Formulas for Final Exam

- **Slope Estimates for Response Surfaces**

  Estimate: $\frac{(\Sigma C_i \overline{Y}_i)}{(\Sigma C_i^2)}$

  Standard Error: $\sqrt{\frac{MS_{Error}}{n\Sigma C_i^2}}$

- **Estimated Survivor Function**

$$\hat{S}_T(t_{(j)}) = \hat{S}_T(t_{(j-1)}) \left(\frac{a_j - d_j}{a_j} \right)$$

  a_j=# alive before $t_{(j)}$
  d_j=# of failures, deaths, at $t_{(j)}$

- **Confidence Interval**

$$\hat{S}_T(t) \pm 2se(\hat{S}_T(t))$$

$$se(\hat{S}_T(t)) = \hat{S}_T(t) \sqrt{\sum \frac{d_j}{a_j(a_j - d_j)}}$$

- **Exponential Model**

$$S_T(t) = e^{-\lambda t} \quad t > 0$$

$$F_T(t) = 1 - e^{-\lambda t} \quad t > 0$$

$$f_T(t) = \lambda e^{-\lambda t} \quad t > 0$$

$$h_T(t) = \lambda$$

- **Weibull Model**

$$S_T(t) = e^{-(\lambda t)^\beta} \quad t > 0$$
$$F_T(t) = 1 - e^{-(\lambda t)^\beta} \quad t > 0$$
$$f_T(t) = \lambda\beta(\lambda t)^{\beta-1} e^{-(\lambda t)^\beta} \quad t > 0$$
$$h_T(t) = \lambda\beta(\lambda t)^{\beta-1}$$

- **Probability Plotting**
  - **Exponential Model**

    A plot of $-ln(1-p)$ versus t will form a straight line with slope equal to λ

  - **Weibull Model**

    A plot of $ln[-ln(1-p)]$ versus $ln(t)$ will form a straight line with slope equal to β and x-intercept equal to $-ln(\lambda)$.

- **Median Time to Failure**
  - **Exponential Model**

$$t_p = \frac{-ln(1-p)}{\lambda}$$

  - **Weibull Model**

$$t_p = \frac{[-ln(1-p)]^{\frac{1}{\beta}}}{\lambda}$$