

KATHMANDU UNIVERSITY  
End Semester Examination  
August, 2018

Marks scored:

Level : B.E.  
Year : III

Course : GEOM 307  
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date AUG 10 2018

SECTION "A"

[20 Q × 0.5 = 10 marks]

Tick the most appropriate answer from the given choices (Assume suitable data if necessary).

1. A statistical analysis of survey observations has indicated that the survey measurements follow normal distribution, being expressed by the equation:

a.  $E_{50} = 0.6745 \sqrt{\frac{\Sigma v^2}{n-1}}$   
b.  $dx = \frac{1}{\sigma\sqrt{2\pi}} e^{-(\mu-x_1)^2/2\sigma^2} dy$   
c.  $dy = \frac{1}{\sigma\sqrt{2\pi}} e^{(\mu-x_1)^2/2\sigma^2} dx$   
d.  $dx = \sigma\sqrt{2\pi} * e^{(\mu-x_1)^2/2\sigma^2} dy$

2. Which of the following is NOT correct?

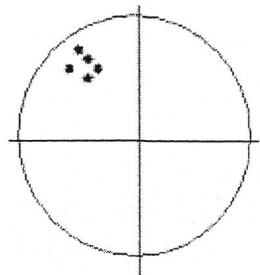
- a. The weights are applied to the individual measurements of unequal reliability to reduce them to one standard.  
b. Weight of the measurement is inversely proportional to the variance.  
c. Most probable error is defined as the error for which there are equal chances of true error being equal to probable error.  
d. Most probable value is the weighted mean of the measurements.

3. What is meant by the term 'accuracy'?

- a. The lack of bias in the data  
b. The extent to which a value approaches its true value  
c. The level of detail at which data is stored  
d. The overall quality of the data

4. Looking at the target rifle shown in the figure, how would you describe the shooting of this contestant?

- a. Accurate and precise                      b. Inaccurate and imprecise  
c. Inaccurate and precise                    d. Accurate and imprecise



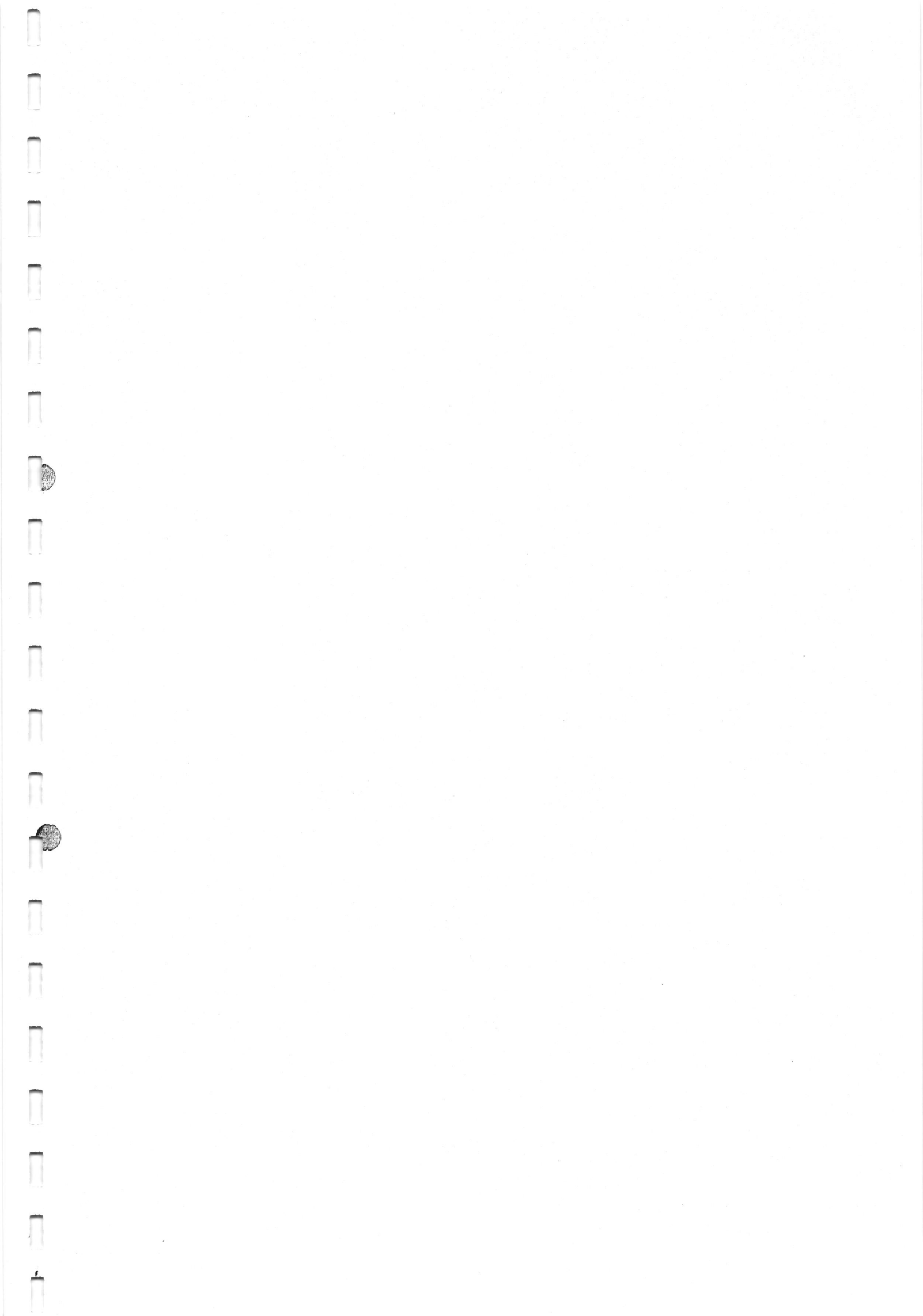
5. Residual of a measured quantity is:

- a. Difference of the observed value from its most probable value.  
b. Value obtained by adding the most probable value to its true value.  
c. Remainder of the division of the true value by its most probable value.  
d. Product of the most probable value and the observed value.

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6. In the case of the function  $y = f(x_1, x_2)$ , the error in  $y$  is computed as:
- $dy = \left(\frac{\partial f}{\partial x_1}\right) dx_1 + \left(\frac{\partial f}{\partial x_2}\right) dx_2$
  - $dy = \left(\frac{\partial f}{\partial x_1}\right)^2 dx_1 + \left(\frac{\partial f}{\partial x_2}\right)^2 dx_2$
  - $dy = \left(\frac{\partial f}{\partial x_1}\right) (dx_1)^2 + \left(\frac{\partial f}{\partial x_2}\right) (dx_2)^2$
  - $dy = \left(\frac{\partial f}{\partial x_1} dx_1\right)^2 + \left(\frac{\partial f}{\partial x_2} dx_2\right)^2$
7. One of the characteristics of random errors is:
- Small errors occur as frequently as the large errors
  - Plus errors occur more frequently than the negative errors
  - Small errors occur more frequently than the large errors
  - Large errors may occur more frequently
8. Theory of errors and adjustments deal with estimating the effects of:
- Mistakes
  - Systematic errors
  - Personal and accidental errors
  - Instrumental errors
9. If three angles of a triangle each have a standard error of  $\pm 4''$ , the total error in the triangle is:
- 6.93''
  - 12''
  - 6''
  - 3.96''
10. Weight of angle  $\alpha$  is 'w'. The weight of angle  $\frac{\alpha}{a}$  will be:
- $\frac{1}{a} w$
  - $a^2 w$
  - $\frac{1}{a^2} w$
  - $aw$
11. If an equation is multiplied by its own weight, the weight of the resulting equation is equal to the \_\_\_\_\_ of that equation.
- Quadruple
  - Product
  - Double
  - Reciprocal
12. A variable that can assume any value between two given points is called:
- Continuous random variable
  - Irregular random variable
  - Uncertain random variable
  - Discrete random variable
13. A normal curve  $\mu \pm 3.06 \sigma$  covers:
- 50% area
  - 68.27% area
  - 95.45% area
  - 99.7% area
14. Systematic errors can be removed by:
- Buying new instrument
  - Breaking the instrument
  - Dusting the instrument
  - Recalibrating the instrument
15. Suppose that an angle is turned six times using the repetition method. For an observer having a personal reading error of  $\pm 1.5''$ , error in the final angle due to circle reading is:
- $\pm 0.3''$
  - $\pm 0.4''$
  - $\pm 9''$
  - $\pm 4''$

16. Assume that a line is observed in three sections, with the individual parts equal to (753.81,  $\pm 0.012$ ) m, (1238.40,  $\pm 0.028$ ) m and (1062.95,  $\pm 0.020$ ) m respectively. The line's total length has an anticipated standard deviation of:
- a.  $\pm 0.060$  m
  - b.  $\pm 0.036$  m
  - c.  $\pm 0.245$  m
  - d.  $\pm 0.109$  m
17. From the probability equation it is found that the most probable values of a series of errors arising out of observations of equal weightage are those for which the sum of their squares is:
- a. Maximum
  - b. Zero
  - c. Minimum
  - d. Infinity
18. Pick out the wrong statements from the following regarding weighted level adjustment:
- a. Weights are inversely proportional to line length.
  - b. Weights can be estimated a priori based on standard deviations of readings.
  - c. Weights are assumed to be inversely proportional to the variances.
  - d. Weights are directly proportional to the number of setups in levelling.
19. Which of the following transformation preserves parallelism?
- a. Affine Transformation
  - b. Projective Transformation
  - c. Mobius Transformation
  - d. Conformal Transformation
20. The following are observed values of an angle  $A = 36^{\circ}22'40''$ ,  $36^{\circ}22'44''$ ,  $36^{\circ}22'42''$ ,  $36^{\circ}22'50''$ ,  $36^{\circ}22'38''$ ,  $36^{\circ}22'46''$ , the most probable value of the angle is:
- a.  $218^{\circ}16'20''$
  - b.  $36^{\circ}22'42''$
  - c.  $36^{\circ}22'43.33''$
  - d.  $43^{\circ}39'16''$



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SECTION "B"  
[6Q. × 4 = 24 marks]

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

1. Show with mathematical expressions "error propagation while computing latitude and departure of a line in traverse surveys".  
A traverse course has a length of  $456.87 \pm 0.02$  m and an azimuth of  $23^{\circ}35'26'' \pm 9''$ . What are the latitude and departure of traverse course? Also calculate the estimated errors associated with these values. [2+2]
  
2. Assuming normal distribution, explain the statement: "*As the standard deviation of the group of observations decreases, the precision of the group increases.*"  
The seconds' portion of 50 micrometer readings from a 1" theodolite are listed below. Check the observations at a 99% level of certainty for blunders. [2+2]  

41.9	46.3	44.6	46.1	42.5	45.9	45.0	42.0	47.5	43.2	43.0	45.7	47.6
49.5	45.5	43.3	42.6	44.3	46.1	45.6	52.0	45.5	43.4	42.2	44.3	44.1
42.6	47.2	47.4	44.7	44.2	46.3	49.5	46.0	44.3	42.8	47.1	44.7	45.6
45.5	43.4	45.5	43.1	46.1	43.6	41.8	44.7	46.2	43.2	46.8		
  
3. Differentiate types of error with one survey related example of each. Briefly describe the possible sources of error that you would consider for establishing control points using differential GPS. [2+2]
  
4. Surveyors must possess skill in instrument operation and knowledge of surveying methods to minimize the amount of error in each measurement. Explain this with one suitable example. Describe an example in which directly measured quantities are used to obtain an indirect measurement. [2+2]
  
5. List out the redundant measurements that are made in traverse and tacheometric surveying. Why are redundant observations preferred by the surveyors in any kind of surveying works? [2+2]
  
6. State different rules regarding weighted level adjustment. A line of levels is run from B. M. at A to a particular point B. The observed data is given below. Determine the weighted mean of measured difference in elevations. What is the standard error of mean? [2+2]

Route	No. of setups	Difference in elevations (m)
I	15	4.325
II	10	4.305
III	8	4.295

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7. What is the main difference between the method of correlates and the method of differences? The equations given below have the weights specified. Form the normal equations and find out the probable values for each of the unknowns involved in the given equations: [1+3]

$$\begin{aligned} 2X + 3Y + 5Z - 41 &= 0 && \text{(weight 2)} \\ 3X + 5Y + 4Z - 46 &= 0 && \text{(weight 3)} \\ 4X + 2Y + 7Z - 51 &= 0 && \text{(weight 3)} \end{aligned}$$

8. Large quantities of computer time and memory are used in the least square adjustments. How do you apply storage and time optimization techniques while doing large least square adjustment? Develop mathematical mapping formula for the following normal matrix in order to optimize storage. [2+2]

1	2	4	7	1
	3	5	8	2
		6	9	3
			10	4
				5
				6
1				7
2	3			8
4	5	6		9
7	8	9	10	10

SECTION "C"  
[2Q. × 8 = 16 marks]

Attempt ANY TWO questions. Assume suitable data if necessary.

9. What do you mean by figure adjustment in triangulation survey? State the rules for applying corrections to the observed angles A, B and C of a triangle. Assume 'n' as number of observations for an angle, 'w' is the weight of angle, 'd' is the error of closure and 'c' the correction to be applied to observed angle. Adjust the following angles of a triangle shown in the below table. The angles are measured with 1'' least count J2-2 Theodolite. [4+4]

Angle A	Angle B	Angle C
34°22'13''	69°32'48''	76°03'18''
12''	44''	22''
16''	45''	21''
17''	49''	17''
11''	46''	
9''		

OR

10. State and explain the laws of weight with one survey related example of each. Following are the values of a geodetic quadrilateral after being adjusted for a spherical excess. The angle may be assumed to be of equal weights. Adjust the quadrilateral. Candidates are required to use the concept of least square condition. [3+5]

Angle	Value	Angle	Value
1	29°25'34''	5	30°29'25''
2	58°41'20''	6	57°37'33''
3	69°36'20''	7	50°35'44''
4	22°17'02''	8	41°17'26''

11. What do you mean by least square adjustment technique? Mention two applications of least square adjustment in surveying.  
 For the levelling network shown below, find out the most probable elevation values of X, B and C given that the elevation of BM 707 at A is 1427.751 m. Also find out the residuals associated with them. Apply appropriate weights in the computation if any.

[3+5]

Levelling Network	Line	Height Difference (m)	Distance (m)
	1	0.89650	99
	2	0.10980	130
	3	0.29355	215
	4	1.18899	264
	5	0.18418	365
	6	1.00653	113

