Given below are three equations: $2x - y = 3, x + y = 2, 3x + 2y = 5$ Find the values of x and y after making adjustments by observation equation method.

a. $x=1.57, y=0.18$

b. $x=1.77, y=0.17$

c. $x=1.97, y=0.19$

d. $x=2.57, y=0.21$

No, the answer is incorrect. Score: 0

Accepted Answers: a. $x=1.57, y=0.18$

9) The velocity of a particle at any instant varies according to the relation: $v=u+at$. Where u is the initial velocity and v is the velocity at any time interval. The particle starts at $t = 0$ minutes. The velocity at different time intervals are observed as: (v,t)=(3,3),(4,5),(5,6),(7) Calculate the value of the acceleration using adjustment by observation equation method.

a. 1.248

b. 0.948

c. 0.848

d. 0.748

No, the answer is incorrect. Score: 0

Accepted Answers: c. 0.848

10) The values of (x, y) for the equation $5x^2 - 2y^2 = 3$ are measured as: (1,1), (3, 2.5), (5, 3.5) What are the values of residuals for each of the respective values of x and y?

a. (0,10,15,36,10)

b. (0,10,25,36,75)

c. (0,10,45,36,55)

d. (0,10,75,36,25)

No, the answer is incorrect. Score: 0

Accepted Answers: d. (0,10,75,36,25)

11) The three angles of a triangle are measured as 29°, 58°, and 91°. If the values are uncorrelated and have equal weights, then find the accurate values of each angle of the triangle.

a. 29°, 59°, 91°

b. 29.37°, 58.37°, 91.37°

c. 29.67°, 58.67°, 91.67°

d. 30°, 60°, 90°

No, the answer is incorrect. Score: 0

Accepted Answers: c. 29.67°, 58.67°, 91.67°

12) Consider following two statements regarding adjustments by observation equation method and choose the correct option.
Statement 1: The condition equations include both observations and unknown parameters.
Statement 2: The number of condition equations is equal to the number of observations.

a. Statement 1 is true and statement 2 is false

b. Statement 1 is false and statement 2 is true

c. Both statement 1 and statement 2 are true

d. Both statement 1 and statement 2 are false

No, the answer is incorrect. Score: 0

Accepted Answers: c. Both statement 1 and statement 2 are true

13) Consider following two statements regarding the normal equation in adjustments computations by observation equation method:
Statement 1: The number of normal equations is not equal to the number of unknowns.
Statement 2: The matrix of Jacobian of dependent variable with respect to unknown parameters in the normal equations is a symmetric matrix.

a. Statement 1 is true and statement 2 is false

b. Statement 1 is false and statement 2 is true

c. Both statement 1 and statement 2 are true

d. Both statement 1 and statement 2 are false

No, the answer is incorrect. Score: 0

Accepted Answers: b. Statement 1 is false and statement 2 is true

14) What is the weight of 3a, if $a=40^\circ$ and its weight is 4?

a. 3/9

b. 3/3

c. 4/9

d. 4/3

No, the answer is incorrect. Score: 0

Accepted Answers: c. 4/9

15) Given two equations: $X = ax^2, Y = by^2$ The values of (X,Y) are found out by putting different values of (x,y) Following are three sets of observations: (X,Y)=(2,4) for (x,y)=(1,2), (X,Y)=(3,4) for (x,y)=(2,3), (X,Y)=(7,9) for (x,y)=(3,5) For determining values of a and b by observation equation method, above measurements are expressed in the form $V=AX-L$. Find the trace of the matrix A.

a. 0

b. 1

c. 4

d. 25

No, the answer is incorrect. Score: 0

Accepted Answers: b. 1

16) Given below are the standard deviations for a set of observations: 0.025, 0.035, 0.045 If reference variance is taken as 0.015, what is the trace of the weight matrix?

a. 0.95

b. 0.65

c. 0.35

d. 0.05

No, the answer is incorrect. Score: 0

Accepted Answers: b. 0.65

17) Following equation expresses variable X as a function of three variables (x, y, a). $X=2x+y+a$ Above equation is expanded by Taylor series around point (1, 2, 3), respectively for (x, y, a). If variations ($\Delta x, \Delta y, \Delta a$) are (0.025, 0.035, 0.015), calculate the sum of the first four terms in the Taylor series expansion of X.

a. 7.705

b. 7.505

c. 7.205

d. 7.005

No, the answer is incorrect. Score: 0

Accepted Answers: c. 7.205

18) The three residuals in the measurement of the angles of an equilateral triangle are in the ratio 1:2:3. What are the field measurement of the angles if the closing error introduced is 0.06 (all the values are in degrees).

a. (59.79,59.78,59.77)

b. (59.89,59.88,59.87)

c. (59.99,59.98,59.97)

d. (60.99,60.98,60.97)

No, the answer is incorrect. Score: 0

Accepted Answers: c. (59.99,59.98,59.97)

19) The three sides a, b and c of a triangle are measured as 3.2, 4.5 and 5.4 (units of distance) respectively. If the sum of first two sides is equal to the third side, what are the residuals (v_a, v_b, v_c) of the three sides?

a. 0.76,0.76 and 0.76

b. 0.66,0.66 and 0.66

c. 0.56,0.56 and 0.56

d. 0.46,0.46 and 0.46

No, the answer is incorrect. Score: 0

Accepted Answers: a. 0.76,0.76 and 0.76

20) The opposite angles of a cyclic trapezium are measured as 121.6° and 59° while other two angles are equal. What are the corrected values of the two measured angles?

a. 121.5° and 58.5°

b. 120.2° and 59.8°

c. 120° and 60°

d. 121.3° and 58.7°

No, the answer is incorrect. Score: 0

Accepted Answers: d. 121.3° and 58.7°

21) From a point on a straight line, two rays are drawn at angles of 31.54° and 58.724° clockwise and anticlockwise (with the horizontal line). The respective values of the angles are 4 and 3. The angle between the two rays is found out to be 90° accurately. What is the error in measurement of the two angles?

a. 0.353 and 0.332

b. 0.252 and 0.223

c. 0.151 and 0.113

d. 0.051 and 0.012

No, the answer is incorrect. Score: 0

Accepted Answers: c. 0.151 and 0.113