Benford Law

Anil Goyal

03/06/2022

Digit Analysis Using Benford's Law

Natural guess

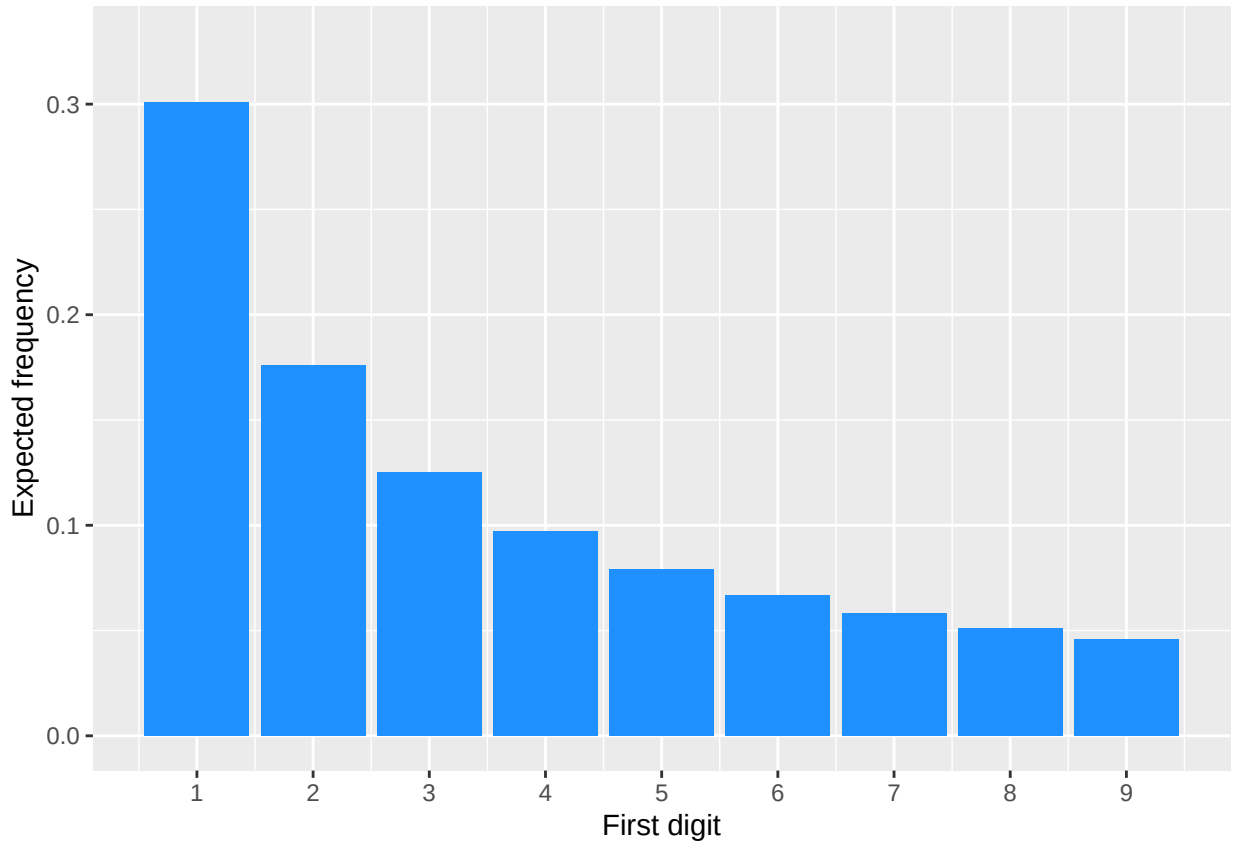
Background

Newcomb - 1881 Benford - 1938

Law $P(d = d_i) = log(1 + 1/d_i)$ where $d_i = 1..9$

Plot

```
## [1] 0.07918125
```



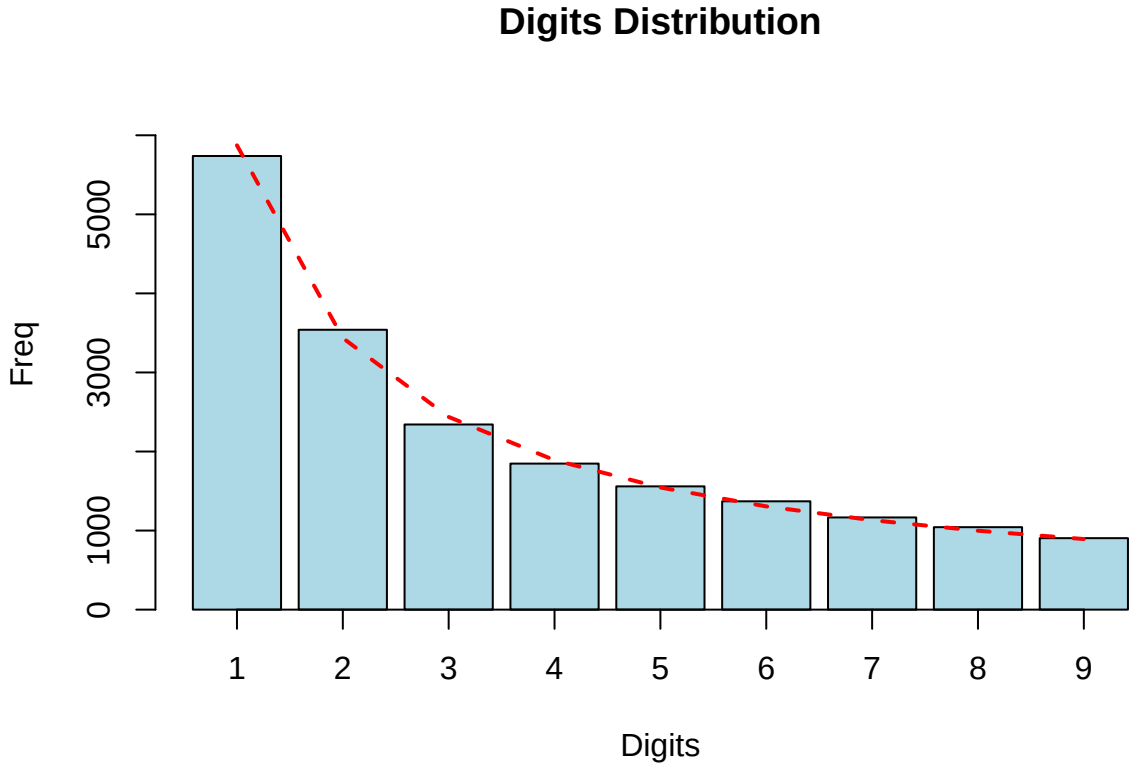
Benford showed it on 20 different datasets

Pickham later showed that law is invariant to scaling

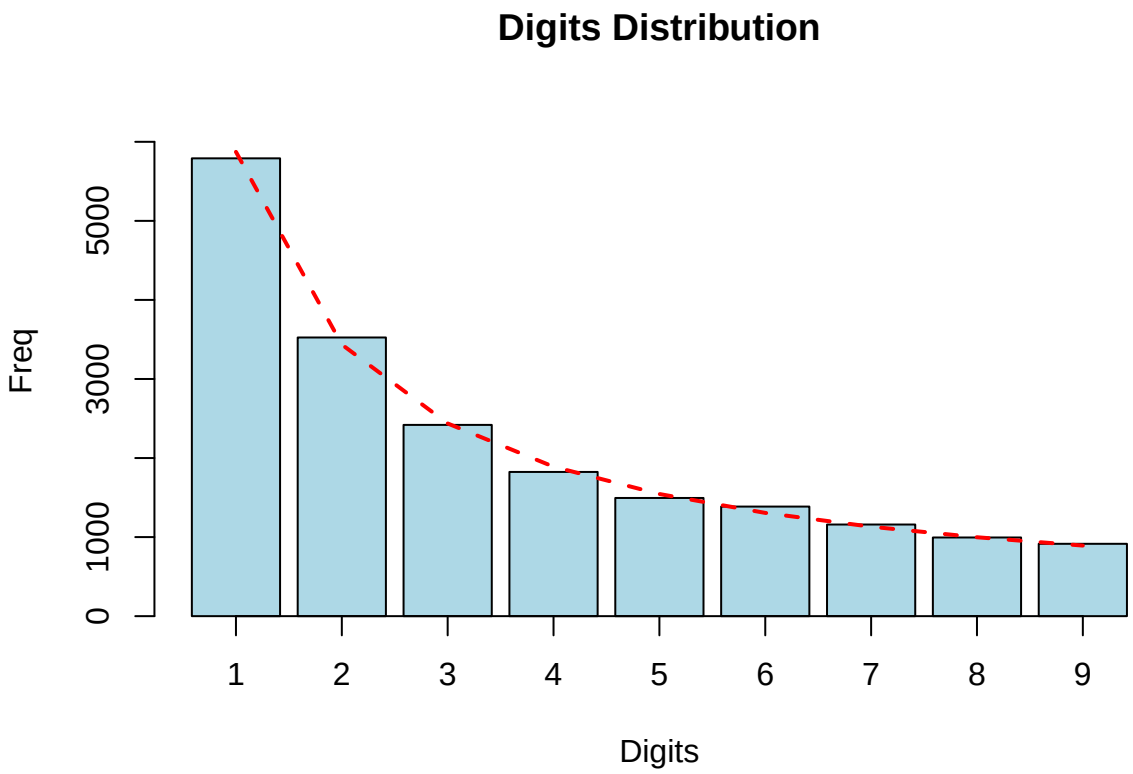
Another example (to be modified)

```
# Load package benford.analysis
library(benford.analysis)
data(census.2009)

# Check conformity
bfd.cen <- benford(census.2009$pop.2009, number.of.digits = 1)
plot(bfd.cen, except = c("second order", "summation", "mantissa", "chi squared","abs diff", "ex summati
```




```
# Multiply the data by 3 and check conformity again
data <- census.2009$pop.2009 * 3
bfd.cen3 <- benford(data, number.of.digits=1)
plot(bfd.cen3, except = c("second order", "summation", "mantissa", "chi squared","abs diff", "ex summat
```



Fraud detection

Two digits

examples

Ref-

ISACA JOURNAL ARCHIVES - Understanding and Applying Benford's Law - 1 May 2011

Detecting outliers

Univariate

multivariate