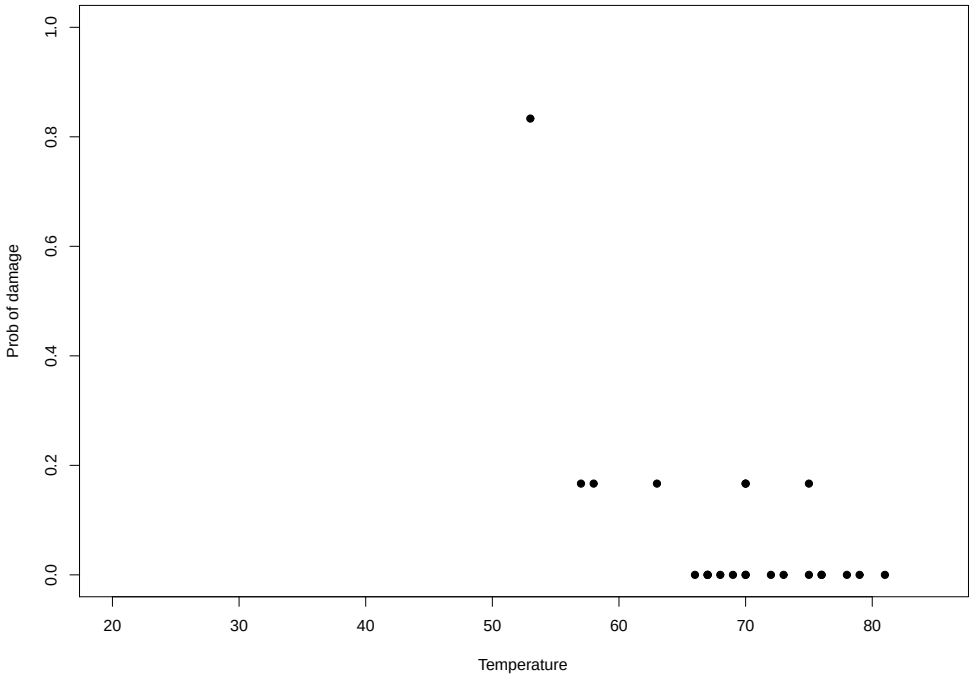
MATH 523: EXAMPLE - BINOMIAL DATA

The following data are counts of the number of failed "O-rings" (out of six) in twenty three launches of the space shuttle Challenger at different ground temperatures ranging from 53F to 81F. We seek to assess the probability of failure of all six rings at different temperatures to assess the safety.

Temperature (F)	53	57	58	63	66	67	67	67	68	69	70	70	70	70	72	73	75	75	76	76	78	79	81
No. damaged (out of 6)	5	1	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0

The following plot depicts the proportion of failures at the different temperatures.



Consider three different models: if Y is the proportion of failures, we fit

- A linear model:
$$\mathbb{E}[Y_i] = \beta_0 + \beta_1 T_i$$
- A GLM with **logistic** link: if $\text{expit}(t) = e^t/(1+e^t)$
$$\mathbb{E}[Y_i] = \text{expit}(\beta_0 + \beta_1 T_i)$$
- A GLM with **probit** link: if $\Phi(t)$ is the standard normal CDF
$$\mathbb{E}[Y_i] = \Phi(\beta_0 + \beta_1 T_i)$$

The parameters can be estimated in `R` using the `lm` and `glm` functions.

This example is taken from the book *Extending the Linear Model with R*, by Julian Faraway. The book website, with code is

http://www.maths.bath.ac.uk/∼jjf23/ELM/

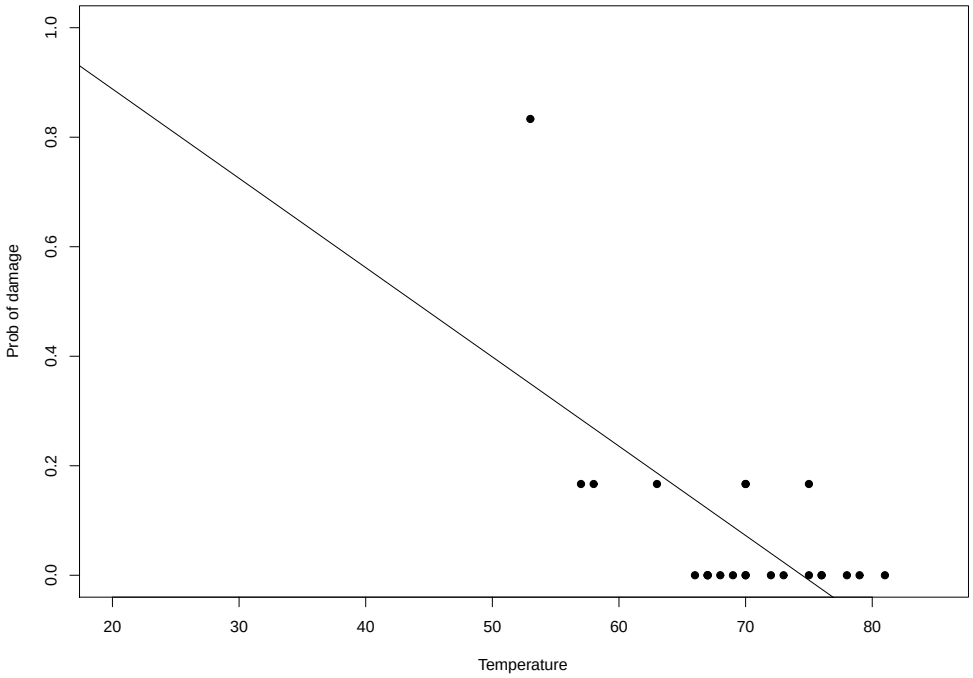


Figure 1: Linear Model Fit

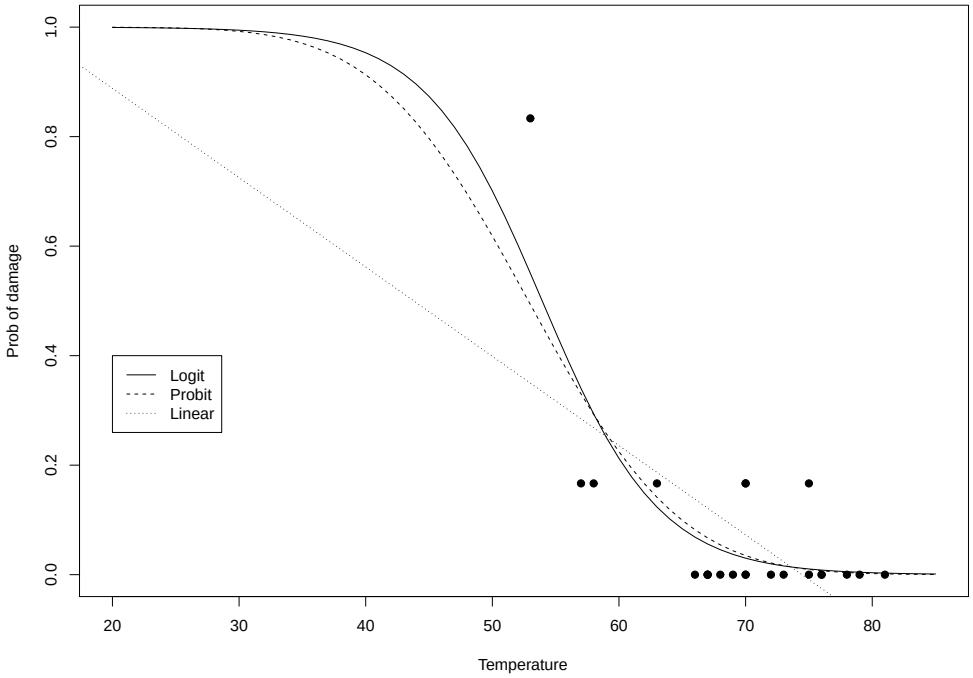


Figure 2: Linear, Logistic and Probit Model Fit