Negative Binomial Regression with R

Introduction Negative binomial regression is for modeling count variables, usually for over-dispersed count outcome variables.

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- Negative binomial regression can be used for over-dispersed count data, that is when the conditional variance exceeds the conditional mean.
- It can be considered as a generalization of Poisson regression since it has the same mean structure as Poisson regression and it has an extra parameter to model the over-dispersion.

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- If the conditional distribution of the outcome variable is over-dispersed, the confidence intervals for Negative binomial regression are likely to be narrower as compared to those from a Poisson regression.

Examples of negative binomial regression

- **Example 1** School administrators study the attendance behavior of high school juniors at two schools.
  Predictors of the number of days of absence include the type of program in which the student is enrolled and a standardized test in math.
- **Example 2** A health-related researcher is studying the number of hospital visits in past 12 months by senior citizens in a community based on the characteristics of the individuals and the types of health plans under which each one is covered.

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Description of the data Let's pursue Example 1 from above.

- We have attendance data on 314 high school juniors from two urban high schools in the file **negbin.csv** .
- The response variable of interest is days absent, **daysabs**.
- The variable **math** gives the standardized math score for each student.
- The variable **prog** is a three-level nominal variable indicating the type of instructional program in which the student is enrolled.

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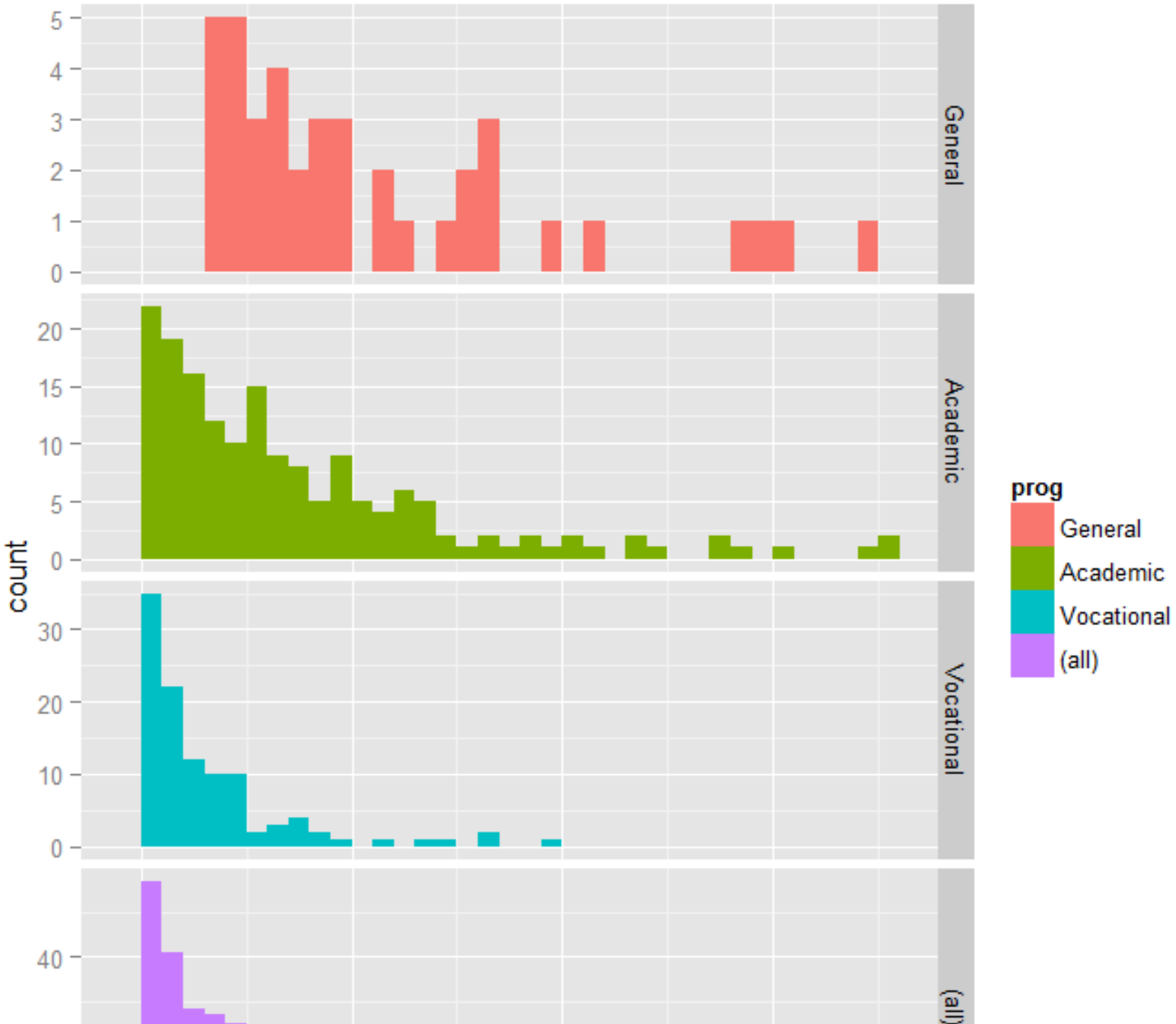
Exploratory Data Analysis

```
summary(dat)
       id          gender         math          daysabs
  1001   :  1   female:160   Min.   : 1.0   Min.   : 0.00
  1002   :  1   male  :154   1st Qu.:28.0   1st Qu.: 1.00
  1003   :  1                Median :48.0   Median : 4.00
  1004   :  1                Mean   :48.3   Mean   : 5.96
  1005   :  1                3rd Qu.:70.0   3rd Qu.: 8.00
  1006   :  1                Max.   :99.0   Max.   :35.00
  (Other):308
         prog
  General   : 40
  Academic  :167
  Vocational:107
```


count
General
Academic
Vocational
(all)
prog
General
Academic
Vocational
(all)

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```
ggplot(dat, aes(daysabs, fill = prog)) + geom_
., margins = TRUE, scales = "free")
```

Histogram plots showing distribution of the data
Each variable has 314 valid observations and their distributions seem quite reasonable. The unconditional mean of our outcome variable is much lower than its variance.