Mini_homework

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- You want to know the density of fish in a set of experimental ponds:
- You observe the following counts in ten ponds: 5,6,7,3,6,5,8,4,4,3
- What is your process model?

My process model is $f(x) = fish\ density$

- What is your data model?

I thought that the poission distribution would be a good fit, because it's sampleing in a fixed space.

$$P(y|\lambda) = e^{-\lambda}\lambda^{y}$$

Becuase I have mulitple data points:

$$P(y_i|\lambda) = \prod_{i=1}^{n} \frac{e^{-\lambda}\lambda^{y_i}}{y_i!}$$

- Solve for the analytical MLE

$$ln(f(y_i)) = \sum_{i=1}^{n} ln(\frac{e^{-\lambda}\lambda^{y_i}}{y_i!})$$

$$ln(f(y_i)) = -\lambda n + (\sum_{i=1}^{n} y_i)ln(\lambda) - (\sum_{i=1}^{n} ln(y_i!))$$

Taking the deriviative:

$$\frac{d}{d\lambda}(ln(f(y))) = -n + (\sum_{i=1}^{n} y_i)\frac{1}{\lambda}$$

$$0 = -n + (\sum_{i=1}^{n} y_i) * \frac{1}{\lambda}$$

$$\lambda = (\sum_{i=1}^{n} y_i) * \frac{1}{n}$$

Aka the mean!

- What is the estimate for this population?

```
obs<-c(5,6,7,3,6,5,8,4,4,3)
mean(obs)
```

```
## [1] 5.1
```

My estimate is 5.1 fish per pond.