STAT 2220: Contemporary Statistics for Engineers
Selected Formulae (Fall 2007)

1. $\bar{x} = \sum_{i=1}^{n} x_i/n$, $s^2 = \sum_{i=1}^{n} \left(x_i - \bar{x}\right)^2/(n-1)$
2. $P(X \in A \cup B) = P(X \in A) + P(X \in B) - P(X \in A \cap B)$
3. $f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-(x-\mu)^2/2\sigma^2}, -\infty < x < \infty.$ $E(X) = \mu$, $V(X) = \sigma^2$
4. $f(x) = \frac{\lambda^r}{\Gamma(r)} x^{r-1} e^{-\lambda x}, x > 0.$ $E(X) = r/\lambda$, $V(X) = r/\lambda^2$
5. $f(x) = \lambda e^{-\lambda x}, x > 0.$ $E(X) = 1/\lambda$, $V(X) = 1/\lambda^2$
6. $f(x) = \frac{n!}{x!(n-x)!} p^x q^{n-x}, x = 0, 1, ..., n.$ $E(X) = np$, $V(X) = npq$
7. $f(x) = e^{-\lambda}\lambda^x/x!, x = 0, 1, 2....$ $E(X) = V(X) = \lambda$
8. $r = r_1 r_2 \cdots r_k$, $r = 1 - (1-r_1)(1-r_2)\cdots(1-r_k)$
9. $E(\bar{X}) = \mu$, $V(\bar{X}) = \frac{\sigma^2}{n}$
10. $Z = \frac{\bar{X}-\mu}{\sigma/\sqrt{n}}$, $\bar{X} \pm z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$, $n = \left(\frac{z_{\alpha/2}\sigma}{E}\right)^2$
11. $T = \frac{\bar{X}-\mu}{S/\sqrt{n}}$, $\bar{X} \pm t_{\alpha/2,n-1}\frac{S}{\sqrt{n}}$
12. $\chi^2 = \frac{(n-1)S^2}{\sigma^2}$, $\frac{(n-1)S^2}{\chi^2_{\alpha/2,n-1}} \le \sigma^2 \le \frac{(n-1)S^2}{\chi^2_{1-\alpha/2,n-1}}$
13. $Z = \frac{\hat{p}-p}{\sqrt{p(1-p)/n}}$, $\hat{p} \pm z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$
14. $Z = \frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\sigma_1^2/n_1+\sigma_2^2/n_2}}$, $(\bar{X}_1 - \bar{X}_2) \pm z_{\alpha/2}\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$
15. $T = \frac{\left(\bar{X}_1-\bar{X}_2\right)-(\mu_1-\mu_2)}{S_p\sqrt{1/n_1+1/n_2}}$, $(\bar{X}_1 - \bar{X}_2) \pm t_{\alpha/2,n_1+n_2-2} S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$, $S_p^2 = \frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_2-2}$
16. $r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}}$, $S_{xy} = \sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y}) = \sum_{i=1}^{n} x_i y_i - \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right)\left(\sum_{i=1}^{n} y_i\right)$
17. $\hat{\beta}_1 = \frac{S_{xy}}{S_{xx}}$, $\hat{\beta}_0 = \bar{y} - \hat{\beta}_1\bar{x}$
18. $\hat{\sigma}^2 = \frac{SS_E}{n-2}$, $SS_E = S_{yy} - \frac{S_{xy}^2}{S_{xx}}$, $R^2 = 1 - \frac{SS_E}{S_{yy}} = r^2$
19. $T = \frac{\hat{\beta}_1-\beta_{1,0}}{se(\hat{\beta}_1)}$, $\hat{\beta}_1 \pm t_{\alpha/2,n-2} se(\hat{\beta}_1)$, $se(\hat{\beta}_1) = \frac{\hat{\sigma}}{\sqrt{S_{xx}}}$
20. $T = \frac{\hat{\beta}_0-\beta_{0,0}}{se(\hat{\beta}_0)}$, $\hat{\beta}_0 \pm t_{\alpha/2,n-2} se(\hat{\beta}_0)$, $se(\hat{\beta}_0) = \hat{\sigma}\sqrt{\frac{1}{n} + \frac{\bar{x}^2}{S_{xx}}}$
21. $\hat{\mu}_{Y|x_0} \pm t_{\alpha/2,n-2} se(\hat{\mu}_{Y|x_0})$, $se(\hat{\mu}_{Y|x_0}) = \hat{\sigma}\sqrt{\frac{1}{n} + \frac{(x_0-\bar{x})^2}{S_{xx}}}$
22. $\hat{Y}_0 \pm t_{\alpha/2,n-2} se(Y_0 - \hat{Y}_0)$, $se(Y_0 - \hat{Y}_0) = \hat{\sigma}\sqrt{1 + \frac{1}{n} + \frac{(x_0-\bar{x})^2}{S_{xx}}}$