Data 556: Discrete Random Variables: Problem 5

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Problem 5

A copy machine is used to make n pages of copies per day. The machine has two trays in which paper gets loaded, and each page is taken randomly and independently from one of the other trays. At the beginning of the day, the trays are refilled so that they each have m pages. Using simulations in R, find the smallest value of m for which there is at least a 95% chance that both trays have enough paper on a particular day, for n = 10, n = 100, n = 1000, and n = 10000.

```
# set seed for reproducibility
set.seed(4472)

# function which runs simulations (default is 10,000) based on the above problem with user input for n
paperFeeder <- function(n, simulationCount = 10000) {
  # create empty vectors to hold the counts of paper used per simulation
  paperUsed1 <- c()
  paperUsed2 <- c()

  # loop to run simulations
  for(i in 1:simulationCount) {
    # set the count of paper used by each tray to 0 to start each ith simulation
    tray1 <- 0
    tray2 <- 0

    # loop to pull paper randomly for either tray
    for(j in 1:n) {
      selectedTray <- sample(1:2, 1) # choose to randomly pull 1 sheet from either tray 1 or tray 2
      ifelse(selectedTray == 1, tray1 <- tray1 + 1, tray2 <- tray2 + 1) # add the pulled sheet
    }
    # append the simulated paper counts
    paperUsed1 <- c(paperUsed1, tray1)
    paperUsed2 <- c(paperUsed2, tray2)
  }
  # calculate 95th quantiles for each tray
  quantile1 <- quantile(paperUsed1, 0.95)
  quantile2 <- quantile(paperUsed2, 0.95)
  #select the max of those to ensure both have paper
  print(max(quantile1,quantile2))
}

# n = 10
paperFeeder(10)
```

```
## [1] 8
```

```
# n = 100
paperFeeder(100)
```

```
## [1] 58
```

```r
# n = 1000
paperFeeder(1000)
```

```
## [1] 526
```

```r
# n = 10000
paperFeeder(10000, 1000) # reduced simulations for time
```

```
## [1] 5083.05
```