MATH 110 Introduction to Statistics Formula Sheet

Module 2 Formulas:

$$\mu = \frac{\sum x_i}{N} \qquad \bar{x} = \frac{\Sigma x_i}{n} \qquad i = \left(\frac{p}{100}\right) n$$

$$\sigma^2 = \frac{\sum \left(x_i - \mu\right)^2}{N} \qquad s^2 = \frac{\sum \left(x_i - \bar{x}\right)^2}{n-1} \qquad z = \frac{x - \mu}{\sigma}$$

$$\text{Coefficient of Variation} = \frac{\text{Standard Deviation}}{\text{Mean}} \cdot 100 \qquad z = \frac{x - \bar{x}}{s}$$

$$r = \frac{\sum \left(\frac{x_i - \bar{x}}{s_x}\right)\left(\frac{y_i - \bar{y}}{s_y}\right)}{n-1} = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{S_x S_Y (n-1)} \qquad s_{xy} = \frac{\Sigma (x_i - \bar{x})(y_i - \bar{y})}{n-1}$$

$$\rho_{xy} = \frac{\sigma_{xy}}{\sigma_x \sigma_y} \qquad \sigma_{xy} = \frac{\Sigma (x_i - \mu_x)(y_i - \mu_y)}{N} \qquad r_{xy} = \frac{s_{xy}}{s_x s_y}$$

Module 3 Formulas:

$$P(E) = \frac{N(E)}{N(S)} \qquad C(n,r) = \frac{n!}{r!\left(n-r\right)!} \qquad P(n,r) = \frac{n!}{\left(n-r\right)!}$$

$$P(A) + P(A^c) = 1 \qquad P(A \mid B) = \frac{n(A \cap B) / n(S)}{n(B) / n(S)} \qquad P(A \cap B) = P(A) \cdot P(B)$$

$$P(A \mid B) = \frac{P(A \cap B)}{P(B)} \text{ or } P(B \mid A) = \frac{P(B \cap A)}{P(A)}$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A \cap B) = P(A) \cdot P(B \mid A) \text{ or } P(A \cap B) = P(B) \cdot P(A \mid B)$$

$$P(A \cap B) = P(A) \cdot P(B \mid A) \text{ or } P(A \cap B) = P(B) \cdot P(A \mid B)$$

$$P(A_i \mid B) = \frac{P(A_i) \cdot P(B \mid A_i)}{P(A_1) \cdot P(B \mid A_1) + P(A_2) \cdot P(B \mid A_2) + \ldots + P(A_n) \cdot P(B \mid A_n)}$$

Module 4 Formulas:

$$E(X) = \mu = x_1 P(X = x_1) + x_2 P(X = x_2) + \ldots + x_n P(X = x_n) \qquad E(X) = \mu = np$$

$$Var(X) = \sigma^2 = \sum (X - \mu)^2 f(x) \qquad Var(X) = \sigma^2 = np(1-p) \qquad \sigma = \sqrt{np(1-p)}$$

$$f(x) = \frac{n!}{x!(n-x)!} p^x (1-p)^{n-x} \qquad z = \frac{x - \mu}{\sigma}$$

Module 5 Formulas:

$$\sigma_{\bar{x}} = \left(\sqrt{\frac{N-n}{N-1}}\right)\left(\frac{\sigma}{\sqrt{n}}\right) \qquad \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \qquad SE = |\bar{x} - \mu|$$

$$z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} \qquad \sigma_{\bar{p}} = \sqrt{\frac{p(1-p)}{n}} \qquad SE = |p^* - p|$$

$$\sigma_{\bar{p}} = \sqrt{\frac{N-n}{N-1}} \cdot \sqrt{\frac{p(1-p)}{n}} \text{ or } \sqrt{\frac{p(1-p)}{n}\left(\frac{N-n}{N-1}\right)}$$

Module 6 Formulas:

$$\bar{x} - z \cdot \frac{s}{\sqrt{n}} < \mu < \bar{x} + z \cdot \frac{s}{\sqrt{n}} \qquad \bar{x} - t \cdot \frac{s}{\sqrt{n}} < \mu < \bar{x} + t \cdot \frac{s}{\sqrt{n}}$$

$$\bar{x} - z \cdot \frac{s}{\sqrt{n}}\sqrt{\frac{N-n}{N-1}} < \mu < \bar{x} + z \cdot \frac{s}{\sqrt{n}}\sqrt{\frac{N-n}{N-1}} \qquad P \pm z\sqrt{\frac{p(1-p)}{n}}$$

$$P \pm z\sqrt{\frac{p(1-p)}{n}}\sqrt{\frac{N-n}{N-1}}$$

***Module 7 Formulas:** no new formulas in this module

Module 8 Formulas:

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

$$\bar{d} = \frac{\sum d_i}{n}$$

$$\bar{d} - t \cdot \frac{s_d}{\sqrt{n}} < \mu_d < \bar{d} + t \cdot \frac{s_d}{\sqrt{n}}$$

$$P_1 - P_2 \pm z\sqrt{\frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}}$$

$$t = \frac{\bar{d} - \mu_d}{\left(s_d / \sqrt{n}\right)}$$

$$\left(\bar{x}_1 - \bar{x}_2\right) - z\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} < \mu_1 - \mu_2 < \left(\bar{x}_1 - \bar{x}_2\right) + z\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

$$s_d = \sqrt{\frac{\sum\left(d_i - \bar{d}\right)^2}{n-1}} = \sqrt{\frac{\left(d_1 - \bar{d}\right)^2 + \left(d_2 - \bar{d}\right)^2 + \ldots + \left(d_n - \bar{d}\right)^2}{n-1}}$$

Module 9 Formulas:

$$r = \frac{\sum\left(\frac{x_i - \bar{x}}{s_x}\right)\left(\frac{y_i - \bar{y}}{s_y}\right)}{n-1} = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{S_x S_Y (n-1)}$$

$$m = r \cdot \frac{s_y}{s_x}$$

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

$$s_x{}^2 = \frac{\sum\left(x_i - \bar{x}\right)^2}{n-1} \text{ and } s_y{}^2 = \frac{\sum\left(y_i - \bar{y}\right)^2}{n-1}$$

$$y = mx + b$$

Module 10 Formulas:

$$DoF = (\#\text{ of Rows } - 1)(\#\text{ of Columns } - 1)$$

$$X^2 = \sum \frac{\left(O_{ij} - E_{ij}\right)^2}{E_{ij}}$$

$$E_{ij} = \frac{(\text{Row Total})(\text{Column Total})}{\text{Total Number in Sample}} = \frac{(TR_i)(TC_j)}{\text{Total Number in Sample}}$$

$$VBS = \frac{A}{k-1} \text{ and } VWS = \frac{B}{n-k}$$

$$A = \sum \frac{ST_i^2}{n_i} - \frac{(\sum x)^2}{n} \text{ and } B = \sum x^2 - \sum \frac{ST_i^2}{n_i}$$

$$F = \frac{VBS}{VWS}$$