IMPORTANT FORMULAS FOR MA110

Graphing

Class Width = $\frac{high\ value - low\ value}{number\ of\ classes}$

Measures of Central Tendency

Sample mean: $\bar{x} = \frac{\Sigma x}{n}$

Population mean: $\mu = \frac{\Sigma x}{N}$

Class Midpoint:

$\frac{lower\ class\ limit\ +\ next\ lower\ class\ limit}{2}$

Range = $largest\ value - smallest\ value$

Sample standard deviation: $s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$

Computation formula: $s = \sqrt{\frac{\Sigma x^2 - [(\Sigma x)^2/n]}{n-1}}$

Population standard deviation: $\sigma = \sqrt{\frac{\Sigma(x-\mu)^2}{N}}$

Sample variance: s^2

Population variance: σ^2

Sample mean for grouped data: $\bar{x} = \frac{\Sigma xf}{n}$

Sample standard deviation for grouped data:

$$s = \sqrt{\frac{\Sigma(x-\bar{x})^2 \cdot f}{n-1}} = \sqrt{\frac{\Sigma x^2 f - [(\Sigma xf)^2/n]}{n-1}}$$

Coefficient of Variation: CV = $\frac{\sigma}{\mu}$

Interquartile range: IQR = Q_3 - Q_1

Lower outlier boundary: Q_1 – 1.5(IQR)

Upper outlier boundary: Q_3 + 1.5(IQR)

Location corresponding to a given percentile:

L = $\frac{P}{100} \cdot n$

Percentile for a given data value:

$\% = 100 \cdot \frac{(Location\ of\ x) - 0.5}{n}$

Correlation and Regression

Correlation coefficient:

$$r = \frac{1}{n-1}\Sigma\left(\frac{x-\bar{x}}{s_x}\right)\left(\frac{y-\bar{y}}{s_y}\right)$$

$$r = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{n\Sigma x^2 - (\Sigma x)^2}\sqrt{n\Sigma y^2 - (\Sigma y)^2}}$$

Coefficient of determination: r^2

Equation of least-squares regression line:

$$\hat{y} = a + bx$$

Slope of least-squares regression line:

$$b = r\frac{s_y}{s_x} = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{n\Sigma x^2 - (\Sigma x)^2}$$

y-intercept of least-squares regression line:

$$a = \bar{y} - b\bar{x}$$

Residual: $y - \hat{y}$

Probability

Rule of Complements: $P(A^C) = 1 - P(A)$

General Addition Rule:

$P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)$

Mutually Exclusive Events:

$P(A\ or\ B) = P(A) + P(B)$

Conditional Probability:

$$P(B|A) = \frac{P(A\ and\ B)}{P(A)}$$

General Multiplication Rule:

$P(A\ and\ B) = P(A)P(B|A) = P(B)P(A|B)$

Independent Events:

$P(A\ and\ B) = P(A)P(B)$

Combination rule: ${}_nC_r = \frac{n!}{r!(n-r)!}$

Permutation rule: ${}_nP_r = \frac{n!}{(n-r)!}$

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Discrete Probability

Mean of a discrete probability distribution:
$\mu = \Sigma x P(x)$

Variance of a discrete random variable:
$\sigma_X^2 = \Sigma[(x - \mu_X)^2 \cdot P(x)] = \Sigma[x^2 \cdot P(x)] - \mu_X^2$

Standard deviation of a discrete random variable:
$\sigma_X = \sqrt{\sigma_X^2}$

Binomial probability distribution:
$P(x) = C_{n,x} p^x (1-p)^{n-x}$

$x = number\ of\ successes$
$p = probability\ of\ success$

Mean of a binomial random variable: $\mu_X = np$
Standard deviation of a binomial random variable:
$\sigma_X = \sqrt{np(1-p)}$

Normal Distribution

z-score: $z = \frac{x-\mu}{\sigma}$

Convert z-score to raw score: $x = z\sigma + \mu$

Mean for a sample mean: $\mu_{\bar{x}} = \mu$
Standard error:
$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

z-score for a sample mean: $z = \frac{\bar{x}-\mu}{\sigma_{\bar{x}}}$

Sample proportion: $\hat{p} = \frac{x}{n}$

Mean of the sample proportion: $\mu_{\hat{p}} = p$
Standard deviation of the sample proportion:

$$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$$

z-score for a sample proportion:
$z = \frac{\hat{p} - \mu_{\hat{p}}}{\sigma_{\hat{p}}}$

Confidence Intervals

Confidence intervals for a mean:

$$\bar{x} - E < \mu < \bar{x} + E$$

When σ is known:

Margin of Error: $E = z_c \cdot \sigma_{\bar{x}}$

When σ is unknown:

Margin of Error: $E = t_c \cdot S_{\bar{x}}$

Determining Sample Size:

$$n = \left(\frac{z_c \cdot \sigma}{E}\right)^2$$

Confidence intervals for a proportion:

$$\hat{p} - E < p < \hat{p} + E$$

Margin of Error: $E = z_c \cdot \sigma_{\hat{p}}$

Where: $\sigma_{\hat{p}} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

Sample Sizes for proportions:

$n = \hat{p}(1-\hat{p})\left(\frac{z_c}{E}\right)^2$ if a value for $\hat{p}$ is available

$n = 0.25\left(\frac{z_c}{E}\right)^2$ if no value for $\hat{p}$ is available

Hypothesis Testing

When σ is known: $z = \frac{\bar{x}-\mu_{\bar{x}}}{\sigma_{\bar{x}}}$

When σ is unknown: $t = \frac{\bar{x}-\mu_{\bar{x}}}{S_{\bar{x}}}$

For a proportion: $z = \frac{\hat{p}-\mu_{\hat{p}}}{\sigma_{\hat{p}}}$

Where $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$