

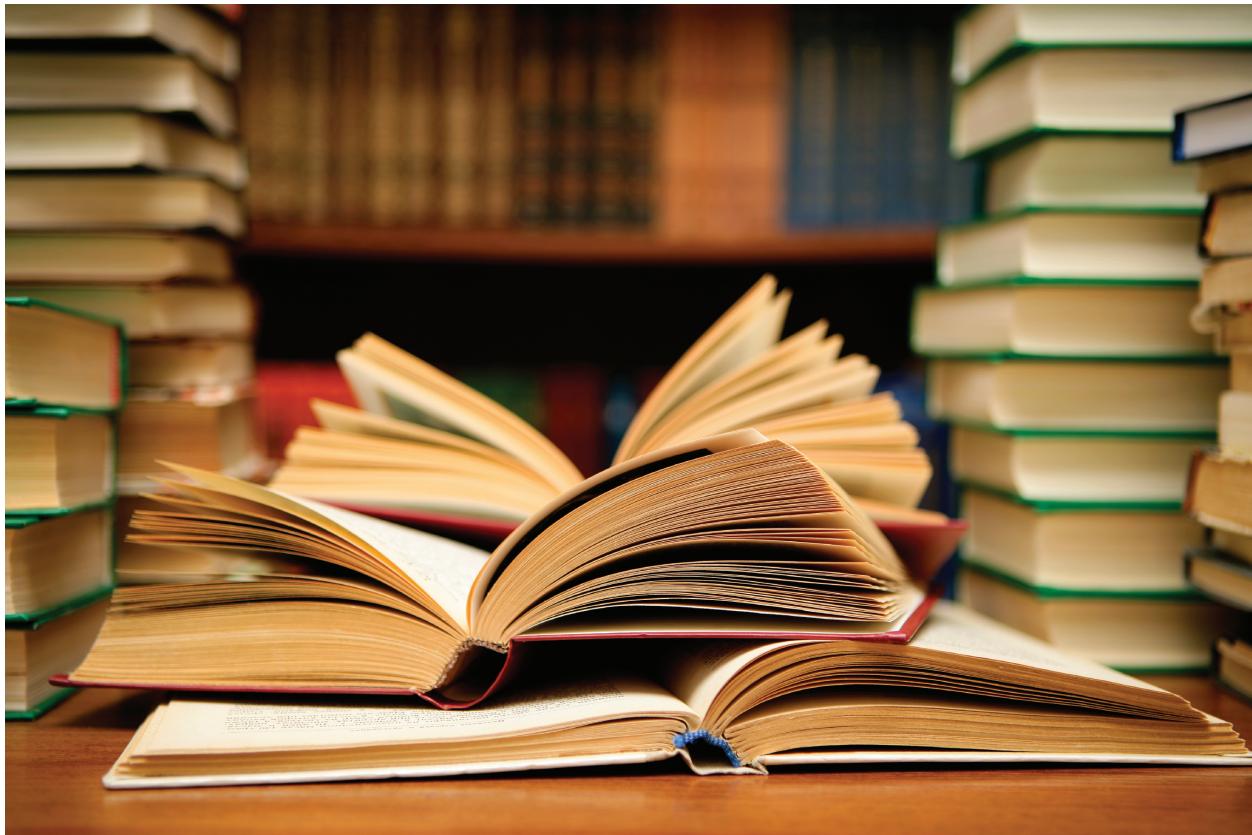
# HW1\_Sloppy\_Printer

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September 16, 2018

Sloppy Pinter Problem -

```
#Adding image
image_book = 'https://elgarblog.files.wordpress.com/2014/01/education-books.jpg'
if (!file.exists(image <- 'education-books.jpg'))
  download.file(image_book,image,mode = 'wb')
knitr::include_graphics(if(identical(knitr:::pandoc_to(),'html')) image_book else image)
```



Step 1. Understand background information We have known the average errors the printer makes is 2, therefore we assume the distribution of the number of misprints on each page would be a Poisson distribution with  $\lambda = 2$  Poisson Distribution -  $P(x) = \frac{e^{-\lambda} \lambda^x}{x!}$

In this problem, we are going to figure out the probability  $P_k$  of the situation when there are more than  $k$  misprints on each page: therefore,  $P_k = 1 - ppois(k, lambda=2)$

Step 2. Modeling in R

```
options(digits = 3)
options(scipen = 999)
#Assume the range of misprints per page is [0,8], total page = 50
k <- c(0:8)
pages <- c(1:51)
```

```

#Use Poisson Distribution to estimate the number of misprints per page
misp_1 <- ppois(k,2)
misp_2 <- dpois(k,2)

#Create temporary tables for storing data points in loop
temptab <- rep(NULL,51)
over_k <- c()

#Calculate number of errors for each pages and how many pages has errors larger than n.
for (i in 1:9) {
  for (j in 1:51) {
    misp_ep <- misp_1[i]
    over_k[j] <- pbinom(j,50,misp_ep)-pbinom(j-1,50,misp_ep)
  }
  temptab <- cbind(temptab,over_k)
}

#Build a data frame and transfer data from the temporary table to here.
sumtab <- as.data.frame(temptab, row.names(pages))
header <- paste(k, "misprints", sep = "")
colnames(sumtab) = header

#Refine the table by using Kable
kable(sumtab)

```

| 0misprints | 1misprints | 2misprints | 3misprints | 4misprints | 5misprints | 6misprints | 7misprints | 8misprints |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| 0.005      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.021      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.052      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.096      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.138      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.163      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.160      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.135      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.098      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.063      | 0.001      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.036      | 0.003      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.018      | 0.006      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.008      | 0.012      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.003      | 0.022      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.001      | 0.037      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.055      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.075      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.094      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.108      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.114      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.111      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.100      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.084      | 0.001      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.064      | 0.002      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.046      | 0.004      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.030      | 0.008      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.018      | 0.015      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |

| 0misprints | 1misprints | 2misprints | 3misprints | 4misprints | 5misprints | 6misprints | 7misprints | 8misprints |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| 0.000      | 0.010      | 0.026      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.005      | 0.041      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.003      | 0.060      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.001      | 0.081      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.101      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.115      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.120      | 0.001      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.115      | 0.002      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.100      | 0.005      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.079      | 0.012      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.057      | 0.025      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.037      | 0.046      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.021      | 0.076      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.011      | 0.112      | 0.001      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.005      | 0.144      | 0.003      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.002      | 0.160      | 0.011      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.001      | 0.153      | 0.031      | 0.000      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.000      | 0.122      | 0.075      | 0.001      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.000      | 0.080      | 0.147      | 0.008      | 0.000      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.000      | 0.041      | 0.225      | 0.041      | 0.001      | 0.000      | 0.000      |
| 0.000      | 0.000      | 0.000      | 0.015      | 0.253      | 0.151      | 0.020      | 0.001      | 0.000      |
| 0.000      | 0.000      | 0.000      | 0.004      | 0.186      | 0.365      | 0.181      | 0.052      | 0.012      |
| 0.000      | 0.000      | 0.000      | 0.000      | 0.067      | 0.434      | 0.797      | 0.947      | 0.988      |
| 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      | 0.000      |