MA615_Assignment_1

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1 Calculate the probability

Base the information in the assignment, this is a possion distribution called M. And the lambda is 2, k is the misprints in a page ranging from 0 to 10. Therefore the probability that k misprints occur is $P(M > k) = 1 - P(M \leq k)$ = 1 - ppois(k, lambda = 2). The following table shows the p.d.f of M as dprob, the C.D.F of M as cprob and the probability of $P(M > k)$ as tailprob.

```
k = 0
result1 = matrix(character(), nrow = 0, ncol = 4, byrow = TRUE)
for (k in 0:10){
  dprob = dpois(k, lambda = 2)
  cprob = ppois(k, lambda = 2)
  tailprob = 1 - ppois(k, lambda = 2)
  result1 = rbind(result1, c(k, dprob, cprob, tailprob))
  next
}
colnames(result1) <- c("k","prob","cprob","tailprob")
print(result1)
```

```
##       k    prob                   cprob
##  [1,] "0"  "0.135335283236613"    "0.135335283236613"
##  [2,] "1"  "0.270670566473225"    "0.406005849709838"
##  [3,] "2"  "0.270670566473225"    "0.676676416183063"
##  [4,] "3"  "0.180447044315484"    "0.857123460498547"
##  [5,] "4"  "0.0902235221577418"   "0.947346982656289"
##  [6,] "5"  "0.0360894088630967"   "0.983436391519386"
##  [7,] "6"  "0.0120298029543656"   "0.995466194473751"
##  [8,] "7"  "0.00343708655839016"  "0.998903281032141"
##  [9,] "8"  "0.000859271639597541" "0.999762552671739"
## [10,] "9"  "0.000190949253243898" "0.999953501924983"
## [11,] "10" "3.81898506487796e-05" "0.999991691775632"
##       tailprob
##  [1,] "0.864664716763387"
##  [2,] "0.593994150290162"
##  [3,] "0.323323583816937"
##  [4,] "0.142876539501453"
##  [5,] "0.0526530173437111"
##  [6,] "0.0165636084806144"
##  [7,] "0.00453380552624882"
##  [8,] "0.0010967189678586 8"
##  [9,] "0.000237447328261142"
## [10,] "4.64980750172206e-05"
## [11,] "8.30822436848067e-06"
```

2 The full table of n x k

First, we should caculate the probability that among 50 pages n pages have the k misprints. The probability is $P(T \leq n) =$ pbinom(n, 50, P_k).

```
k = 10
n = 50
result2 = matrix(character(), nrow = 10, ncol = 50)
for (n in 1:50){
  for (k in 1:10){
    result2[k,n] = pbinom(n ,50, 1 - ppois(k, lambda = 2))
    next
  }
}
print(result2)
```

```
##       [,1]                   [,2]                   [,3]
##  [1,] "1.98030086490985e-18" "7.20048608618277e-17" "1.71116071221867e-15"
##  [2,] "8.22406835663262e-08" "1.00630202591393e-06" "8.07073206022307e-06"
##  [3,] "0.00419051422221681"  "0.0194711101327286"   "0.060225820805454"
##  [4,] "0.25282935689842"     "0.506002873867792"    "0.731142761558435"
##  [5,] "0.79916015422266"     "0.949913585295363"    "0.990538818706377"
##  [6,] "0.978196500977891"    "0.998442286931162"    "0.999917623118331"
##  [7,] "0.99857730268561"     "0.999975124778562"    "0.999999679996784"
##  [8,] "0.999931455591713"    "0.999999739790259"    "0.999999999274281"
##  [9,] "0.999997355400681"    "0.999999998032797"    "0.999999999998925"
## [10,] "0.999999915464902"    "0.999999999988763"    "0.999999999999999"
##       [,4]                   [,5]                   [,6]
##  [1,] "2.988901974266e-14"   "4.09156578775248e-13" "4.57072306152156e-12"
##  [2,] "4.77324332587204e-05" "0.000222079846880433" "0.000846868474649041"
##  [3,] "0.140049772076724"    "0.262465886165012"    "0.415510268621681"
##  [4,] "0.87817226804681"     "0.953352993938667"    "0.984691765292518"
##  [5,] "0.998578566351332"    "0.999824339385038"    "0.999981704647529"
##  [6,] "0.999996575499535"    "0.999999883681819"    "0.999999996684062"
##  [7,] "0.999999996773739"    "0.999999999973469"    "0.999999999999817"
##  [8,] "0.999999999998415"    "0.999999999999997"    "1"
##  [9,] "1"                    "1"                    "1"
## [10,] "1"                    "1"                    "1"
##       [,7]                   [,8]                   [,9]
##  [1,] "4.28409775899472e-11" "3.43787754421673e-10" "2.3984779775656e-09"
##  [2,] "0.00272334914880266"  "0.00754259306784827"  "0.0182884742064099"
##  [3,] "0.575867876961757"    "0.719544323877644"    "0.83131037348024"
##  [4,] "0.995640168672951"    "0.998910889274282"    "0.999759218472845"
##  [5,] "0.999998364539782"    "0.999999872741177"    "0.999999991283873"
##  [6,] "0.999999999919091"    "0.999999999998285"    "0.999999999999968"
##  [7,] "0.999999999999999"    "1"                    "1"
##  [8,] "1"                    "1"                    "1"
##  [9,] "1"                    "1"                    "1"
## [10,] "1"                    "1"                    "1"
##       [,10]                  [,11]                  [,12]
##  [1,] "1.47232838731464e-08" "8.02920893084615e-08" "3.9205935182022e-07"
##  [2,] "0.0393399347618309"   "0.0759167494755229"   "0.132716389951804"
##  [3,] "0.90769593899245"     "0.95399755457576"     "0.979081569267262"
##  [4,] "0.999952532095598"    "0.999991602144397"    "0.999998659491898"
##  [5,] "0.99999999946979"     "0.999999999971143"    "0.999999999998586"
```

```
##  [6,] "0.999999999999999"    "1"                    "1"
##  [7,] "1"                    "1"                    "1"
##  [8,] "1"                    "1"                    "1"
##  [9,] "1"                    "1"                    "1"
## [10,] "1"                    "1"                    "1"
##       [,13]                  [,14]                  [,15]
##  [1,] "1.72533710025657e-06" "6.88052140582067e-06" "2.4981635899779e-05"
##  [2,] "0.212047252180778"    "0.312225217451315"    "0.427103991327173"
##  [3,] "0.991303922511445"    "0.99668843092936"     "0.998842575479469"
##  [4,] "0.999999806049649"    "0.999999974465828"    "0.999999996930974"
##  [5,] "0.999999999999937"    "0.999999999999998"    "1"
##  [6,] "1"                    "1"                    "1"
##  [7,] "1"                    "1"                    "1"
##  [8,] "1"                    "1"                    "1"
##  [9,] "1"                    "1"                    "1"
## [10,] "1"                    "1"                    "1"
##       [,16]                  [,17]                  [,18]
##  [1,] "8.29115993133251e-05" "0.000252416838800695" "0.000707063953072924"
##  [2,] "0.54717666929971"     "0.661920814749798"    "0.762435221601309"
##  [3,] "0.999628065089348"    "0.99988993643565"     "0.999969965355688"
##  [4,] "0.999999999662287"    "0.999999999965897"    "0.999999999996833"
##  [5,] "1"                    "1"                    "1"
##  [6,] "1"                    "1"                    "1"
##  [7,] "1"                    "1"                    "1"
##  [8,] "1"                    "1"                    "1"
##  [9,] "1"                    "1"                    "1"
## [10,] "1"                    "1"                    "1"
##       [,19]                  [,20]                  [,21]
##  [1,] "0.00182732876135797" "0.00436772972412212" "0.00967723560000268"
##  [2,] "0.843322651232972"   "0.903228479430359"   "0.944119446349347"
##  [3,] "0.999992433172497"   "0.999998238277944"   "0.999999620664856"
##  [4,] "0.999999999999729"   "0.999999999999979"   "0.999999999999998"
##  [5,] "1"                   "1"                   "1"
##  [6,] "1"                   "1"                   "1"
##  [7,] "1"                   "1"                   "1"
##  [8,] "1"                   "1"                   "1"
##  [9,] "1"                   "1"                   "1"
## [10,] "1"                   "1"                   "1"
##       [,22]                 [,23]                 [,24]
##  [1,] "0.0199167485584634" "0.0381539994339928" "0.0681706183776068"
##  [2,] "0.969874297288988"  "0.98485546201945"   "0.992908401687339"
##  [3,] "0.999999924419182"  "0.999999986060257"  "0.999999997619789"
##  [4,] "1"                  "1"                  "1"
##  [5,] "1"                  "1"                  "1"
##  [6,] "1"                  "1"                  "1"
##  [7,] "1"                  "1"                  "1"
##  [8,] "1"                  "1"                  "1"
##  [9,] "1"                  "1"                  "1"
## [10,] "1"                  "1"                  "1"
##       [,25]                [,26]                [,27]
##  [1,] "0.113842088184772" "0.17809037123101"  "0.261642761912468"
##  [2,] "0.996910098009941" "0.998748612818706" "0.999529468821702"
##  [3,] "0.999999999623759" "0.999999999944959" "0.999999999992552"
##  [4,] "1"                 "1"                 "1"
```

```
##  [5,] "1"                "1"                "1"
##  [6,] "1"                "1"                "1"
##  [7,] "1"                "1"                "1"
##  [8,] "1"                "1"                "1"
##  [9,] "1"                "1"                "1"
## [10,] "1"                "1"                "1"
##       [,28]              [,29]              [,30]
##  [1,] "0.362053130813846" "0.473496215003435" "0.587626536284162"
##  [2,] "0.999835945266816" "0.999947036075425" "0.999984192379763"
##  [3,] "0.999999999999068" "0.999999999999892" "0.999999999999988"
##  [4,] "1"                "1"                "1"
##  [5,] "1"                "1"                "1"
##  [6,] "1"                "1"                "1"
##  [7,] "1"                "1"                "1"
##  [8,] "1"                "1"                "1"
##  [9,] "1"                "1"                "1"
## [10,] "1"                "1"                "1"
##       [,31]              [,32]              [,33]
##  [1,] "0.695352209980953" "0.788929985791953" "0.86360600536425"
##  [2,] "0.999995646379181" "0.999998895883533" "0.999999742783335"
##  [3,] "0.999999999999999" "1"                "1"
##  [4,] "1"                "1"                "1"
##  [5,] "1"                "1"                "1"
##  [6,] "1"                "1"                "1"
##  [7,] "1"                "1"                "1"
##  [8,] "1"                "1"                "1"
##  [9,] "1"                "1"                "1"
## [10,] "1"                "1"                "1"
##       [,34]              [,35]              [,36]
##  [1,] "0.918232211888859" "0.954766685779645" "0.977037776814586"
##  [2,] "0.999999945112449" "0.99999998930679"  "0.999999998105353"
##  [3,] "1"                "1"                "1"
##  [4,] "1"                "1"                "1"
##  [5,] "1"                "1"                "1"
##  [6,] "1"                "1"                "1"
##  [7,] "1"                "1"                "1"
##  [8,] "1"                "1"                "1"
##  [9,] "1"                "1"                "1"
## [10,] "1"                "1"                "1"
##       [,37]              [,38]              [,39]
##  [1,] "0.989366488085887" "0.995537086946978" "0.998314841261371"
##  [2,] "0.999999999696075" "0.999999999956098" "0.999999999994326"
##  [3,] "1"                "1"                "1"
##  [4,] "1"                "1"                "1"
##  [5,] "1"                "1"                "1"
##  [6,] "1"                "1"                "1"
##  [7,] "1"                "1"                "1"
##  [8,] "1"                "1"                "1"
##  [9,] "1"                "1"                "1"
## [10,] "1"                "1"                "1"
##       [,40]              [,41]              [,42]
##  [1,] "0.999432415550238" "0.999831203863129" "0.999956225597192"
##  [2,] "0.999999999999349" "0.999999999999934" "0.999999999999994"
##  [3,] "1"                "1"                "1"
```

```
##  [4,] "1"                 "1"                 "1"
##  [5,] "1"                 "1"                 "1"
##  [6,] "1"                 "1"                 "1"
##  [7,] "1"                 "1"                 "1"
##  [8,] "1"                 "1"                 "1"
##  [9,] "1"                 "1"                 "1"
## [10,] "1"                 "1"                 "1"
##       [,43]               [,44]               [,45]
##  [1,] "0.999990255203665" "0.999998175695808" "0.999999720739557"
##  [2,] "1"                 "1"                 "1"
##  [3,] "1"                 "1"                 "1"
##  [4,] "1"                 "1"                 "1"
##  [5,] "1"                 "1"                 "1"
##  [6,] "1"                 "1"                 "1"
##  [7,] "1"                 "1"                 "1"
##  [8,] "1"                 "1"                 "1"
##  [9,] "1"                 "1"                 "1"
## [10,] "1"                 "1"                 "1"
##       [,46]               [,47]               [,48]
##  [1,] "0.999999966438242" "0.999999997030733" "0.999999999828069"
##  [2,] "1"                 "1"                 "1"
##  [3,] "1"                 "1"                 "1"
##  [4,] "1"                 "1"                 "1"
##  [5,] "1"                 "1"                 "1"
##  [6,] "1"                 "1"                 "1"
##  [7,] "1"                 "1"                 "1"
##  [8,] "1"                 "1"                 "1"
##  [9,] "1"                 "1"                 "1"
## [10,] "1"                 "1"                 "1"
##       [,49]               [,50]
##  [1,] "0.999999999995112" "1"
##  [2,] "1"                 "1"
##  [3,] "1"                 "1"
##  [4,] "1"                 "1"
##  [5,] "1"                 "1"
##  [6,] "1"                 "1"
##  [7,] "1"                 "1"
##  [8,] "1"                 "1"
##  [9,] "1"                 "1"
## [10,] "1"                 "1"
```

3 The book is here

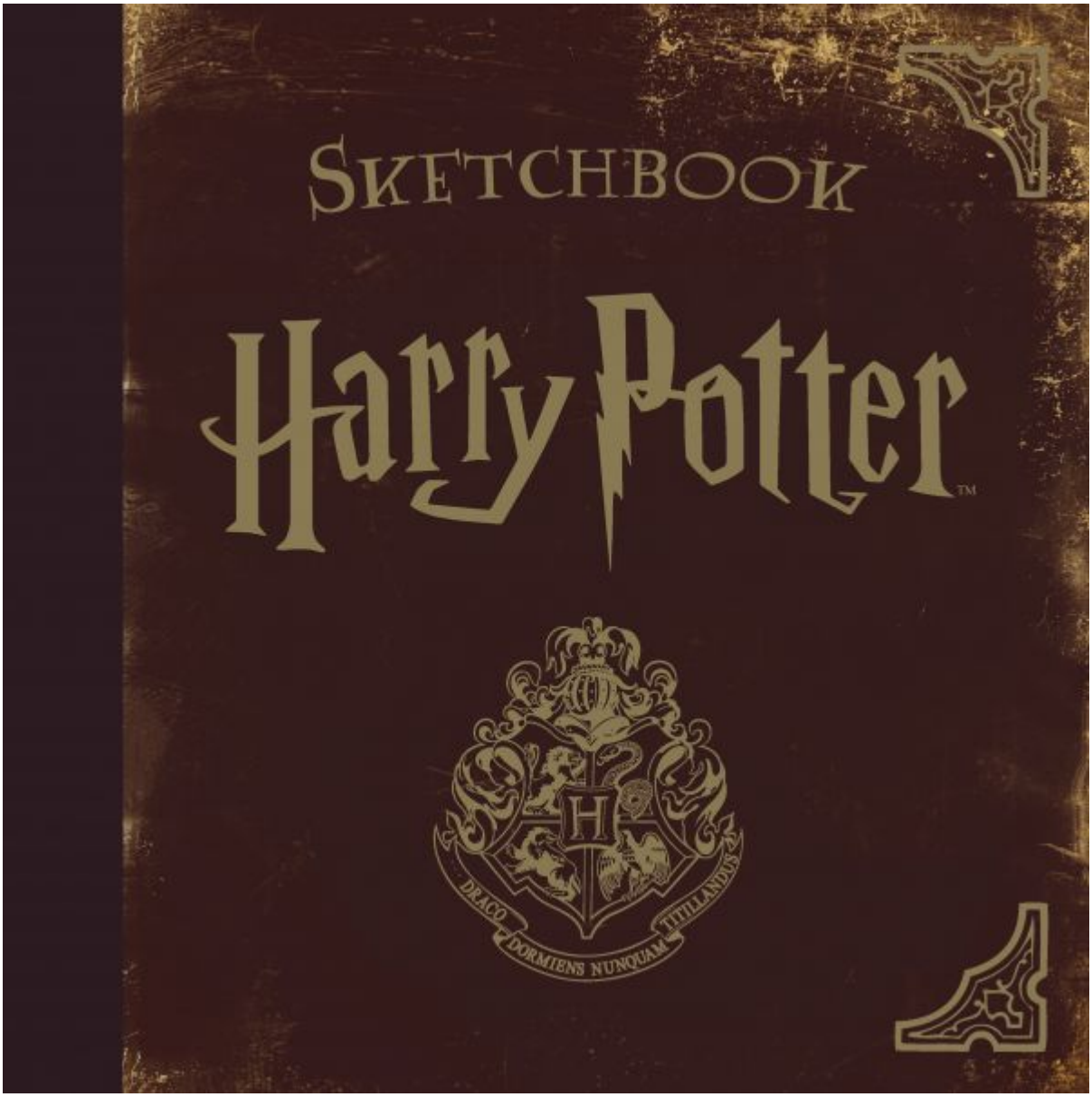

Figure 1: All statistics magic and secrets are in the book.