9 CHAPTER
Traverse Computation and Adjustment

Q.1 Consider the following assumptions of Bowditch method:
1. Angular measurements are more precise than linear measurements
2. Linear measurements are more precise than angular measurements
3. Error in linear measurements are proportional to $\sqrt{L}$
4. Correction to latitude or departure of any side = Total error in L (or D) $\times \frac{\text{Length of that side}}{\text{Perimeter of traverse}}$

Which of the above statements are correct?
(a) 1 and 4 (b) 1, 2 and 3
(c) 2, 3 and 4 (d) 3 and 4

Q.2 The Bowditch method of adjusting a traverse is based on the assumption that

(a) $e_1 \propto \sqrt{l}$ and $e_2 \propto \frac{1}{\sqrt{l}}$

(b) $e_1 \propto \sqrt{l}$ and $e_2 \propto \sqrt{l}$

(c) $e_1 \propto \frac{1}{\sqrt{l}}$ and $e_2 \propto \sqrt{l}$

(d) $e_1 \propto \frac{1}{\sqrt{l}}$ and $e_2 \propto \frac{1}{\sqrt{l}}$

where e_1 and e_2 are errors in linear and angular measurements respectively and l is the length of traverse line

Q.3 In a closed traverse, the sum of south latitudes exceeds the sum of north latitudes and the sum of east departures exceeds the sum of west departures. The closing line will lie in the
(a) N-W quadrant (b) N-E quadrant
(c) S-E quadrant (d) S-W quadrant

Q.4 A traverse deflection angle is
(a) less than 90°
(b) more than 90° but less than 180°
(c) the difference between the included angle and 180°
(d) the difference between 360° and the included angle

Q.5 If L is the perimeter of a closed traverse, ΔD is the closing error in departure, the correction for the departure of a traverse side of length l, according to Bowditch rule, is

(a) $\Delta D \times \frac{L}{l}$ (b) $\Delta D \frac{l^2}{L}$

(c) $L \times \frac{l}{\Delta D}$ (d) $\Delta D \times \frac{l}{L}$

Q.6 If arithmetic sum of latitudes of a closed traverse is ΣL and closing error in latitude is dx, the correction for a side whose latitude is l, as given by Transit Rule, is

(a) $l \times \frac{dx}{\Sigma L}$ (b) $l \times \frac{\Sigma L}{dx}$

(c) $\Sigma L \times \frac{dx}{l}$ (d) none of these

Q.7 Latitude and departure of a station with respect to the preceding station is called
(a) dependent coordinates
(b) consecutive coordinates
(c) both of the above
(d) none of these

Q.8 Bowditch's rule is applied to:
(a) an open traverse for graphical adjustment
(b) a closed traverse for adjustment of closing error
(c) determination of the effect of local attraction
(d) None of the above

Q.9 For a closed traverse, the omitted measurement may be calculated
(a) length of one side only
(b) bearing of one side only
(c) length or bearing of adjacent sides
(d) All of the above

Q.10 If the angular measurements of a traverse are more precise than its linear measurements, balancing of the traverse, is done by
(a) Bowditch rule (b) Transit rule
(c) Empirical rule (d) All of the above

Q.11 If θ is the probable error of an observed bearing of a line of length l, the error over the whole length of the traverse of n lines of length l is
(a) $l\sqrt{n}$ (b) $\frac{\theta}{l}\sqrt{n}$
(c) $\theta\sqrt[3]{}$ (d) $\frac{\theta\sqrt{n}}{3}$

Q.12 Removal of parallax, may be achieved by focussing
(a) the objective (b) eyepiece
(c) both (a) and (b) (d) None of these

Q.13 The bearing of two traverse lines AB and BC are N 52° 45′ E and N 34° 30′ E respectively. The deflection angle is
(a) 18° 15′ L (b) 18° 15′ N
(c) 18° 15′ R (d) 18° 15′ W

Q.14 The bearing of C and A is N30°E and from B, 50 m east of A, is N60°W. The departure of C from A is
(a) 50 m (b) $50\sqrt{3}$ m
(c) $25\sqrt{3}$ m (d) 25 m

Q.15 The following are the lengths and bearings of the sides of a closed traverse ABCD.

Line	Length in metre	Bearing
AB	78.20	140° 12′
BC	198.0	36° 24′
CD	37.80	338° 48′
DA	–	–

The length DA in metres is
(a) 186.20 m (b) 204.399 m
(c) 153.884 m (d) 134.531 m

Q.16 For a given traverse, the summation of latitudes and departure are +0.508 and +0.223 respectively. The closing error and direction of closing error is
(a) 0.6657, N 23° 42′ E (b) 0.5547, N 66° 18′ E
(c) 0.6657, N 66° 18′ E (d) 0.5547, N 23° 42′ E

Q.17 Match List-I and List-II and select the correct answer.
List-I
A. Bowditch's rule
B. Deflection angle
C. Triangulation
D. Bessel's method
List-II
1. Measuring all angles and baseline
2. Solution of three point problem
3. Balancing latitudes and departure
4. Measured in case of open traverse instead of measuring included angle
Codes:

	A	B	C	D
(a)	3	4	1	2
(b)	1	2	3	4
(c)	1	2	4	3
(d)	3	2	1	4

Q.18 In a closed traverse with 6 sides, the error found from the fore bearing and back bearing of last line is + 4°. The correction required in the 4th line of traverse is
(a) 2° 40′ 00″ (b) 2° 20′ 00″
(c) 1° 59′ 00″ (d) 2° 10′ 00″

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Answers Traverse Computation and Adjustment

1. (d)	2. (a)	3. (a)	4. (c)	5. (d)	6. (a)	7. (c)	8. (b)	9. (d)	10. (b)
11. (a)	12. (c)	13. (a)	14. (d)	15. (b)	16. (d)	17. (a)	18. (a)		

Explanations Traverse Computation and Adjustment

2. (a)
Bowditch's method is based on the assumption that the error in linear measurements are proportional to $\sqrt{l}$ and that the errors in angular measurements are inversely proportional to $\sqrt{l}$ where l is the length of line.

$$\therefore \quad e_1 \propto \sqrt{l} \text{ and } e_2 \propto \frac{1}{\sqrt{l}}$$

Hence option (a) is correct.

5. (d)
Bowditch's method: Correction to latitude (or departure) of any side
= Total error in latitude (or departure)

$$\times \frac{\text{Length of side}}{\text{perimeter of traverse}}$$

6. (a)
Transit method: Correction of latitude (and departure) of any side
= Total error in latitude (or departure)

$$\times \left[\frac{\text{Latitude or departure}}{\text{Sum of latitude (or departure)}}\right]$$

7. (c)
Latitude and departure coordinate of any point with reference to the preceding point are equal to latitude and departure of the line joining the preceding point to the point under consideration. Such coordinates are known as 'consecutive coordinate'. Consecutive coordinates are also known as 'dependent coordinates'.
Hence option (c) is correct.

15. (b)
Let l be the length and θ be bearing of line DA
Then $\Sigma L = 0$
$\Rightarrow 78.2 \cos 140° 12' + 198.0 \cos 36° 24' + 37.8 \cos 338° 48' + l \cos\theta = 0$
$\therefore l\cos\theta = -134.531$
$\Sigma D = 0$
$78.2\, l \sin 140° 12' + 198.0 \sin 36° 24' + 37.8 \sin 338° 48' + l\sin\theta = 0$
$\therefore l\sin\theta = -153.884$

$$\therefore \quad l = \sqrt{(134.531)^2 + (153.884)^2}$$
$$= 204.399 \text{ m}$$

16. (d)
Closing error,

$$e = \sqrt{(\Sigma L)^2 + (\Sigma D)^2}$$
$$= \sqrt{(0.508)^2 + (0.223)^2} = 0.5547$$
$$\tan\theta = \frac{\Sigma D}{\Sigma L} = \frac{0.223}{0.508}$$
$$\Rightarrow \quad \theta = \tan^{-1}\left(\frac{0.223}{0.508}\right) = 23° 42'$$

The direction of closing error is N 23° 42′ E.

17. (a)
Bowditch rule is used for balancing latitudes and departures. Bessel's method is used in plane table surveying for solution of three point problem

18. (a)
n, number of sides = 6
correction to P^{th} line $= \frac{Pe}{n}$

Correction in 4th line $= \frac{4e}{n} = \frac{4e}{6} = \frac{4}{6} \times (+4')$
$= \frac{2}{3} \times 4'$

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