

# Lab 7

## Negative Binomial Regression

Use the `make_negbinom()` function to generate data for this lab.

```
make_negbinom <- function(size = 1, beta0 = 1, beta1 = 1, n = 100){  
  x <- seq(-2, 2, length.out = n)  
  mu <- exp(beta0 + beta1 * x)  
  y <- rnbinom(n, size = size, mu = mu)  
  return(tibble(x = x,  
                 y = y))  
}
```

## Question 1: Data Visualization

### 1.1 (4 points)

Create figure that includes data points and a smoother line to compare data generated from these four settings

1. `make_negbinom(size = .1)`
2. `make_negbinom(size = 1)`
3. `make_negbinom(size = 10)`
4. `make_negbinom(size = 100)`

### 1.2 (4 points)

Do these figures match your intuition, why or why not?

## Question 2: Poisson Model Fitting

Now we will fit a Poisson regression model to the cases where `size = 1` and `size = 100`.

### 2.1 (4 points)

Fit the models and discuss how the model parameters match your expectations.

### 2.2 (4 points)

Plot the model fits to the data.

## Question 3: Negative Binomial Model Fitting

Now we will fit a Negative Binomial regression model to the cases where `size = 1` and `size = 100`.

### 3.1 (4 points)

Fit the models and discuss how the model parameters match your expectations. You can use `glm.nb` from the `MASS` package

### 3.2 (4 points)

Add the model fits to the data.

## Question 4: Model Comparisons

### 4.1 (4 points)

Which model do you prefer in the `size = 1` case, why?

### 4.2 (4 points)

Which model do you prefer in the `size = 100` case, why? Does it matter?

### 4.3 (4 points)

Do your figures in question 3 illustrate the differences in uncertainty between Poisson and negative binomial models?