




ASQ CRE Prep course

Lesson II. A. 2. c.

Basic Probability Concepts

Expectation

A wide-angle photograph of a sunset over a frozen body of water. The sun is a bright, glowing orb on the horizon, casting a long, shimmering reflection across the dark water. Several large, dark ice floes are scattered across the foreground and middle ground. The sky is a gradient of dark blue and orange, with some light clouds. The overall mood is serene and contemplative.

Just as we suspected

EXPECTATION

Expected Value

- **The expected value is like a weighted average**

$$\mu = E[x] = \int xf(x)dx$$

- **The mean is the expected value of a random variable**

$$\mu = E[x] = \sum p_i x_i$$

Variance and Notes

$$\text{Var}(x) = E[(x - \mu)^2] = \sigma^2$$

X is a random variable and c is a constant, then

$$E[c] = c$$

$$\text{Var}[c] = 0$$

$$E[x] = \mu$$

$$\text{Var}[x] = \sigma^2$$

$$E[cx] = cE[x] = c\mu$$

$$\text{Var}[cx] = c^2\text{Var}[x] = c^2\sigma^2$$

Robustness

- **Some statistical procedures still work well enough even if the underlying assumptions are not totally true**

$$E[s^2] = \sum \frac{s_i^2}{n} = \sigma^2$$

$$Var[s^2] = \frac{2\sigma^4}{n-1} \quad \text{normal}$$

$$Var[s^2] = \frac{2\sigma^4}{n-1} \left(1 + \frac{n-1}{2n} \left(\frac{\mu^4}{\sigma^4} - 3 \right) \right) \quad \text{Not normal}$$

Do you see any
similarity between
histograms and PDFs?



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Lesson II. A. 3. a.

Probability Distributions

The Four Functions