1. This is book problem 2.36. Derive the property in equation (2.6) that
\[ \sum_{i=1}^{n} k_i x_i = 1 \]

2. These are book problems 2.37 and 2.38.
   (a) Show that \( b_0 \) is an unbiased estimator for \( \beta_0 \).
   (b) Derive the variance of \( b_0 \) making use of equation (2.31) which says
   \[ \text{Cov}(b_1, \bar{Y}) = 0 \]
   (c) Explain how \( \text{Var}(b_0) \) is a special case of \( \text{Var}(\hat{Y}_h) \).

3. Refer to the Grade Point Average problem from the previous homework. This problem comes from book problems 2.4, 2.13, and 2.23. Recall that the command
   ```R
   > mydata <- read.table(file=http://www.stat.unm.edu/~storlie/st540/hw1_data.txt”, header=TRUE)
   ```
   will read the data into an R data frame
   (a) Obtain a 99% CI for \( \beta_1 \). Interpret your CI. Does it include zero? Why might the director of admissions be interested in whether or not the interval includes zero?
   (b) Test, using the test statistic \( t^* \), whether or not a linear association exists between a student’s entrance test score (\( X \)) and GPA at the end of the freshman year (\( Y \)). Use a LOS of .01. State the hypotheses, decision rule, p-value, and conclusion.
   (c) Obtain a 95% CI estimate for the mean freshman GPA for students whose entrance test score is 32. Interpret your CI.
   (d) Frank Buffay obtained a score of 32 on the entrance test. Predict his freshman GPA using a 95% prediction interval. Interpret your prediction interval.
   (e) Comment on the width of the interval in (c) versus the interval in (d).
   (f) Set up the ANOVA table for this problem.
   (g) What is estimated by \( \text{MSR} \) in your ANOVA table? by \( \text{MSE} \)? Under what conditions do \( \text{MSR} \) and \( \text{MSE} \) estimate the same quantity?
   (h) Conduct an \( F \) test of whether or not \( \beta_1 = 0 \). Control the type I error rate at .01. State the alternatives, decision rule, and conclusion.
   (i) Calculate \( r^2 \). Interpret this quantity. What is \( r \)? Is there a strong linear relationship between entrance test score and GPA?