Math Medic Ultimate Interpretations Guide

CED Unit 1: Exploring One-Variable Data and Collecting Data

Standard Deviation: The **context** typically varies by SD from the mean of mean.

Example: *The **height of power forwards in the NBA** typically varies by 1.52 inches from the mean of 80.1 inches.*

Percentile: percentile % of **context** are less than or equal to value.

Example: *75% of **high school student SAT scores** are less than or equal to 1200.*

z-score: Specific value with **context** is z-score standard deviations above/below the mean of mean.

Example: *A **quiz score** of 71 is 1.43 standard deviations below the mean of 80. (z = -1.43)*

Describe a distribution: Be sure to address shape, center, variability, and outliers (in **context**).

Example: *The **distribution of student height** is unimodal and roughly symmetric. The mean height is 65.3 inches with a standard deviation of 8.2 inches. There is a potential upper outlier at 79 inches and a gap between 60 and 62 inches.*

Investigative Question: Be sure to address the variable(s), the parameter and direction/goal of estimation, and the conclusion and population.

Example: *For all app users, is there convincing statistical evidence that premium app access will cause the mean daily listening time to be greater when compared to free app access?*

CED Unit 2: Probability, Random Variables and Probability Distributions

Probability $P(A)$: After many, many **context**, the proportion of times that **context A** will occur is about P(A).

Example: P(heads) = 0.5.
*After many, many **coin flips**, the proportion of times that **heads** will occur is about 0.5.*

Conditional Probability $P(A|B)$: Given **context B**, there is a P(A|B) probability of **context A**.

Example: P(red car | pulled over) = 0.48.
*Given that **a car is pulled over**, there is a 0.48 probability of **the car being red**.*

Expected Value (Mean, μ): If the random process of **context** is repeated many, many times, the average number of **x-context** we can expect is expected value. (decimals OK).

Example: *If the random process of **asking a student how many movies they watched this week** is repeated many, many times, the average number of **movies** we can expect is 3.23 movies.*

Binomial Mean (μ_X): After many, many trials, the average # of **success context** out of n is μ_X.

Example: *After many, many trials, the average # of **property crimes that go unsolved** out of 100 is 80.*

Binomial Standard Deviation (σ_X): The number of **success context** out of n typically varies by σ_X from the mean of μ_X.

Example: *The number of **property crimes that go unsolved** out of 100 typically varies by 1.6 crimes from the mean of 80 crimes.*

CED Units 3 & 4: Inference for Categorical and Quantitative Data

Standard Deviation of Sample Proportions ($\sigma_{\hat{p}}$): The sample proportion of **success context** typically varies by $\sigma_{\hat{p}}$ from the population proportion of p.

Example: *The sample proportion of **students that did their AP Stats homework last night** typically varies by 0.12 from the population proportion of 0.73.*

Standard Deviation of Sample Means ($\sigma_{\bar{x}}$): The sample mean amount of **x-context** typically varies by $\sigma_{\bar{x}}$ from the population mean of μ_x.

Example: *The sample mean amount of **defective parts** typically varies by 5.6 parts from the population mean of 23.2 parts.*

Confidence Interval (A, B): We are % confident that the interval from A to B captures the population **parameter context**.

Example: *We are 95% confident that the interval from 0.23 to 0.27 captures the population **proportion of flowers that will be red after cross-fertilizing red and white**.*

Confidence Level: If we select many, many samples of the same size and calculate a confidence interval for each, about confidence level % of them will capture the population **parameter in context**

Example: *If we select many, many samples of size 20 and calculate a confidence interval for each, about 90% of them will capture the population **mean weight of a soda case**.*

***p*-value**: Assuming **H_0 is true in context** (H_0), there is a p-value probability of getting the observed result or less/greater/more extreme, purely by chance.

Example: *Assuming the **mean body temperature is 98.6 °F** (H_0: $\mu = 98.6$), there is a 0.023 probability of getting a sample mean of 97.9 °F or less, purely by chance.*

Conclusion for a Hypothesis Test: Because the *p*-value p-value < / > α we reject / fail to reject H_0. We do / do not have convincing statistical evidence for **H_a in context**.

Example: *Because the p-value 0.023 ≤ 0.05, we reject H_0. We do have convincing statistical evidence that the **mean body temperature is less than 98.6 °F** (H_a: $\mu < 98.6$).*

Type 1 Error: We find convincing statistical evidence for **H_a context,** but **H_0 context** is true.

Example: We *find convincing statistical evidence* ***the mean body temperature is less than 98.6 °F,*** *but the* ***mean body temperature is actually 98.6 °F.***

Type II Error: We don't find convincing statistical evidence for **H_a context,** but **H_a context** is true.

Example: We *don't find convincing statistical evidence that* ***the mean body temperature is less than 98.6 °F,*** *but the* ***mean body temperature is actually less than 98.6 °F.***

Power: If **H_a context is true at a specific value** there is a power probability the hypothesis test will correctly reject H_0.

Example: *If the* ***population mean body temperature is 97.5 °F****, there is a 0.73 probability the hypothesis test will correctly reject $H_0: \mu = 98.6$.*

CED Unit 5: Linear Regression

Correlation (r): The linear association between **x-context** and **y-context** is weak/moderate/strong (strength) and positive/negative (direction).

Example: *The linear association between **student absences** and **final grades** is fairly strong and negative. (r = −0.93)*

Residual: The actual **y-context** was residual above/below the predicted value when **x-context** = #.

Example: *The actual **heart rate** was 4.5 beats per minute above the number predicted when **Matt ran** for 5 minutes.*

y-intercept: The predicted **y-context** when x = 0 **context** is y-intercept.

Example: *The predicted **time to checkout at the grocery store** when there are 0 **customers In line** is 72.95 seconds.*

Slope: The predicted **y-context** increases/decreases by slope for each additional **x-context**.

Example: *The predicted **heart rate** increases by 4.3 beats per minute for each additional **minute jogged**.*

Coefficient of Determination (r^2): About r^2% of the variation in **y-context** can be explained by the linear relationship with **x-context**.

Example: *About 87.3% of variation in **electricity production** is explained by the linear relationship with **wind speed**.*

Describe the relationship: Be sure to address strength, direction, form and unusual features (in **context**).

Example: *The scatterplot reveals a moderately strong, positive, linear association between the **weight and length of rattlesnakes**. The point at (24.1, 35,7) is a potential outlier.*