STAT 206 FINAL EXAM Formula Sheet

Confidence Level	Z-value
90%	1.645
95%	1.96
99%	2.58
99.90%	3.08

Discrete Probability Distributions:

$\mu = E(X) = \sum x_i \, P(X = x_i)$

$\sigma = \sqrt{\sum [x_i - E(X)]^2 P(X = xi)}$

Sample Size Calculations:

$n_e = \dfrac{z^2\sigma^2}{(MOE)^2}$

$n_e = \dfrac{(z)^2 p(1-p)}{(MOE)^2}$

Confidence Intervals (one sample):

CI for p = $\hat{p} \pm z\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$, where $\hat{p} = \frac{\#successes}{n}$

CI for $\mu = \bar{X} \pm z(\frac{\sigma}{\sqrt{n}})$

CI for $\mu = \bar{X} \pm t(\frac{s}{\sqrt{n}})$

Hypothesis Tests (one sample):

$Z_{test} = \dfrac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$ $\quad Z_{test} = \dfrac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$ $\quad t_{test} = \dfrac{\bar{X} - \mu}{\frac{s}{\sqrt{n}}}$

Confidence Intervals (two samples):

$CI\ (diff\ in\ proportions) = (\hat{p}_1 - \hat{p}_2) \pm Z\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$

$CI\ (paired\ difference) = \bar{D} \pm t(\frac{s_D}{\sqrt{n}})$, (dependent/related populations)

$CI(diff\ in\ means) = (\bar{X}_1 - \bar{X}_2) \pm t\sqrt{s^2_{pool}(\frac{1}{n_1} + \frac{1}{n_2})}$, (independent, variances =)

Chebychev Rule:
data within indicated interval is at least $(1 - 1/k^2) \times 100\%$

Empirical Rule:

- μ ± σ → 68%
- μ ± 2σ → 95%
- μ ± 3σ → 99.7%

Probability Rules:

P ($\mathbf{A}^C$) = 1 – P(A) and P(A) = 1 – P(A^c)

P (A or B) = P(A) + P(B) – P(A and B)

Independent events: P (A|B) = P (A)
P (B|A) = P (B)
P (A and B) = P (A) * P (B)

Conditional Probability: P (A|B) = $\dfrac{P(A \text{ and } B)}{P(B)}$

Multiplication Rule:
P (A and B) = P (A|B)* P (B) = P(B) * P(A|B)

Calculating Sample Statistics:

$\bar{X} = \dfrac{\sum_{i=1}^{n} X_i}{n} = \dfrac{X_1 + X_2 + \cdots + X_n}{n}$ $\qquad S = \sqrt{\dfrac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n-1}}$

Binomial:

$P(X = x|n,p) = \dfrac{n!}{x!\,(n-x)!} p^x (1-p)^{n-x}$

$\mu = E(X) = np$

$\sigma = \sqrt{np(1-p)}$

Normal:

$z = \dfrac{(x-\mu)}{\sigma} \approx \dfrac{x - \bar{X}}{s}$

x = μ + Zσ

Sampling Distributions:

$\mu_{\bar{X}} = \mu$ and $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$

$Z = \dfrac{(\bar{X} - \mu_{\bar{X}})}{\sigma_{\bar{X}}} = \dfrac{(\bar{X} - \mu)}{\frac{\sigma}{\sqrt{n}}}$

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

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

Hypothesis Tests (two samples):

$Z_{test} = \dfrac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\bar{p}(1-\bar{p})(\frac{1}{n_1} + \frac{1}{n_2})}}$, where $\bar{p} = \dfrac{X_1 + X_2}{n_1 + n_2}$

$t_{test} = \dfrac{\bar{D} - \mu_D}{\frac{s_D}{\sqrt{n}}}$, where $D_i = paired\ difference$

$t_{test} = \dfrac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{s^2_{pool}(\frac{1}{n_1} + \frac{1}{n_2})}}$

$t_{test} = \dfrac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$

Counting Rules:

Rule 1: ***k*** events on each of ***n*** trials,
outcomes is k^n

Rule 2: k_i events on ***n*** trials,
outcomes is $(k_1)(k_2)\ldots(k_n)$

Rule 3: arrange ***n*** items in order is
n! = (***n***)(***n-1***)(***n-2***)…(***1***)

Rule 4 (PERMUTATIONS): ***x*** objects selected from ***n*** objects in order is ${}_nP_x = \frac{n!}{(n-x)!}$

Rule 5 (COMBINATIONS): x objects selected from ***n*** objects, irrespective of order is ${}_nC_x = \frac{n!}{x!(n-x)!}$

Chi-Square Statistics:

$\chi^2 = \sum \frac{(f_o - f_e)^2}{f_e}$, where $\bar{p} = \frac{x_1 + x_2}{n_1 + n_2}$

	Do NOT Reject H_0	**Reject H_0**
H_0 True	No Error Probability 1- $\boldsymbol{\alpha}$	Type I Error P(Type I)= $\boldsymbol{\alpha}$
H_0 False	Type II Error P(Type II)= $\boldsymbol{\beta}$	No Error Power=1- $\boldsymbol{\beta}$