

107-1 Statistics  
**LAB4: RANDOM VARIABLE and PROBABILITY DISTRIBUTION**

助教：廖皓宇、吳家禎、賴冠宇  
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## 作業4 - R程式練習題 題目更正

- R程式練習題(繳交程式碼與執行結果)
  - 某都市有10萬人口，假設流行一種新興疾病，每人每年受到感染機率 $p=0.01$ ，請繪製該市每年感染人數頻率分布圖。**改為1050人**
  - 該市市長競選時承諾，任期內任一年感染人數超過~~1200~~人，就辭職下台。若市長任期4年且信守承諾，請評估市長在任期內，因前述承諾而辭職的機率。
  - 利用電腦模擬針對100年內發生最大疫情規模的年度，估計該年度的感染人數，提供市府作為醫療資源整備的參考依據。

# THIS WEEK LAB

1. The probability of binomial distribution by simulation
2. Binomial and normal distribution functions in R
3. Plotting normal distributions

## QUICK REVIEW: Binomial distribution

### Binomial conditions:

- ①  $N$  trials
- ② Only 2 choices (eg. Win vs. lose, sick vs. not sick)
- ③ Each trial is independent to others
- ④ The probability of 2 choices:  $p$  and  $(1-p)$



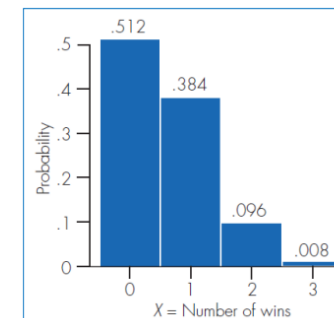
Random variable ( $x$ ): in  $N$  trials, the count of a certain choice



*With multiple times...*

The distribution of random variable ( $x$ )

- The probability of  $x = 1$



# Binomial distribution **BY SIMULATION**

## Binomial conditions:

- ① N trials
- ② Only 2 choices (eg. Win vs. lose, sick vs. not sick)
- ③ Each trial is independent to others
- ④ The probability of 2 choices:  $p$  and  $(1-p)$



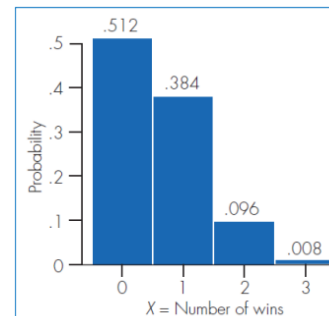
Random variable ( $x$ ): in N trials, the count of a certain choice



*With multiple times...*

The distribution of random variable ( $x$ )

- The probability of  $x = 1$



Step1. Simulate **one** binomial event



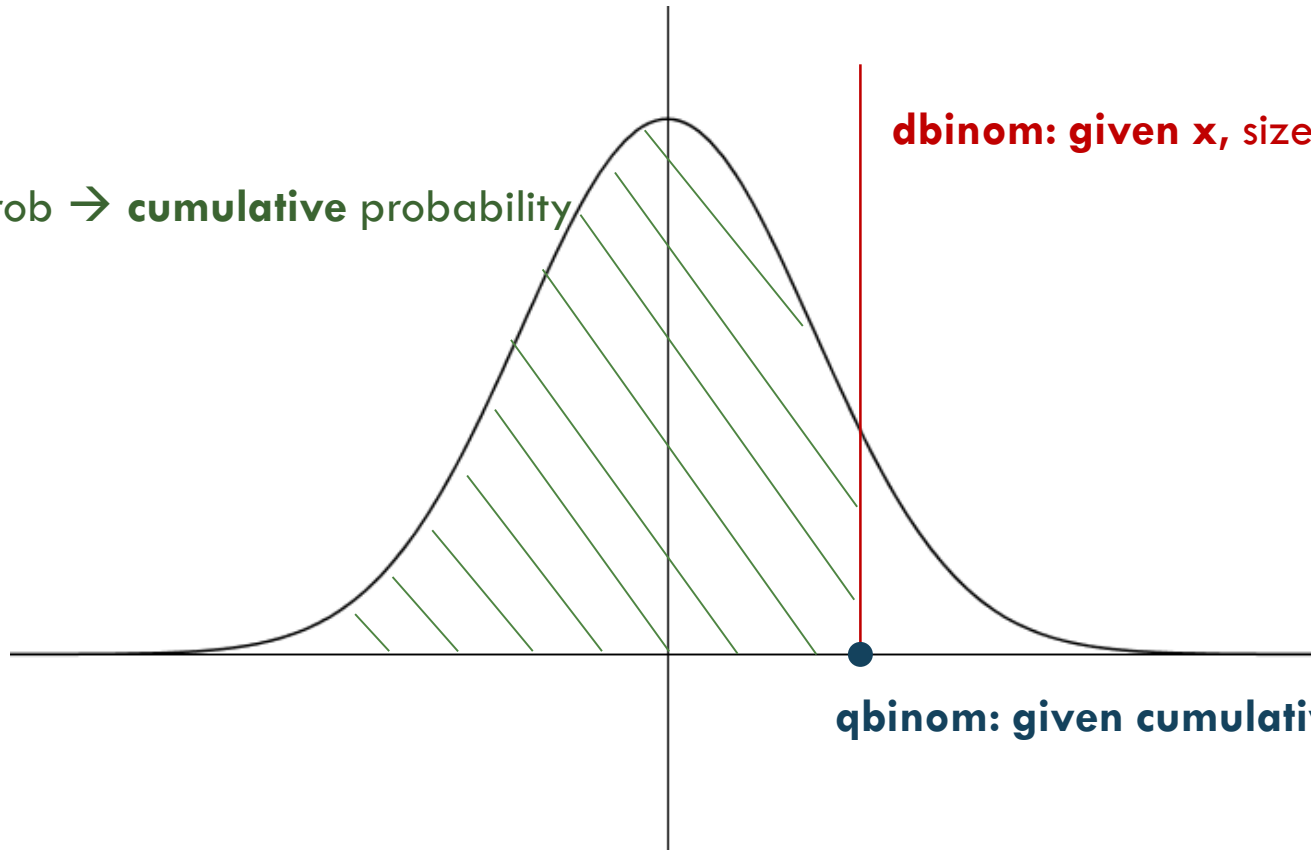
Step2. Simulate **multiple** binomial events

Step3. Calculate probability

# BINOMIAL DISTRIBUTION FUNCTIONS IN R

**pbinom:** given  $x$ , size, prob  $\rightarrow$  cumulative probability

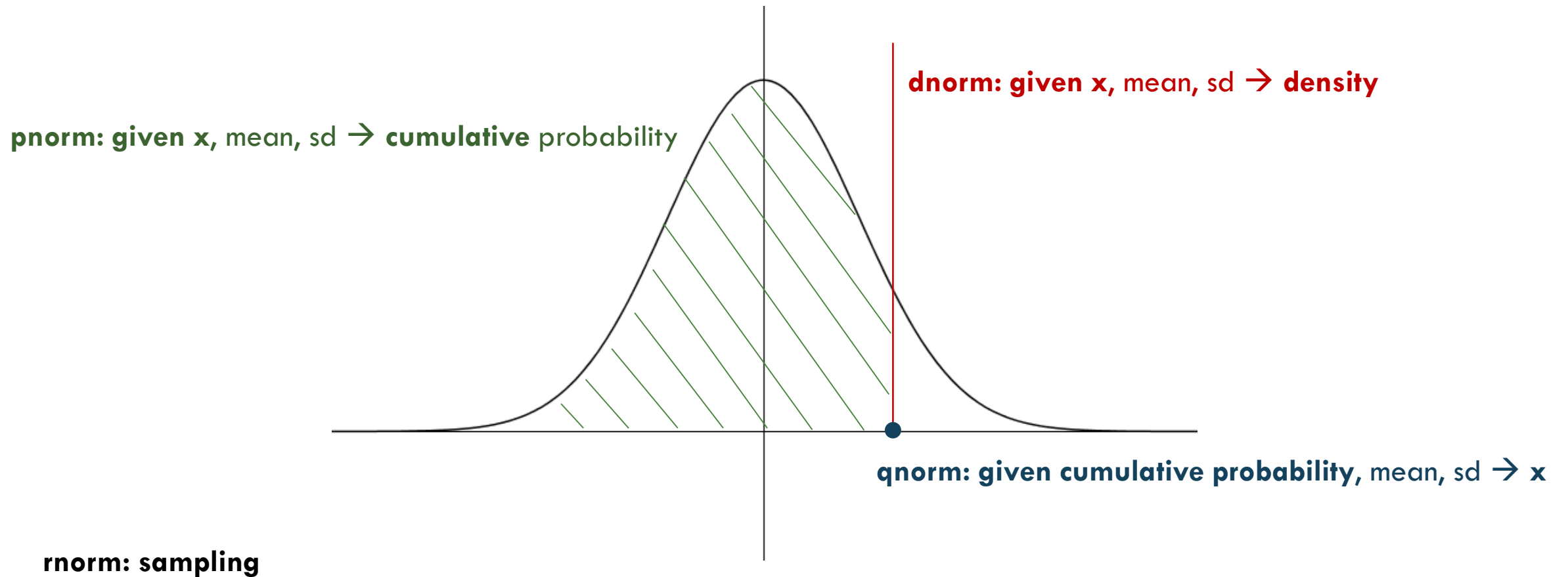
**dbinom:** given  $x$ , size, prob  $\rightarrow$  probability



**qbinom:** given cumulative probability, size, prob  $\rightarrow x$

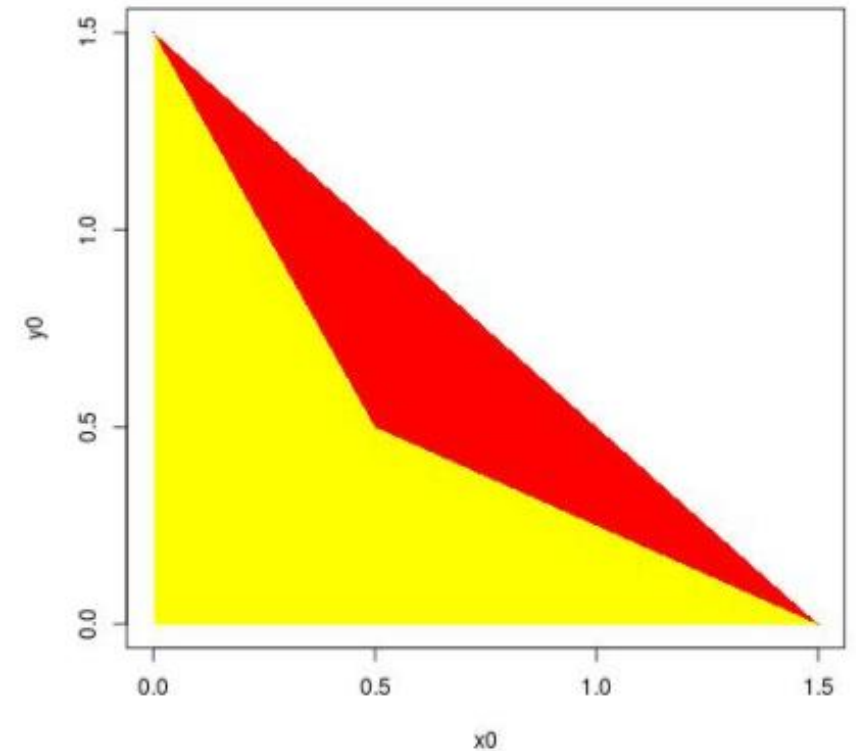
**rbinom:** sampling

# NORMAL DISTRIBUTION FUNCTIONS IN R



# SUPPLEMENTS: polygon()

```
x0 <- c(0, 0.5, 1.5)
y0 <- c(1.5, 0.5, 0)
## triangle, with three vertices
plot(x0, y0, pch = ".")
polygon(x0, y0, col = "red", border = NA)
## area under triangle, four vertices
polygon(c(0, x0), c(0, y0), col = "yellow", border = NA)
```



Resources:

<https://stackoverflow.com/questions/37472365/how-to-use-polygon-to-shade-below-a-probability-density-curve>



# SUPPLEMENTS: mathematical symbols in Rmarkdown

- <https://www.calvin.edu/~rpruim/courses/s341/S17/from-class/MathinRmd.html>
- <http://www.math.mcgill.ca/yyang/regression/RMarkdown/example.html>