

ADA2: Polynomial Regression and Logistic Regression, due April 11 Thursday

Problem 1: Muscle mass data:

A person's muscle mass is expected to decrease with age. To explore this relationship in women, a nutritionist randomly selected 15 women from each 10-year age group, beginning with age 40 and ending with age 79.

```
mmass<-read.table("https://math.unm.edu/~luyan/ADA219/mmass.txt",header=TRUE)
```

- (1.) Fit regression model $Y_i = \beta_0 + \beta_1 x_i + \beta_{11} x_i^2 + \epsilon_i$, where $x_i = X_i - \bar{X}$. Plot the fitted regression function with the data. Does the quadratic regression function appear to be a good fit here? Find R^2 .
- (2.) Test whether or not there is a regression relation use $\alpha = 0.05$. State the alternative, decision rule, and conclusion.
- (3.) Test whether the quadratic term can be dropped from the regression model; use $\alpha = 0.05$. State the alternative, decision rule, and conclusion.
- (4.) Express the fitted regression function obtained in part (a) in terms of the original variable X .
- (5.) Calculate the coefficient of simple correlation between X and X^2 and between x and x^2 . Is the use of a centered variable helpful here?

Problem 2: Space shuttle flights data

For the 23 space shuttle flights before the Challenger mission disaster in 1986, the following table shows the temperature at the time of the flight and whether at least one primary O-ring suffered thermal distress.

```
oring<-read.table("https://math.unm.edu/~luyan/ADA219/oring.txt",header=TRUE)
```

- (1.) Use logistic regression to model the effect of temperature on the probability of thermal distress. Write down the fitted model and interpret the meaning of the coefficient of temperature. Plot a figure of the fitted probabilities v.s temperature, and discuss what you have found.
- (2.) Estimate the probability of thermal distress at $31^{\circ}F$, the temperature at the place and time of the Challenger flight.
- (3.) Construct a confidence interval for the effect of temperature on the odds ratio of thermal distress, and test the statistical significance of the effect.