MA615 Assignment 1

Andrew Zhang

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```
#install.packages("kableExtra")
library(knitr)
```

```
## Warning: package 'knitr' was built under R version 3.4.3
```

```
library(data.table)
```

```
## Warning: package 'data.table' was built under R version 3.4.4
```

```
library(kableExtra)
```

```
## Warning: package 'kableExtra' was built under R version 3.4.4
```

```
## Poisson Distribution
data <- c()
lambda <- 2
for (r in seq(0:100)){
  poisson_1 <- lambda ^ r * exp(-lambda)/factorial(r)
  data <- rbind(data, data.frame(r, poisson_1))
}

## Probability more than k missprints on any page
set.seed(123)

## Set number of pages and number of misprints
n = 50
k = 25

## Create matrix nxk
page_rel <- matrix(0, nrow = n, ncol = k)
for (i in seq(0, n)){
  for (j in seq(0, k)){
    pois <- dpois(j, 2)
    page_rel[i, j] <- pbinom(i, n, pois)
  }
}

## Convert matrix to a table
page_tab <- data.table(page_rel)
colnames(page_tab) <- as.character(seq(1:25))

## Presentable table
kable(page_rel, "latex", booktabs = "T", col.names = as.character(seq(1:25))) %>%
  kable_styling(latex_options = c("striped", "scale_down"))
```

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
0.0000027	0.0000027	0.0005733	0.0527079	0.4571163	0.8784116	0.9870276	0.9991200	0.9999556	0.9999982	0.9999999	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.0000264	0.0000264	0.0034081	0.1592795	0.7304290	0.9775764	0.9992947	0.9999879	0.9999999	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.0001666	0.0001666	0.0133949	0.3283807	0.8941569	0.9968957	0.9999717	0.9999999	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.0007784	0.0007784	0.0392315	0.5254275	0.9661853	0.9996598	0.9999991	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.0028670	0.0028670	0.0915671	0.7052079	0.9909957	0.9999694	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.0086804	0.0086804	0.1779903	0.8389255	0.9979626	0.9999977	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.0222418	0.0222418	0.2975977	0.9222799	0.9996022	0.9999998	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.0492940	0.0492940	0.4391475	0.9667115	0.9999321	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.0961457	0.0961457	0.5845891	0.9872743	0.9999898	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.1674354	0.1674354	0.7158832	0.9956352	0.9999986	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.2636434	0.2636434	0.8210032	0.9986504	0.9999998	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.3796846	0.3796846	0.8962247	0.9996222	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.5055683	0.5055683	0.9446368	0.9999039	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.6290380	0.6290380	0.9728077	0.9999777	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.7390117	0.7390117	0.9876940	0.9999953	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.8282918	0.8282918	0.9948638	0.9999991	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.8945594	0.8945594	0.9980210	0.9999998	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.9396474	0.9396474	0.9992955	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.9678295	0.9678295	0.9997681	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.9840410	0.9840410	0.9999293	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.9926359	0.9926359	0.9999801	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.9968406	0.9968406	0.9999948	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.9987403	0.9987403	0.9999987	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.9995335	0.9995335	0.9999997	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.9998396	0.9998396	0.9999999	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.9999488	0.9999488	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.9999849	0.9999849	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.9999959	0.9999959	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.9999990	0.9999990	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.9999998	0.9999998	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0.9999999	0.9999999	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Solution

$P[Y = r] = \frac{e^{-\lambda}\lambda^r}{r!}$

The probability of k missprints on any given page will be:

$P = 1 - P[Y \leq k]$

$p = 1 - \sum \frac{e^{-\lambda}\lambda^r}{r!}$

Then we can apply the binomial distribution to determine how many pages will have more than k misprints. Let Y denote the number of pages out of 50 that contain more than k misprints.

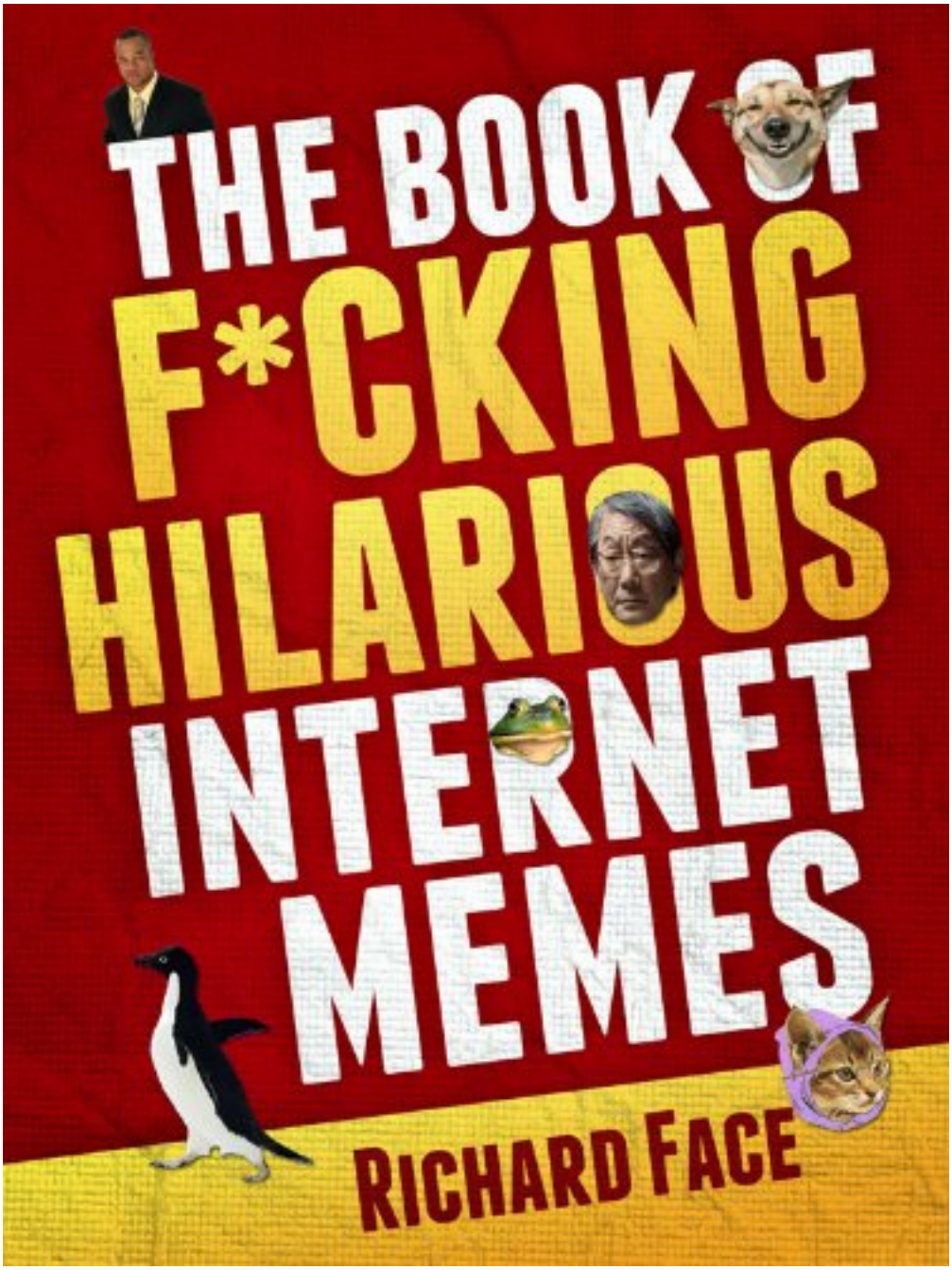
Y ~ Binomial(n,p)

$P[Y \geq m] = \sum \binom{50}{b} p^b (1-p)^{50-b}$

and

$p = 1 - \sum \frac{e^{-\lambda}\lambda^r}{r!}$

```
## Download image from repository and place in same working directory
include_graphics("Book Image.jpg")
```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