

Answer Key: Civil Engineering Licensure Exam – Mock Exam (Day 14: Errors in Surveying, Precision, and Adjustments)

February 24, 2025

Answer Key

Section A: Multiple Choice Solutions

1. A systematic error: **(b) An error that follows a predictable pattern**
2. Random errors: **(c) Occur without a definite pattern**
3. Probability of small errors: **(b) Greater than that of large errors**
4. Precision in measurement: **(b) The consistency of repeated measurements**
5. Correction to a linear measurement: **(c) Either positive or negative depending on error type**

Section B: Problem-Solving Solutions

1. Corrected length:

$$L_{\text{true}} = L_{\text{measured}} \times \frac{L_{\text{actual}}}{L_{\text{nominal}}}$$
$$L_{\text{true}} = 250 \times \frac{30}{30.02} = 249.83 \text{ m}$$

2. Relative error:

$$\text{Relative error} = \frac{\text{Measured distance} - \text{True distance}}{\text{True distance}}$$
$$= \frac{600 - 598.5}{598.5} = 0.00251$$

3. Probable error:

$$PE = 0.6745 \times 0.02 = 0.0135 \text{ m}$$

4. Mean and standard deviation:

$$\bar{x} = \frac{100.2 + 100.3 + 100.1 + 100.4}{4} = 100.25 \text{ m}$$

$$\begin{aligned} \sigma &= \sqrt{\frac{(100.2 - 100.25)^2 + (100.3 - 100.25)^2 + (100.1 - 100.25)^2 + (100.4 - 100.25)^2}{4}} \\ &= \sqrt{\frac{0.0025 + 0.0025 + 0.0225 + 0.0225}{4}} = 0.1118 \text{ m} \end{aligned}$$

5. Corrected distance:

$$L_{\text{true}} = L_{\text{measured}} \times \frac{L_{\text{nominal}}}{L_{\text{actual}}}$$

$$L_{\text{true}} = 450 \times \frac{30}{30.02} = 449.7 \text{ m}$$