



10. Let  $y = k \times x$ , where  $k$  is a constant. If  $\pm\sigma_x$  be the uncertainty on the measured quantity "x" then, the propagation of error on  $y$  is given by
- a.  $\sigma_y = \pm\sigma_x$       b.  $\sigma_y = \pm\frac{\sigma_x}{k}$       c.  $\sigma_y = \pm k^2\sigma_x$       d.  $\sigma_y = \pm k\sigma_x$
11. The regression line  $x$  on  $y$  is given by,  $(x - \bar{x}) = b_{xy}(y - \bar{y})$ , where  $b_{xy}$  is
- a.  $\frac{n\sum xy - \sum x \sum y}{n\sum y^2 - (\sum y)^2}$       b.  $\frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$       c.  $\frac{n\sum xy - \sum x \sum y}{n\sum y^2 - (\sum x)^2}$       d.  $\frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum y)^2}$
12. The relationship between correlation and regression is given by  $r^2 = b_{xy} \times b_{yx}$ , where  $r^2$  is called
- a. Coefficient of regression      b. Correlation coefficient  
c. Coefficient of determination      d. Coefficient of deviation
13. The correction applied to an observation is ..... to the weight of the observation.
- a. Directly proportional      b. Inversely proportional  
c. Equal      d. There is no relation
14. Method of correlates in least square adjustment is also called.....
- a. Conditioned equation method      b. Observation equation method  
c. Normal equation method      d. Legendre's method
15. The spherical excess for a geodetic triangle having area less than or equal to 197 sq. km is approximately.....
- a. 4"      b. 2"      c. 0.5"      d. 1"
16. Which of the following is **NOT** the computation method for sides of a spherical triangle?
- a. Delambre's method      b. Spherical trigonometric method  
c. Lagrange's method      d. Legendre's method
17. If an angle is observed with 3 sets face-left and face-right observations, then the degree of freedom for the observation is.....
- a. 2      b. 5      c. 6      d. 1
18. The sample standard deviation of 8 observation is found to be  $\pm 13.1''$ . Find the most probable error of the mean.
- a.  $\pm 4.6''$       b.  $\pm 8.8''$       c.  $\pm 3.1''$       d.  $\pm 43.1''$
19. How many minimum numbers of control points are required in both systems to transform points using 2D projective transformation?
- a. 2      b. 3      c. 5      d. 4
20. Which of the following statement is **INCORRECT**?
- a. The weight of a level line is taken as inversely proportional to the length of the route  
b. The weights are inversely proportional to the number of times an observation is taken  
c. The weight is inversely proportional to the square of the probable (or standard) errors  
d. The weights are generally taken inversely proportional to the variance

KATHMANDU UNIVERSITY  
End Semester Examination  
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Level : B.E.  
Year : III  
Time : 2 hrs. 30 mins.

Course : GEOM 307  
Semester : II  
F. M. : 40

SECTION "B"  
[6 Q. × 4 = 24 marks]

Attempt *ANY SIX* questions. Assume suitable data where necessary.

1. What are the types and sources of errors in measurement? Describe the importance of redundant observation in surveying. [3+1]
2. State and explain laws of random errors. Also illustrate them showing Gaussian distribution curve. [3+1]
3. A sample of observations were taken for a measurement of length of a line which is given below:  
2.13, 2.15, 2.14, 2.16, 2.13, 2.35, 2.50, 2.12, 2.11, 2.10, 2.09, 2.11, 2.12, 2.13, 2.15, 2.16, 2.14, 2.13, 2.13, 2.11, 2.12  
Detect outliers for 95% error
4. Radius of a spherical ball was measured as  $8.4 \pm 0.1$  cm. Find the error in it's [2+2]  
a. diameter                      b. Volume
5. What is coordinate transformation? Describe the application of least square to find transformation parameters of various 2D coordinate transformations. [1+3]
6. State principles of least square. Show from principle of least square that MPV of an observation with unequal weight is weighted arithmetic mean of the observations. [1+3]
7. Find the regression line Y on X from the following data, also estimate the value of Y for X=20. [3.5+0.5]

X	6	2	10	4	8
Y	9	11	5	8	7

SECTION "C"  
[2 Q. × 8 = 16 marks]

Attempt *ANY TWO* questions. Assume suitable data where necessary.

8. a. How do you define weight of a measurement? State and explain any 4 laws of weights. If  $\alpha = 45^\circ 15' 20''$ ,  $wt = 1$ ,  $\beta = 55^\circ 15' 25''$ ,  $wt = 2$  and  $\gamma = 64^\circ 15' 30''$ ,  $wt = 3$ . Calculate  $3\alpha + 2\beta + \gamma$  and find its weight. [0.5+2+1.5]

- b. List out the rules for applying corrections to field measurement with a closing error. Let  $P = 84^{\circ}15'12'' \pm 3''$ ,  $Q = 125^{\circ}11'15'' \pm 4''$  and  $R = 150^{\circ}33'18'' \pm 5''$ , such that P, Q and R close the horizon, determine the corrected angles. [2+2]
9. a. The following data pertains to a circuit of precise levels connecting four BMs A, B, C and D. Calculate the elevations of points B, C and D if that of A is 1200.000 m. [4]

Circuit	Level lines	Weight	Observed difference of elevations (in meters)
I	A to B	2	+2.633
	B to C	2	-1.823
	C to A	1	-0.710
II	A to D	2	-1.424
	D to C	2	+2.324
	C to A	1	-0.710

- b. Adjust the angles A, B and C of a triangle ABC from the following data. [4]

Angle A	Angle B	Angle C
$64^{\circ}12'40''$	$50^{\circ}14'21''$	$65^{\circ}33'20''$
$64^{\circ}12'42''$	$50^{\circ}14'25''$	$65^{\circ}33'22''$
$64^{\circ}12'37''$	$50^{\circ}14'22''$	$65^{\circ}33'18''$
$64^{\circ}12'41''$	$50^{\circ}14'23''$	$65^{\circ}33'24''$
	$50^{\circ}14'24''$	$65^{\circ}33'23''$
		$65^{\circ}33'19''$

10. a. The mean observed angles of a spherical triangle ABC are as follows: [4]

$$A = 56^{\circ}15'23.45'' \quad \text{weight} = 1$$

$$B = 63^{\circ}24'31.23'' \quad \text{weight} = 2$$

$$C = 60^{\circ}20'11.35'' \quad \text{weight} = 3$$

If the length of the side BC is equal to 61254.3 m, adjust the angles of spherical triangle.

- b. Describe the procedures of different methods to compute the sides of a spherical triangle. Compute the sides of triangle given in question number 10a. using Legendre's method. [2+2]