MATH 10 FORMULA SHEET – FINAL EXAM

Standard Deviation for a sample: $s = \sqrt{\frac{n\sum x^2 - \left(\sum x\right)^2}{n\left(n-1\right)}}$

Permutation Rule:

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

Combination Rule:

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

Mean for a probability distribution:

$$\mu = \sum x \cdot P(x)$$

Variance for a probability distribution:

$$\sigma^2 = \sum\left[x^2 \cdot P(x)\right] - \mu^2$$

Expectation (expected value):

$$E(x) = \sum x \cdot P(x)$$

Binomial Probability:

$$P(x) = \frac{n!}{(n-x)!x!} \cdot p^x \cdot q^{n-x}$$

Mean for binomial distribution:

$$\mu = n \cdot p$$

Variance for binomial distribution:

$$\sigma^2 = n \cdot p \cdot q$$

Standard Score:

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

Central Limit Theorem formula:

$$z = \frac{\bar{x} - \mu_x}{\frac{\sigma}{\sqrt{n}}}$$

CONFIDENCE INTERVALS

z confidence interval for means:

$$\bar{X} - z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right) < \mu < \bar{X} + z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)$$

t confidence interval for means:

$$\bar{X} - t_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right) < \mu < \bar{X} + t_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right)$$

Confidence interval for a proportion:

$$\hat{p} - z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}} < p < \hat{p} + z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$$

Minimum Sample Size for Means:

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

Minimum Sample Size for Proportions:

$$n = \hat{p}\hat{q}\left(\frac{z_{\alpha/2}}{E}\right)^2$$

TEST VALUES

z test for the mean: $z = \dfrac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$

t test for the mean: $t = \dfrac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$

z test for the proportion: $z = \dfrac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$

z test for the difference of two means (independent samples):

$$z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

t test for the difference of two means (independent samples), variances **not equal**:

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$d.f. = the\ smaller\ of\ n_1 - 1\ and\ n_2 - 1$$

t test for the difference of 2 means (dependent samples): $t = \dfrac{\bar{D} - \mu_D}{\frac{s_D}{\sqrt{n}}}$

where $s_D = \sqrt{\dfrac{\sum D^2 - \frac{\left(\sum D\right)^2}{n}}{n-1}}$ $\qquad d.f. = n - 1$

TEST VALUES (continued)

z test for the difference of 2 proportions:

$$z = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\overline{p}\overline{q}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

where $\overline{p} = \frac{X_1 + X_2}{n_1 + n_2}$

F test for the difference of 2 variances:

$$F = \frac{s_1^2}{s_2^2}$$

Chi-square test for goodness-of-fit:

$$\chi^2 = \sum \frac{(O - E)^2}{E} \qquad d.f. = \text{no. of categories} - 1$$

Chi-square test for independence and homogeneity of proportions:

$$\chi^2 = \sum \frac{(O - E)^2}{E} \qquad d.f. = (R - 1)(C - 1)$$

CORRELATION AND REGRESSION

Correlation Coefficient

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

Regression Line Coefficients

$$a = \frac{\left(\sum y\right)\left(\sum x^2\right) - \left(\sum x\right)\left(\sum xy\right)}{n\left(\sum x^2\right) - \left(\sum x\right)^2} \qquad b = \frac{n\left(\sum xy\right) - \left(\sum x\right)\left(\sum y\right)}{n\left(\sum x^2\right) - \left(\sum x\right)^2}$$

Standard Error of the Estimate

$$s_{est} = \sqrt{\frac{\sum y^2 - a\sum y - b\sum xy}{n - 2}}$$