

WS #26 - Poisson Technical Conditions

Math 150, Jo Hardin

Wednesday, April 29, 2026

Your Name: _____

Names of people you worked with: _____

What is the hardest thing you have to do in the next 2.5 weeks?

Task: Consider the elephant data on age and mating success (number of successful matings) in male African Elephants. What do each of these figures / tables show in terms of the technical conditions of Poisson regression?

Figure 1

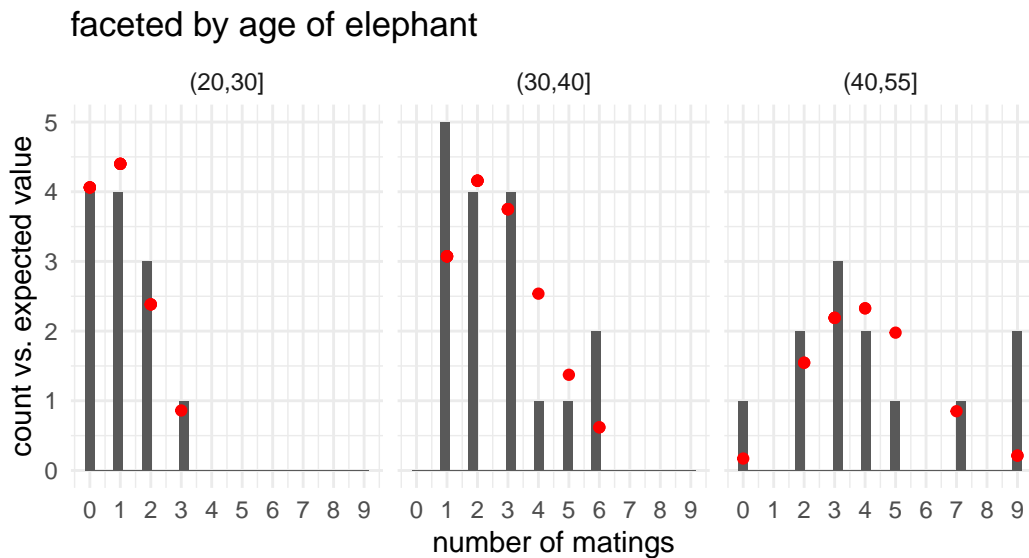


Figure 1: The red dots on each plot correspond to the expected count under the Poisson model given by the average number of matings and total count of elephants (in each age group).

Table 1:

```
# A tibble: 3 x 5
  AGEgroups mean variance stdev    n
  <chr>      <dbl>    <dbl> <dbl> <int>
1 (20,30]    1.08     0.992 0.996    12
2 (30,40]    2.71     2.85  1.69    17
3 (40,55]    4.25     7.84  2.80    12
```

Table 2 / Figure 2:

```
  agecut mean_mate log_mean_mate  n age
1 (26.5,29.5]  1.090909  0.08701138 11 28
2 (29.5,32.5]  1.500000  0.40546511  2 31
3 (32.5,35.5]  2.444444  0.89381788  9 34
4 (35.5,38.5]  3.500000  1.25276297  6 37
5 (38.5,41.5]  2.000000  0.69314718  2 40
6 (41.5,44.5]  3.571429  1.27296568  7 43
7 (44.5,47.5]  6.000000  1.79175947  2 46
8 (47.5,50.5]  2.000000  0.69314718  1 49
9 (50.5,53.5]  9.000000  2.19722458  1 52
```

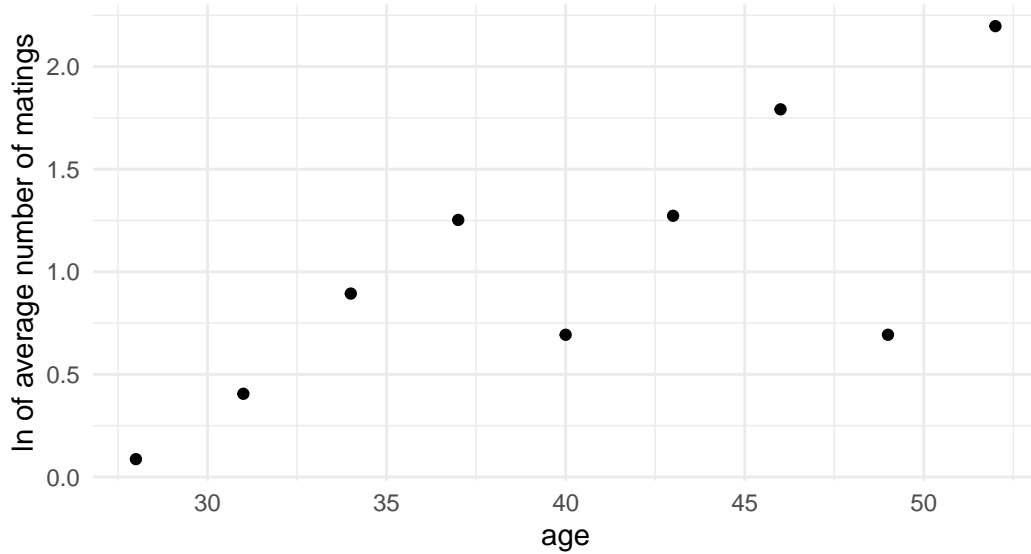


Figure 2: x-axis is the center of the age range. y-axis is the natural log of the average number of matings for the elephants in that age range.

Solution:

Figure 1: **Technical Condition 3, Poisson:** It seems as though, even when conditioning on the explanatory variable, the response is right skewed with variance dependent on the mean. The Poisson expected values are not perfect, but they are close to the observed counts.

Table 1: **Technical Condition 4, Error:** To check whether the mean and variance are similar, we can calculate the values per group (with more data we would probably have more groups of the explanatory variable, and the following analysis would be done with a scatterplot of means on the x-axis and variance on the y-axis). Note that the mean and variance are reasonably similar!

Table 2 / Figure 2: **Technical Condition 1, Line:** The Poisson model implies that the log of the mean will be a linear function of the explanatory variable. The linear relationship mostly holds here. The points that don't follow the linear relationship are based on age groups with very few observations.