

# Assignment 1

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## 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 in a 50 page book will have more than k misprints. Make an n x k table that shows the probability that n or fewer pages in a 50 page book will have more than k misprints.

Explanation:

This problem contains two parts to solve. To find out the probability that n pages in the book will have more than k misprints, we need to figure out two things:

- (a) The probability that n pages in the book of 50 pages are selected, or are seen as ‘successful trials’ in a binomial distribution. For example, if n = 10, the prob(a) will be

$$\binom{50}{10} p^{10} q^{40}$$

P and q are solved as following.

- (b) The probability that one page has more than k misprints. This should be solved by using Poisson Distribution because k misprints occur with a known constant rate 2 per page and it is reasonable to suppose that the number of misprints on each page is independent of one another. Then, we set x = the number of misprints shown on one page and we get:

$$P_0(x = k) = e^{-2} \frac{2^k}{k!}$$

$$\text{So } P_1(x > k) = 1 - P(x \leq k) = 1 - \sum_{i=0}^k e^{-2} \frac{2^i}{i!}$$

This is the prob that a page will have more than k misprints.

So our final answer is  $\binom{50}{n} p^n q^{50-n}$  with  $p = 1 - \sum_{i=0}^k e^{-2} \frac{2^i}{i!}$

```
library(knitr)
library(kableExtra)
table <- as.data.frame(matrix(ncol = 10, nrow=50, dimnames = list(c(1:50), c(1:10))))
for ( i in 1:50) {
  for (j in 1:10){
    p0 <- ppois(j, lambda = 2, lower.tail = FALSE)
    table[i,j] = pbinom(i, size=50, prob=p0)
  }
}
kableExtra::kable(digits = 10, x = table, row.names = TRUE)
```

	1	2	3	4	5	6	7	8	
1	0.0000000000	0.0000000822	0.004190514	0.2528294	0.7991602	0.9781965	0.9985773	0.9999315	0.99999
2	0.0000000000	0.0000010063	0.019471110	0.5060029	0.9499136	0.9984423	0.9999751	0.9999997	1.00000
3	0.0000000000	0.0000080707	0.060225821	0.7311428	0.9905388	0.9999176	0.9999997	1.0000000	1.00000
4	0.0000000000	0.0000477324	0.140049772	0.8781723	0.9985786	0.9999966	1.0000000	1.0000000	1.00000
5	0.0000000000	0.0002220798	0.262465886	0.9533530	0.9998243	0.9999999	1.0000000	1.0000000	1.00000
6	0.0000000000	0.0008468685	0.415510269	0.9846918	0.9999817	1.0000000	1.0000000	1.0000000	1.00000
7	0.0000000000	0.0027233491	0.575867877	0.9956402	0.9999984	1.0000000	1.0000000	1.0000000	1.00000
8	0.0000000003	0.0075425931	0.719544324	0.9989109	0.9999999	1.0000000	1.0000000	1.0000000	1.00000
9	0.0000000024	0.0182884742	0.831310374	0.9997592	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
10	0.0000000147	0.0393399348	0.907695939	0.9999525	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
11	0.0000000803	0.0759167495	0.953997555	0.9999916	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
12	0.0000003921	0.1327163900	0.979081569	0.9999987	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
13	0.0000017253	0.2120472522	0.991303922	0.9999998	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
14	0.0000068805	0.3122252175	0.996688431	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
15	0.0000249816	0.4271039913	0.998842575	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
16	0.0000829116	0.5471766693	0.999628065	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
17	0.0002524168	0.6619208147	0.999889936	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
18	0.0007070640	0.7624352216	0.999969965	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
19	0.0018273288	0.8433226512	0.999992433	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
20	0.0043677297	0.9032284794	0.999998238	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
21	0.0096772356	0.9441194463	0.999999621	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
22	0.0199167486	0.9698742973	0.999999924	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
23	0.0381539994	0.9848554620	0.999999986	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
24	0.0681706184	0.9929084017	0.999999998	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
25	0.1138420882	0.9969100980	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
26	0.1780903712	0.9987486128	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
27	0.2616427619	0.9995294688	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
28	0.3620531308	0.9998359453	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
29	0.4734962150	0.9999470361	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
30	0.5876265363	0.9999841924	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
31	0.6953522100	0.9999956464	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
32	0.7889299858	0.9999988959	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
33	0.8636060054	0.9999997428	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
34	0.9182322119	0.9999999451	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
35	0.9547666858	0.9999999893	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
36	0.9770377768	0.9999999981	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
37	0.9893664881	0.9999999997	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
38	0.9955370869	1.0000000000	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
39	0.9983148413	1.0000000000	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
40	0.9994324156	1.0000000000	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
41	0.9998312039	1.0000000000	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
42	0.9999562256	1.0000000000	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
43	0.9999902552	1.0000000000	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
44	0.9999981757	1.0000000000	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
45	0.9999997207	1.0000000000	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
46	0.9999999664	1.0000000000	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
47	0.9999999970	1.0000000000	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
48	0.9999999998	1.0000000000	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
49	1.0000000000	1.0000000000	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000
50	1.0000000000	1.0000000000	1.000000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000

HOW TO BE THE  
PERFECT

# Dutch

Kathian Brands



Figure 1: include a picture  
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