Formula Sheet

Sample mean $\bar{x}$

ungrouped data:

$$\bar{x} = \frac{\sum_{i=1}^{n} X_i}{n}$$

grouped data:

$$\bar{x} = \frac{\sum_{i=1}^{n} X_i f(X_i)}{n}$$

Sample variance

ungrouped data:

$$S^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}$$

grouped data:

$$S^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2 f(x_i)}{n-1}$$

Z score:

$$z = \frac{x - \bar{x}}{s}$$

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

Pearson's R

$$r = \frac{\sum_{i=1}^{n} Z_{x_i} Z_{y_i}}{n-1}$$

Regression Line:

$$\hat{y} = ax + b$$

$$a = r\left(\frac{S_y}{S_x}\right) = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sum(x-\bar{x})^2}$$

$$b = \bar{y} - a\,(\bar{x})$$

CLT: if $X \sim N(\mu, \sigma^2)$ then

$$\bar{X} \sim N\left(\mu, \frac{\sigma^2}{n}\right)$$

if $X_1 \sim N(\mu_1, \sigma_1^2), X_2 \sim N(\mu_2, \sigma_2^2)$ then

$$\bar{X}_1 - \bar{X}_2 \sim N(\mu_1 - \mu_2, \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2})$$

$$if\ \sigma_1 = \sigma_2 = \sigma$$

$$\sigma^2 = \frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1 + n_2 - 2}$$

if $X \sim B(n, p)$

$$\hat{p} \sim N(p, \frac{pq}{n})$$

$$if\ \hat{p}_1 \sim N\left(p_1, \frac{p_1 q_1}{n_1}\right), \hat{p}_2 \sim N(p_2, \frac{p_2 q_2}{n_2})$$

$$\therefore\ \hat{p}_1 - \hat{p}_2 \sim N(p_1 - p_2, \frac{p_1 q_1}{n_1} + \frac{p_2 q_2}{n_2})$$

$$if\ p_1 = p_2 = p \rightarrow$$

$$\hat{p} = \frac{X_1 + X_2}{n_1 + n_2},$$

$$Z = \frac{p_1 - p_2}{\sqrt{\hat{p}\hat{q}(\frac{1}{n_1} + \frac{1}{n_2})}}$$

CI for a parameter θ (Mean or Proportion):

$$\hat{\theta} \pm margin\ of\ error$$

$$margin\ of\ error = (Z\ or\ t)(S.E)$$

$$\frac{(n-1)S^2}{\sigma^2} \sim \chi^2(n-1)$$

CI for variance: $\frac{(n-1)S^2}{\chi^2_{\alpha/2}(v)} \leq \sigma^2 \leq \frac{(n-1)S^2}{\chi^2_{1-\alpha/2}(v)}$

Goodness of fit test: $\chi^2 = \sum \frac{(O-E)^2}{E}$

Standard Normal Distribution Values:

z	$P(Z \leq z)$
-1.645	0.05
-2.575	0.005
-1.96	0.025
-2.05	0.02
-2.33	0.01
-2.0	0.0228
-0.675	0.25
0.675	0.75
0.25	0.5987
2.75	0.9970
1.29	0.9015
-1.25	0.1056
2.5	0.9938
-1.28	0.1003
-0.24	0.4052
-2.5	0.0062
2.06	0.9803
-1.5	0.0668
-0.5	0.3085
2.32	0.9898
2.36	0.9909
0.93	0.8238
1.65	0.9505

T-Distribution Values:

v	t	Tail Probability ($P(T > t)$)
3	3.182	0.025
4	2.776	0.025
3	2.353	0.05
4	2.132	0.05
11	1.363	0.1
12	1.356	0.1
80	2.374	0.01
80	2.639	0.005
24	2.492	0.01
24	2.797	0.005

Binomial distribution sums $\sum_{x=0}^{r} P(x|n,p)$

		P		
n	**r**	**0.30**	**0.40**	**0.50**
20	2	0.0355	0.0036	0.0002
	3	0.1071	0.0160	0.0013
	4	0.2375	0.0510	0.0059
	5	0.4164	0.1256	0.0207
	6	0.6080	0.2500	0.0577
	7	0.7723	0.4159	0.1316
	8	0.8867	0.5956	0.2517
	9	0.9520	0.7553	0.4119

χ^2-Distribution Values:

v	χ^2	Tail Probability ($P(T > \chi^2)$)
90	65.647	0.975
90	118.136	0.025
40	55.76	0.95
40	51.81	0.1
30	43.773	0.05
11	4.575	0.95
12	5.226	0.95
11	19.675	0.05
12	21.026	0.05
3	7.815	0.05
4	9.488	0.05
3	0.352	0.95
4	0.711	0.95
3	11.143	0.025
4	0.484	0.975
3	0.216	0.975
4	9.348	0.025