Assignment 1

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September 12, 2018

Document assignment

Consider the following situation:

A sloppy printer produces books with an average of 2 misprints per page. You want to know how many pages have more than k misprints in a book of n pages. Make an n x k table that shows the relationship between the total number of pages in a book and the number of pages with k misprints.

Show and explain your work. Include equations and calculations to teach the reader how to solve the problem. Include an image of a book.

Push your solution to a github repository and submit the url for repository on blackboard. Be sure your repo includes your document as a pdf file and as an RMD file. Include other files needed to recompile your document.

```
options(digits=2)
k<-vector(mode="numeric",length=0)
result<-rep(NULL,51)
p<-ppois(q = 0:10, lambda=2, lower.tail = FALSE) #Find out the possibility of more than k misprints and
for (i in 1:11) {
  for (n in 1:51) {
    p1<-p[i] #Assign each probability of more than k misprints to p1
    k[n]<-pbinom(q = n, size = 50,prob = p1) #Figure out the binomial probability for different n pages
  }
  result<-rbind(result,k)
}

table<-as.data.frame(result)
table
```

```
##           V1      V2      V3      V4      V5      V6      V7      V8
## k    1.2e-41 1.9e-39 1.9e-37 1.4e-35 8.5e-34 4.1e-32 1.7e-30 5.7e-29
## k.1  2.0e-18 7.2e-17 1.7e-15 3.0e-14 4.1e-13 4.6e-12 4.3e-11 3.4e-10
## k.2  8.2e-08 1.0e-06 8.1e-06 4.8e-05 2.2e-04 8.5e-04 2.7e-03 7.5e-03
## k.3  4.2e-03 1.9e-02 6.0e-02 1.4e-01 2.6e-01 4.2e-01 5.8e-01 7.2e-01
## k.4  2.5e-01 5.1e-01 7.3e-01 8.8e-01 9.5e-01 9.8e-01 1.0e+00 1.0e+00
## k.5  8.0e-01 9.5e-01 9.9e-01 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.6  9.8e-01 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.7  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.8  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.9  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.10 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
##           V9     V10     V11     V12     V13     V14     V15     V16
## k    1.7e-27 4.5e-26 1.1e-24 2.2e-23 4.1e-22 7.0e-21 1.1e-19 1.5e-18
## k.1  2.4e-09 1.5e-08 8.0e-08 3.9e-07 1.7e-06 6.9e-06 2.5e-05 8.3e-05
## k.2  1.8e-02 3.9e-02 7.6e-02 1.3e-01 2.1e-01 3.1e-01 4.3e-01 5.5e-01
## k.3  8.3e-01 9.1e-01 9.5e-01 9.8e-01 9.9e-01 1.0e+00 1.0e+00 1.0e+00
## k.4  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.5  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
```

```
## k.6  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.7  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.8  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.9  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.10 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
##          V17     V18     V19     V20     V21     V22     V23     V24
## k    2.0e-17 2.3e-16 2.5e-15 2.5e-14 2.3e-13 2.0e-12 1.5e-11 1.1e-10
## k.1  2.5e-04 7.1e-04 1.8e-03 4.4e-03 9.7e-03 2.0e-02 3.8e-02 6.8e-02
## k.2  6.6e-01 7.6e-01 8.4e-01 9.0e-01 9.4e-01 9.7e-01 9.8e-01 9.9e-01
## k.3  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.4  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.5  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.6  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.7  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.8  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.9  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.10 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
##          V25     V26     V27     V28     V29     V30     V31     V32
## k    7.6e-10 4.7e-09 2.7e-08 1.4e-07 7.2e-07 3.3e-06 1.4e-05 5.4e-05
## k.1  1.1e-01 1.8e-01 2.6e-01 3.6e-01 4.7e-01 5.9e-01 7.0e-01 7.9e-01
## k.2  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.3  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.4  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.5  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.6  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.7  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.8  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.9  1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
## k.10 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00 1.0e+00
##          V33     V34    V35    V36   V37   V38   V39  V40  V41  V42  V43
## k    0.00019 0.00064 0.0019 0.0054 0.014 0.032 0.068 0.13 0.23 0.36 0.52
## k.1  0.86361 0.91823 0.9548 0.9770 0.989 0.996 0.998 1.00 1.00 1.00 1.00
## k.2  1.00000 1.00000 1.0000 1.0000 1.000 1.000 1.000 1.00 1.00 1.00 1.00
## k.3  1.00000 1.00000 1.0000 1.0000 1.000 1.000 1.000 1.00 1.00 1.00 1.00
## k.4  1.00000 1.00000 1.0000 1.0000 1.000 1.000 1.000 1.00 1.00 1.00 1.00
## k.5  1.00000 1.00000 1.0000 1.0000 1.000 1.000 1.000 1.00 1.00 1.00 1.00
## k.6  1.00000 1.00000 1.0000 1.0000 1.000 1.000 1.000 1.00 1.00 1.00 1.00
## k.7  1.00000 1.00000 1.0000 1.0000 1.000 1.000 1.000 1.00 1.00 1.00 1.00
## k.8  1.00000 1.00000 1.0000 1.0000 1.000 1.000 1.000 1.00 1.00 1.00 1.00
## k.9  1.00000 1.00000 1.0000 1.0000 1.000 1.000 1.000 1.00 1.00 1.00 1.00
## k.10 1.00000 1.00000 1.0000 1.0000 1.000 1.000 1.000 1.00 1.00 1.00 1.00
##       V44  V45  V46  V47  V48 V49 V50 V51
## k    0.69 0.82 0.92 0.97 0.99   1   1   1
## k.1  1.00 1.00 1.00 1.00 1.00   1   1   1
## k.2  1.00 1.00 1.00 1.00 1.00   1   1   1
## k.3  1.00 1.00 1.00 1.00 1.00   1   1   1
## k.4  1.00 1.00 1.00 1.00 1.00   1   1   1
## k.5  1.00 1.00 1.00 1.00 1.00   1   1   1
## k.6  1.00 1.00 1.00 1.00 1.00   1   1   1
## k.7  1.00 1.00 1.00 1.00 1.00   1   1   1
## k.8  1.00 1.00 1.00 1.00 1.00   1   1   1
## k.9  1.00 1.00 1.00 1.00 1.00   1   1   1
## k.10 1.00 1.00 1.00 1.00 1.00   1   1   1
```

```r
colnames(table)=paste(0:50,"pages",sep="")
```

The approach to this problem starts with a simple poisson distribution, we are interested in figuring out the probability of misprints for each value of more than k misprints. Notice that we set lower.tail to FALSE because we are interested in the probability of more than k instead of leass than k. Then we need to plug in the probability from poisson distribution into each binomial distribution for different values of n.

Here is the equation of poisson distribution and binomial distribution

$P_x = e^{-\lambda}\frac{\lambda^k}{k!}$

$\sum_{i=0}^{k} \binom{n}{i} p^i (1-p)^{n-i}$

Here is a picture of the book