Exploring the Titanic data

- Early course feedback form sent out
- Today: summary of logistic regression (so far)
- Next week: Likelihood ratio tests and prediction

What we've covered so far...

- Interpretation and model fitting (MLE, Fisher scoring, gradient ascent)
- Visualizations and diagnostics (empirical logit plots, quantile residual plots, VIFs, Cook's distance)
- Hypothesis testing (Wald tests)

Data

Data on the RMS *Titanic* disaster. We have data on 891 passengers on the ship, with the following variables:

- `Passenger`: A unique ID number for each passenger.
- `Survived`: An indicator for whether the passenger survived (1) or perished (0) during the disaster.
- `Pclass`: Indicator for the class of the ticket held by this passengers; 1 = 1st class, 2 = 2nd class, 3 = 3rd class.
- `Sex`: Binary Indicator for the biological sex of the passenger.
- `Age`: Age of the passenger in years; Age is fractional if the passenger was less than 1 year old.
- `Fare`: How much the ticket cost in US dollars.
- + others

Research question

Is there a relationship between passenger age and their probability of survival, after accounting for sex, passenger class, and the cost of their ticket?

> What steps should I take to investigate this question with logistic regression?

Part I . Exploratory data analysis (EDA) (empirical logit plots)

Part II [. Fit model
. Diagnostics (shape, multicollinearity, ...)]

Part III . Hypothesis testing

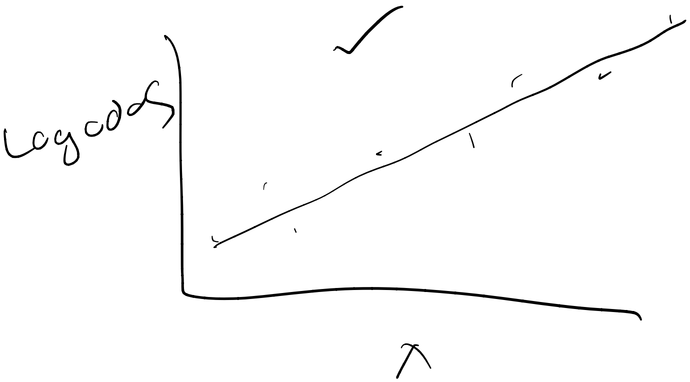
Class activity, Part I (EDA)

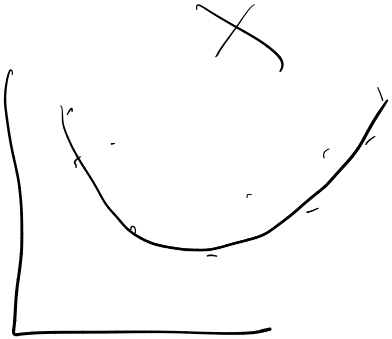
https://sta712-f22.github.io/class_activities/ca_lecture_12.html

$$\log\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 X$$

Assumption: log odds are a linear function of X

1) Bin X into n_{bins} different bins
2) Calculate average value of X in each bin
3) Calculate empirical log odds in each bin
4) Plot them together



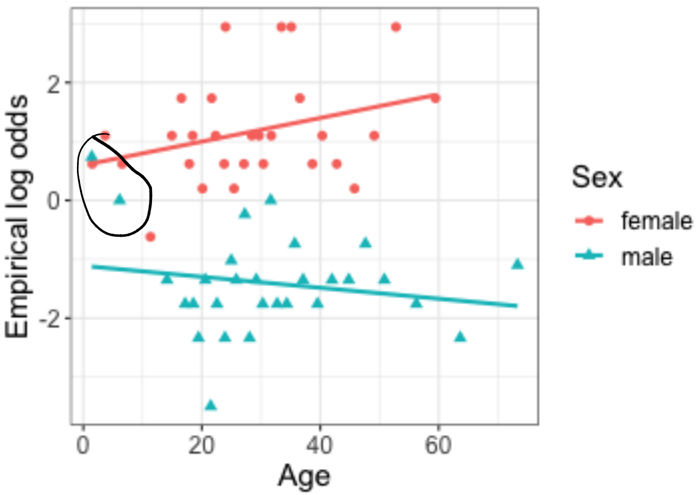


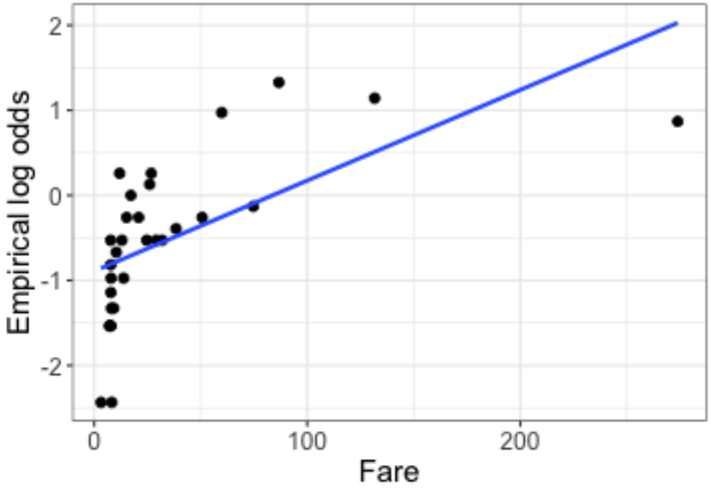
Class activity

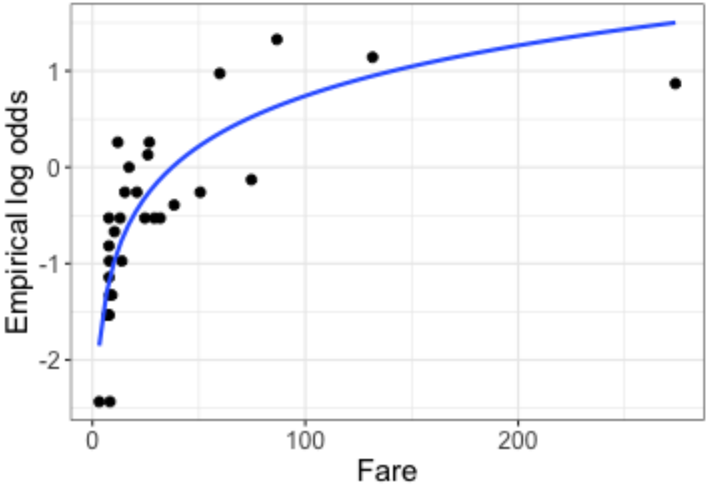
1) we should transform Fare (maybe a log)

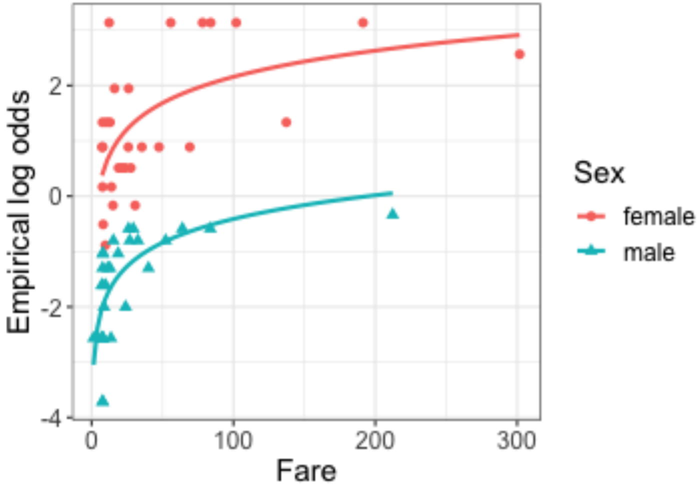
2) slope on age depends on sex (interaction!)

3) Female passengers more likely to survive









$$\log\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 Age_i + \beta_2 Sex_i + \beta_3 Age_i * Sex_i + \beta_4 \log(Fare_i + 1)$$

option 2: remove Fare = 0

```
titanic %>%
    drop_na( )
```

```
drop-na(titanic)

na.omit(titanic)
```

Class activity

> Based on your EDA, what model would you fit to address the research question?

Class activity, Part II (Diagnostics)

https://sta712-f22.github.io/class_activities/ca_lecture_12.html

Class activity, Part III (Hypothesis testing)

https://sta712-f22.github.io/class_activities/ca_lecture_12.html