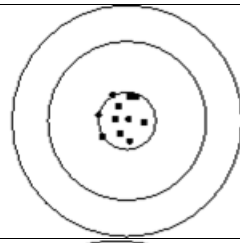
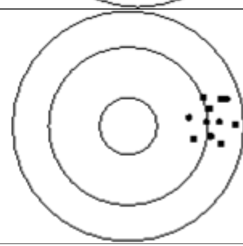
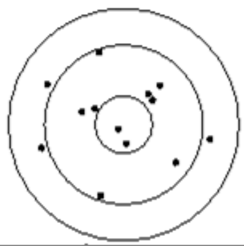
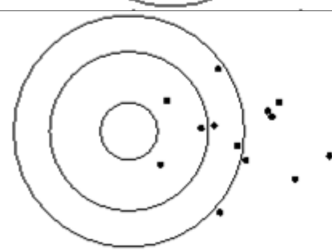
Math 327 – Chapter 6 and 7 Review Questions – Homework due Nov. 3. Ahmad M. Osman

1. Fill in each of the blanks below with the word ‘high’ or ‘low’ corresponding to the diagram at the right.

High Precision **High** Accuracy	
High Precision **Low** Accuracy	
Low Precision **High** Accuracy	
Low Precision **Low** Accuracy	

2. In this first-order model, $Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \varepsilon_i$

What is the interpretation of β_1?

β_1 indicates the change in the mean response E{Y} per unit increase in X1 when X2 is held constant.

What is the interpretation of β_2?

β_2 indicates the change in the mean response per unit increase in X2 when X1 is held constant.

3. For each of the following regression models, indicate whether it is a general linear regression model. If it is not, state whether it can be expression as a general linear regression model of the form, $Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \cdots + \beta_{p-1} X_{i-1} + \varepsilon_i$, by a suitable transformation:

   a. $Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 \log_{10} X_{i2} + \beta_3 X_{i1}^2 + \varepsilon_i$
      Does not show a linear regression model, however, can be transformed into a linear regression model.

   b. $Y_i = \varepsilon_i \exp\,(\beta_0 + \beta_1 X_{i1} + \beta_2 X_{i1}^2)$
      Does not show a linear regression model, however, can be transformed into a linear regression model.

   c. $Y_i = \log_{10}(\beta_1 X_{i1}) + \beta_2 X_{i2} + \varepsilon_i$
      Does not show a linear regression model and cannot be transformed into a linear regression model.

   d. $Y_i = \beta_0 \exp(\beta_1 X_{i1}) + \ \varepsilon_i$
      Does not show a linear regression model and cannot be transformed into a linear regression model.

   e. $Y_i = [\beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_3 + \varepsilon_i]^{-1}$
      Does not show a linear regression model, however, can be transformed into a linear regression model.

4. For this regression function, $E\{Y\} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$, where
   Y = Salary in \$1000's
   X_1 = Years on the job
   $$X_2 = \begin{cases} 0 & \textit{if subject is male} \\ 1 & \textit{if subject is female} \end{cases}$$
   $$X_3 = \begin{cases} 0 & \textit{if subject does not have a bachelor's degree} \\ 1 & \textit{if subject does have a bachelor's degree} \end{cases}$$

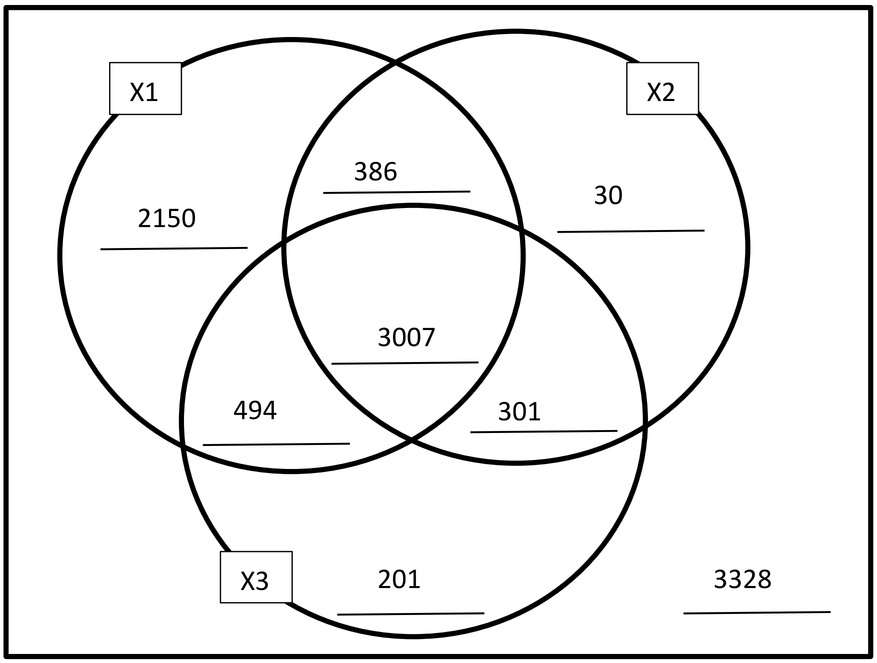
   Write the sub-model for each of these four conditions:

   a. Males without a bachelor's degree:
   $$E\{Y\} = \beta_0 + \beta_1 X_1$$
   b. Males with a bachelor's degree:
   $$E\{Y\} = \beta_0 + \beta_1 X_1 + \beta_3$$
   c. Females without a bachelor's degree:
   $$E\{Y\} = \beta_0 + \beta_1 X_1 + \beta_2$$
   d. Females with a bachelor's degree:
   $$E\{Y\} = \beta_0 + \beta_1 X_1 + \beta_2 + \beta_3$$

e. Interpret the parameter, β_3

It indicates the change in mean response per unit increase in X3 when X2 and X1 are held constant. Also, it is the coefficient for when the subject does have a bachelor's degree.

5. Complete this diagram with the component sums of squares using the ANOVA tables that follow it:



Response: Y
          Df Sum Sq
X1   1 6037
X2   1   331
X3   1   201
Residuals 32 3328
	Response: Y
	          Df Sum Sq
	X1 1 6037
	X2 1 331
	Residuals 33 3530

Response: Y
          Df Sum Sq
X1   1 6037
X3   1   502
X2   1   30
Residuals 32 3328
	Response: Y
	          Df Sum Sq
	X2 1 3724
	X3 1 695
	Residuals 33 5478

Response: Y
          Df Sum Sq
X2   1 3724
X3   1   695
X1   1 2150
Residuals 48 3328
	Response: Y
	          Df Sum Sq
	X3 1 4003
	X1 1 2536
	Residuals 33 3358