Hurricanes EDA

Data Sources

amo_by_month.csv:
https://climatedataguide.ucar.edu/sites/default/files/amo_monthly.10yrLP.txt
(Manually generated CSV file from the textual data)

category4_atlantic_by_decade.csv:
https://en.wikipedia.org/wiki/List_of_Category_4_Atlantic_hurricanes
(Manually generated CSV file from the tables)

category4_atlantic_by_year.csv:
https://en.wikipedia.org/wiki/List_of_Category_4_Atlantic_hurricanes
(Manually generated CSV file from the tables)

category5_atlantic_by_decade.csv:
https://en.wikipedia.org/wiki/List_of_Category_5_Atlantic_hurricanes
(Manually generated CSV file from the tables)

category5_atlantic_by_year.csv:
https://en.wikipedia.org/wiki/List_of_Category_5_Atlantic_hurricanes
(Manually generated CSV file from the tables)

tropical_storm_data:

Plot Bar Plots of Hurricanes by Decade

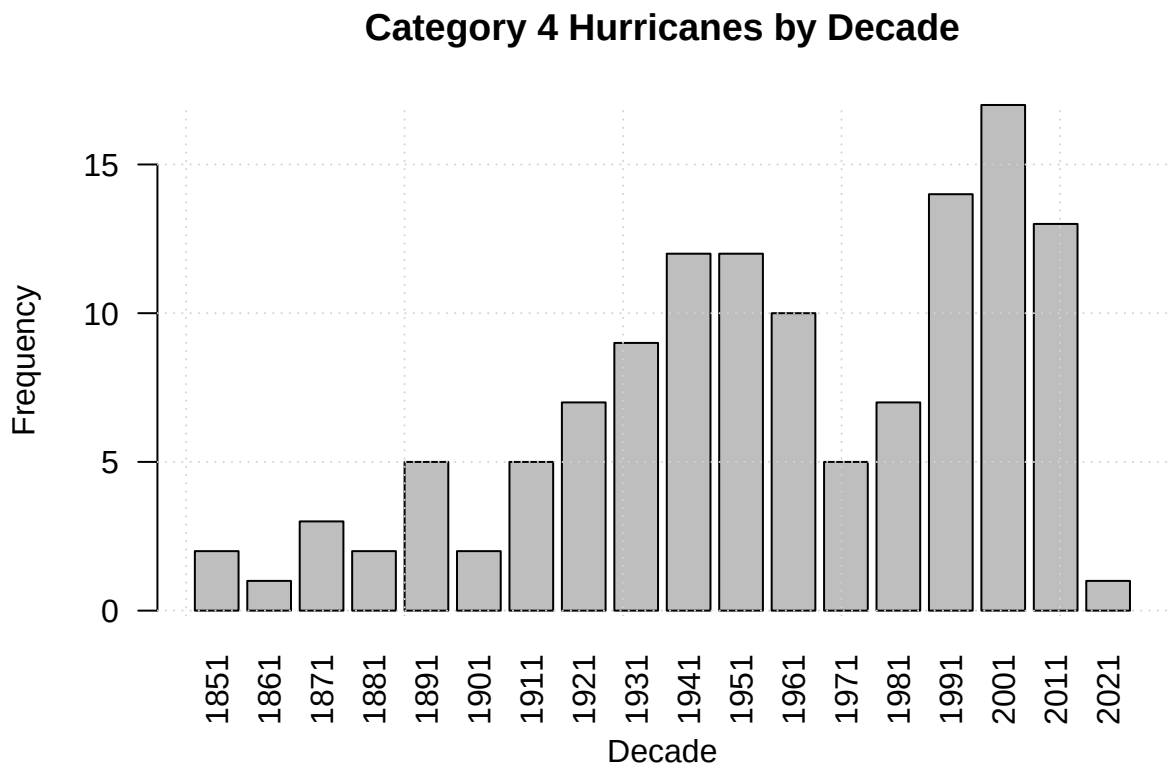
Category 4 Hurricanes

```
Cat4.Atlantic.decade <-
  read.csv('datasets/category4_atlantic_by_decade.csv')
Cat4.Atlantic.decade
```

```
##    decade frequency
## 1    1851         2
## 2    1861         1
## 3    1871         3
## 4    1881         2
## 5    1891         5
## 6    1901         2
## 7    1911         5
## 8    1921         7
## 9    1931         9
## 10   1941        12
## 11   1951        12
```

```
## 12   1961         10
## 13   1971          5
## 14   1981          7
## 15   1991         14
## 16   2001         17
## 17   2011         13
## 18   2021          1
```

```
barplot(
  Cat4.Atlantic.decade$frequency,
  names.arg = Cat4.Atlantic.decade$decade,
  main = 'Category 4 Hurricanes by Decade',
  xlab = 'Decade',
  ylab = 'Frequency',
  las = 2
)
grid()
```

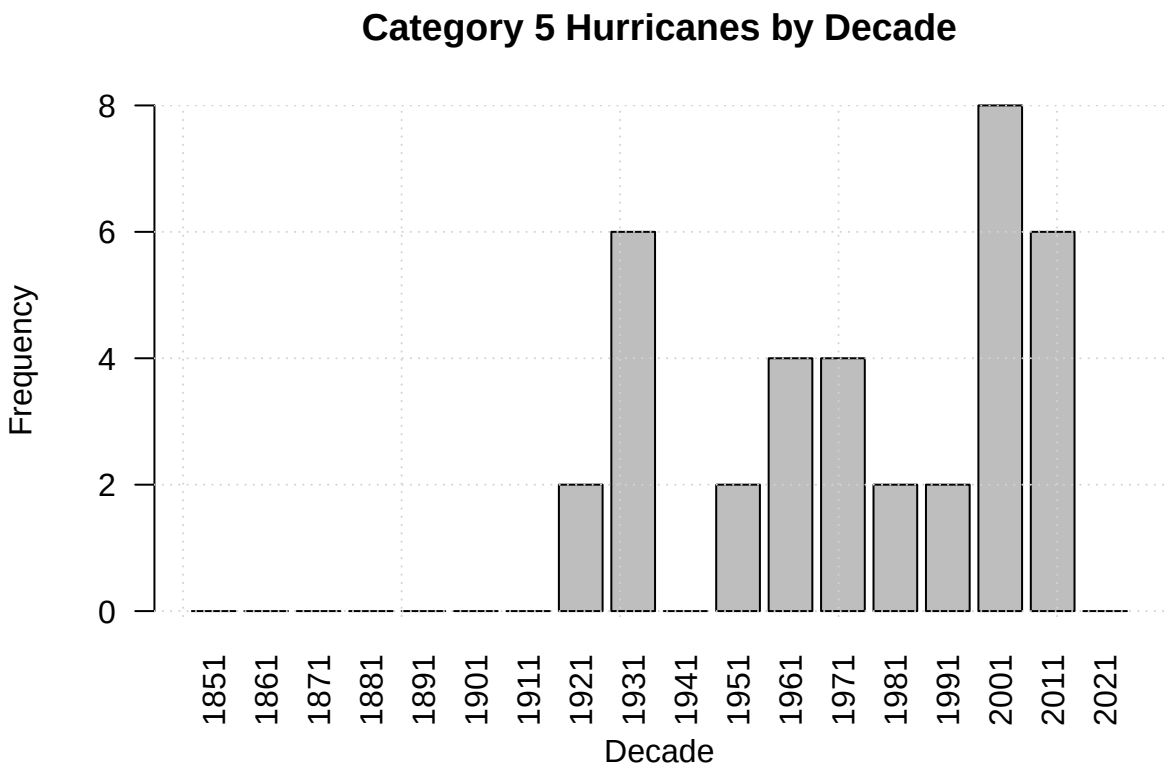


Category 5 Hurricanes

```
Cat5.Atlantic.decade <-
  read.csv('datasets/category5_atlantic_by_decade.csv')
Cat5.Atlantic.decade
```

```
##    decade frequency
## 1    1851         0
## 2    1861         0
## 3    1871         0
## 4    1881         0
## 5    1891         0
## 6    1901         0
## 7    1911         0
## 8    1921         2
## 9    1931         6
## 10   1941         0
## 11   1951         2
## 12   1961         4
## 13   1971         4
## 14   1981         2
## 15   1991         2
## 16   2001         8
## 17   2011         6
## 18   2021         0
```

```
barplot(
  Cat5.Atlantic.decade$frequency,
  names.arg = Cat5.Atlantic.decade$decade,
  main = 'Category 5 Hurricanes by Decade',
  xlab = 'Decade',
  ylab = 'Frequency',
  las = 2
)
grid()
```



Calculate the Highest Frequency of Hurricanes Over the Decades

```
Cat4.max_freq = max(Cat4.Atlantic.decade$frequency)
Cat4.max_freq
```

```
## [1] 17
```

```
Cat5.max_freq = max(Cat5.Atlantic.decade$frequency)
Cat5.max_freq
```

```
## [1] 8
```

Calculate Number of Decades

```
num_decades = length(Cat4.Atlantic.decade$decade)
num_decades
```

```
## [1] 18
```

Function to Count the Number of Decades Having the Same Hurricane Frequencies

Example: Number of Decades where there was 1 occurrence of Category 4 Hurricane is 2,
Number of Decades where there were 2 occurrences of Category 4 Hurricanes is 3, etc.

```
get_freqs <- function(Cat, freqs_list) {
  for (i in Cat$frequency) {
    freqs_list[i + 1] = freqs_list[i + 1] + 1
  }
  return(freqs_list)
}
```

```
Cat4.freqs =  c(0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0)
Cat4.freqs = get_freqs(Cat4.Atlantic.decade, Cat4.freqs)
Cat4.freqs
```

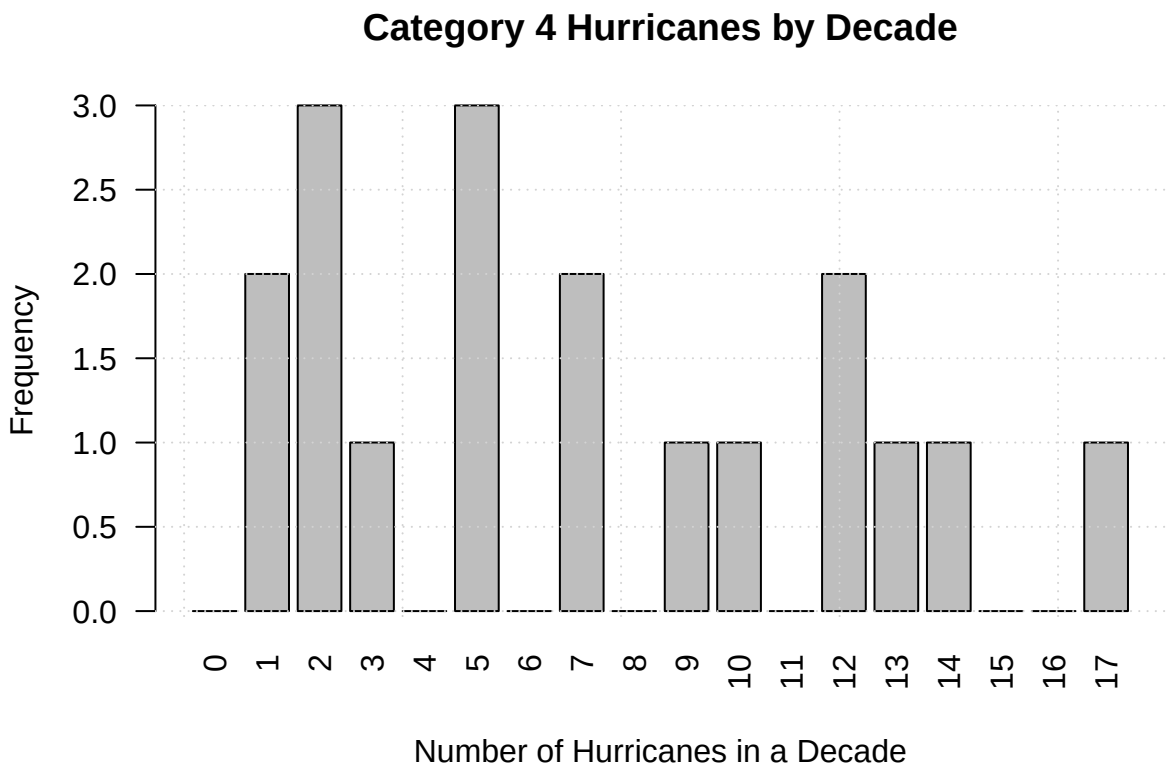
```
##  [1] 0 2 3 1 0 3 0 2 0 1 1 0 2 1 1 0 0 1
```

```
Cat5.freqs =  c(0, 0, 0, 0, 0, 0, 0, 0, 0)
Cat5.freqs = get_freqs(Cat5.Atlantic.decade, Cat5.freqs)
Cat5.freqs
```

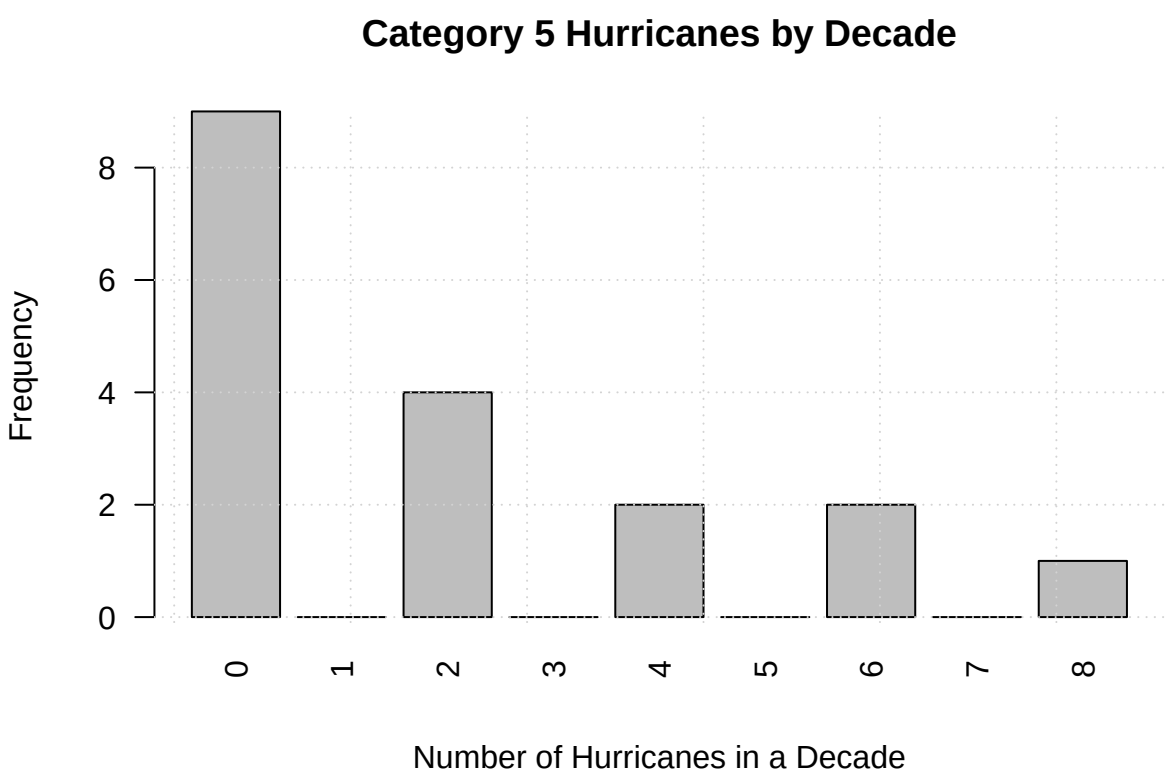
```
## [1] 9 0 4 0 2 0 2 0 1
```

Plot Number of Hurricanes in a Decade

```
barplot(
  Cat4.freqs,
  names.arg = 0:Cat4.max_freq,
  main = 'Category 4 Hurricanes by Decade',
  xlab = 'Number of Hurricanes in a Decade',
  ylab = 'Frequency',
  las = 2
)
grid()
```




```
barplot(
  Cat5.freqs,
  names.arg = 0:Cat5.max_freq,
  main = 'Category 5 Hurricanes by Decade',
  xlab = 'Number of Hurricanes in a Decade',
  ylab = 'Frequency',
  las = 2
)
grid()
```



Calculate lambda Value for Poisson Distribution

```
Cat4.lambda = mean(Cat4.Atlantic.decade$frequency)
Cat4.lambda
```

```
## [1] 7.055556
```

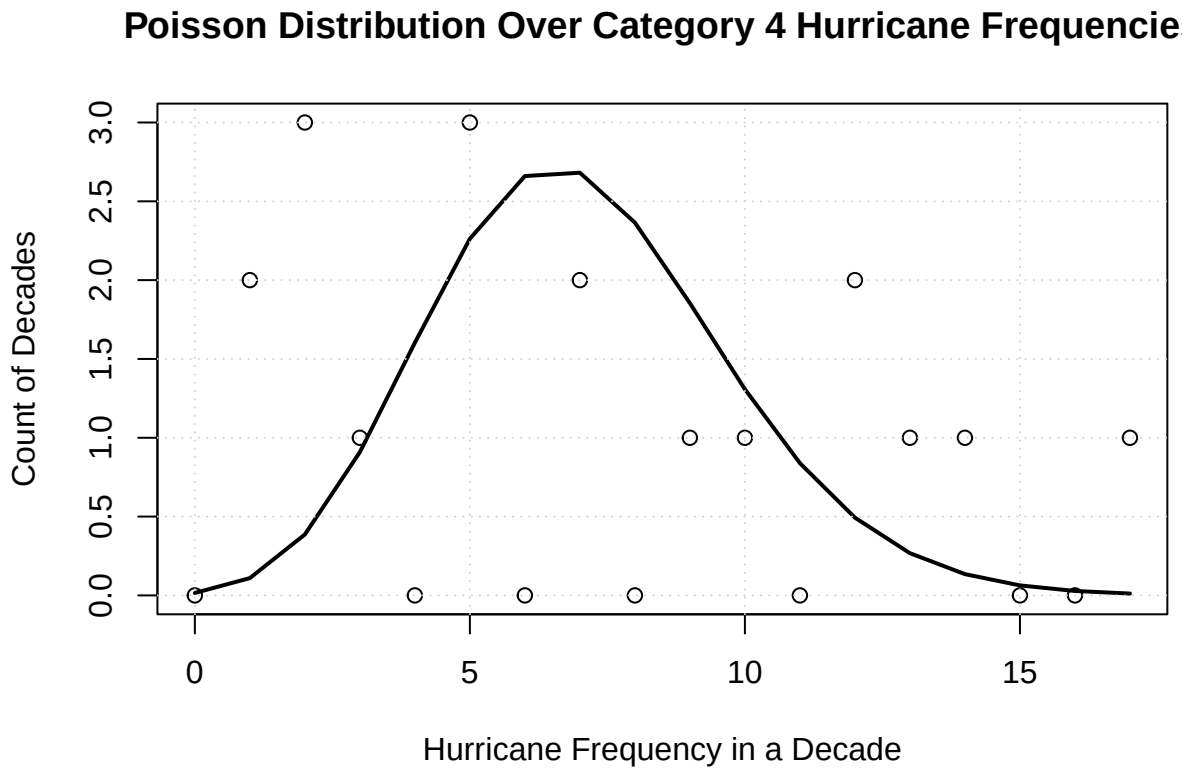
```
Cat5.lambda = mean(Cat5.Atlantic.decade$frequency)
Cat5.lambda
```

```
## [1] 2
```

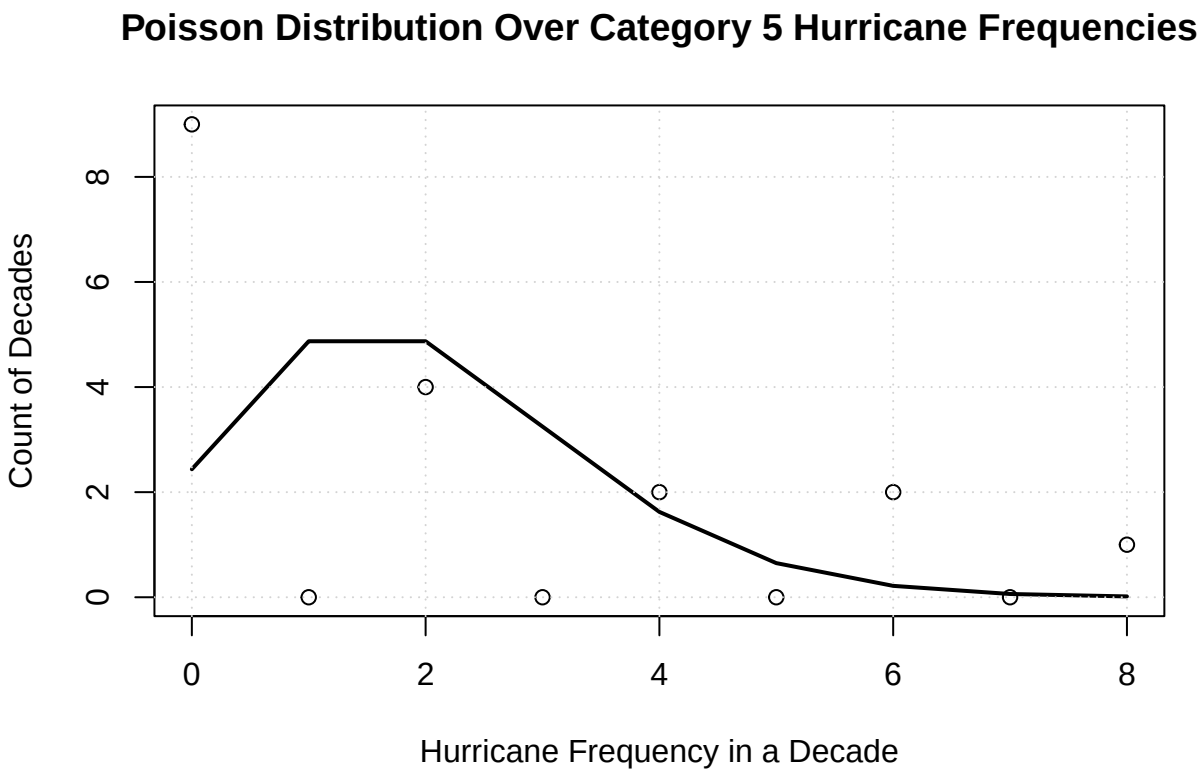
Plot Poisson Distribution Over Hurricane Frequencies

```
plot(
  0:Cat4.max_freq,
  Cat4.freqs,
  main = 'Poisson Distribution Over Category 4 Hurricane Frequencies',
  xlab = 'Hurricane Frequency in a Decade',
```

```
  ylab = 'Count of Decades'
)
lines(0:Cat4.max_freq,
      dpois(0:Cat4.max_freq, Cat4.lambda) * sum(Cat4.freqs),
      lwd = 2)
grid()
```

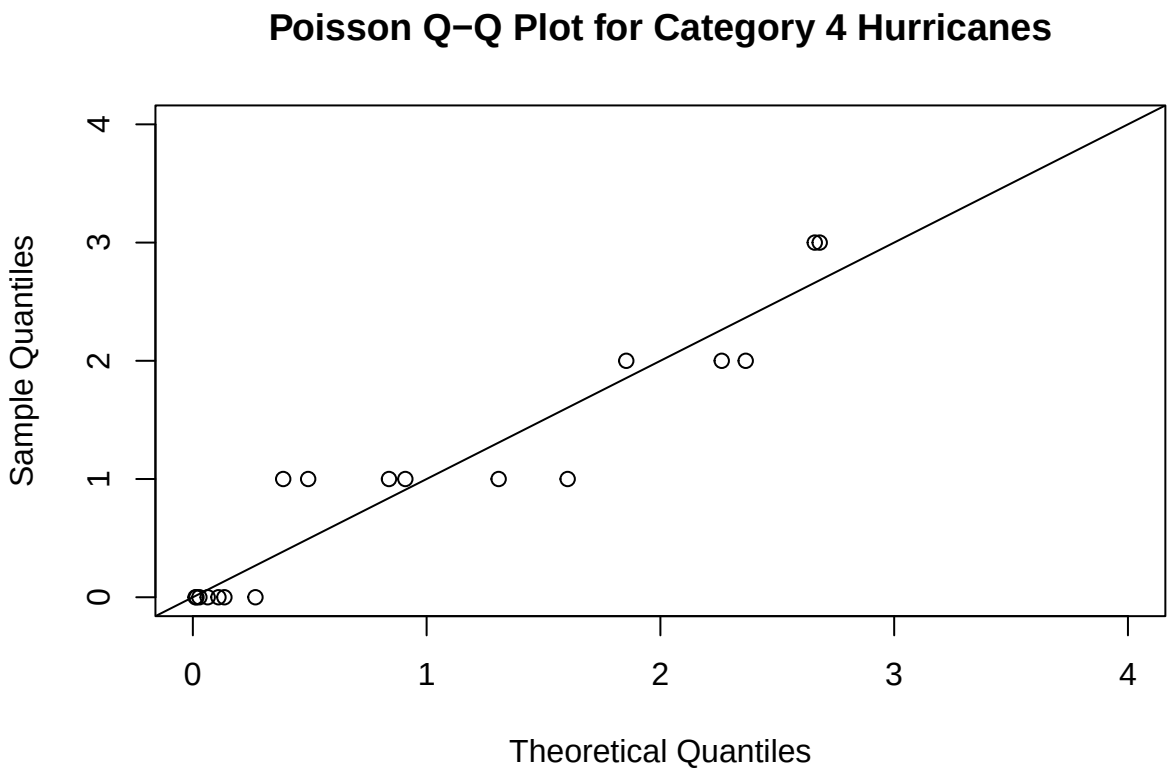



```
plot(
  0:Cat5.max_freq,
  Cat5.freqs,
  main = 'Poisson Distribution Over Category 5 Hurricane Frequencies',
  xlab = 'Hurricane Frequency in a Decade',
  ylab = 'Count of Decades'
)
lines(0:Cat5.max_freq,
      dpois(0:Cat5.max_freq, Cat5.lambda) * sum(Cat5.freqs),
      lwd = 2)
grid()
```

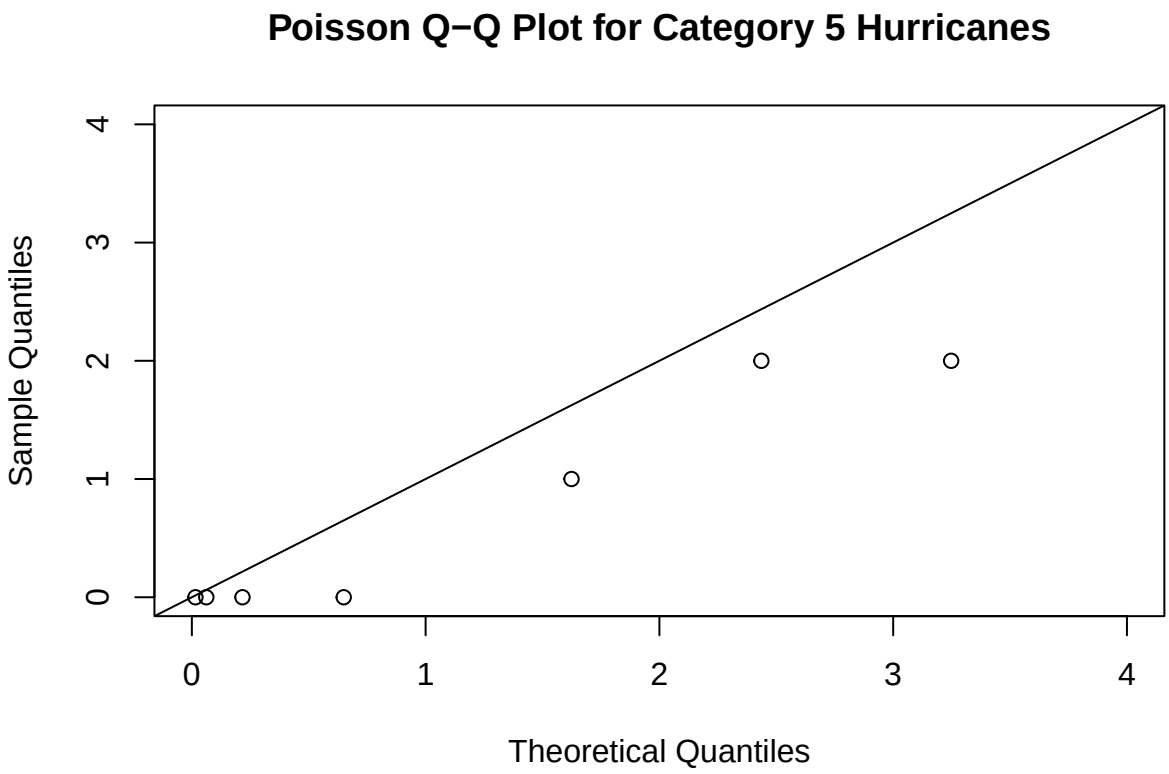


Plot Q-Q Plots

```
qqplot(
  dpois(0:Cat4.max_freq, Cat4.lambda) * sum(Cat4.freqs),
  Cat4.freqs,
  main = 'Poisson Q-Q Plot for Category 4 Hurricanes',
  xlab = 'Theoretical Quantiles',
  ylab = 'Sample Quantiles',
  xlim = c(0, 4),
  ylim = c(0, 4)
)
abline(0, 1)
```




```
qqplot(
  dpois(0:Cat5.max_freq, Cat5.lambda) * sum(Cat5.freqs),
  Cat5.freqs,
  main = 'Poisson Q-Q Plot for Category 5 Hurricanes',
  xlab = 'Theoretical Quantiles',
  ylab = 'Sample Quantiles',
  xlim = c(0, 4),
  ylim = c(0, 4)
)
abline(0, 1)
```



Read Monthly Atlantic Multidecadal Oscillation Index CSV File

```
AMO.month <- read.csv('datasets/amo_by_month.csv')
AMO.month
```

Remove Outlier Values

```
AMO.month = AMO.month[c(-146:-152), ]
AMO.month
```

Plot AMO Index (Yearly Mean)

```
AMO.month.means = rowMeans(AMO.month[, -1])
AMO.month.means.ts = ts(AMO.month.means, frequency = 1, start = 1870)
plot(AMO.month.means.ts,
     main = 'AMO Index (Yearly Mean)',
     xlab = 'Year',
```

```
     ylab = 'Temperature Anomaly')
abline(h = 0, lwd = 2)
grid()
```