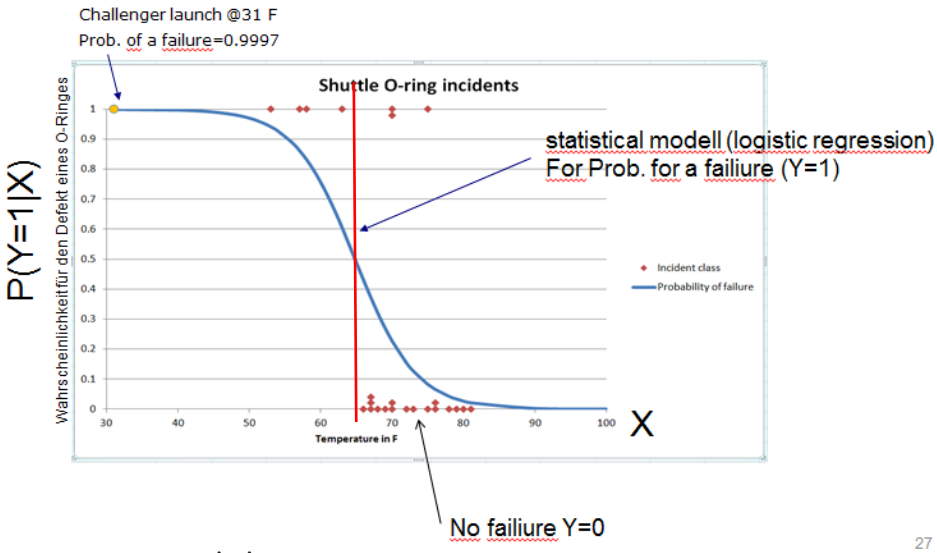
In-class exercise week 10
Topic: Using a logistic regression for binary classification

1) Challenger accident

We want to predict if a O-ring will break (Y=1) depending on the start temperature x during takeoff of the challenger. The probability for Y=1 can be estimated by a logistic regression model which is visualized below.



$$\hat{\pi}(x) = \frac{e^{\hat{\beta}_0 + \hat{\beta}_1 X}}{1 + e^{\hat{\beta}_0 + \hat{\beta}_1 X}}$$

a) Lets assume β_1 is given with −1. Guess an appropriate value for β_0.

Hint: at which *x* value should *p*(*yi* = 1|*xi*) be 0.5? Look at the data!
At this *x* value the denominator must be twice as big as the nominator.

b) In the example above we only had one predictor leading to a cutoff at about 65° Fahrenheit, indicating that for temperatures below this cutoff we would predict a damage at the o-rings.
Assume we have a second predictor x_2 in the logistic regression model and have the following estimated model:

$$\ln\left(\frac{p}{1-p}\right) = 1 + 2x_1 + 0.5x_2$$

Determine the separation curve between Y=1 and Y=0 in the room which is spanned by x_1 and x_2 and draw it in a plot x_2 and x_2.
Hint: on the separation curve should hold: $p(y_i = 1|x_i)=0.5$
-> plug in 0.5 for p and solve for x_2.