6.4. Yield strength of steel alloy. Industrial engineers at the University of Florida used regression modeling as a tool to reduce the time and cost associated with developing new metallic alloys (Modelling and Simulation in Materials Science and Engineering, Vol. 13, 2005). To illustrate, the engineers built a regression model for the tensile yield strength (y) of a new steel alloy. The potential important predictors of yield strength are listed below.

x1 = Carbon amount (% weight)

x2 = Manganese amount (% weight)

x3 = Chromium amount (% weight)

x4 = Nickel amount (% weight)

x5 = Molybdenum amount (% weight)

x6 = Copper amount (% weight)

x7 = Nitrogen amount (% weight)

x8 = Vanadium amount (% weight)

x9 = Plate thickness (millimeters)

x10 = Solution treating (milliliters)

x11 = Aging temperature (degrees, Celsius)

1. The engineers used stepwise regression in order to search for a parsimonious set of predictor variables. Do you agree with this decision? Explain.

* Yes, since there are many independent variables, and we want to know only the independent variables which significantly influences in predicting the dependent variable (Y->Tensile yield strength).

(b)The stepwise regression selected the following independent variables: x1 = Carbon, x2 = Manganese, x3 = Chromium, x5 = Molybdenum, x6 = Copper, x8 = Vanadium, x9 = Plate thickness, x10 = Solution treating, and x11 = Ageing temperature. Based on this information, determine the total number of first-order models that were fit in the stepwise routine.

-> As there are 9 independent variables selected, the total number of first-order models that were fit are 9.

c) Refer to part b. All these variables were statistically significant in the stepwise model, with R2 = .94. Consequently, the engineers used the estimated stepwise model to predict yield strength. Do you agree with this decision? Explain.

->With just the R2 value we can’t comment on the best model and hence we do not agree with the decision. Even if these were statistically significant, other variables like Adjusted R2, CP, MSE are required to evaluate further.