Textbooks

- **Probability & Statistics for Engineers & Scientists**, Ninth Edition, Ronald E. Walpole, Raymond H. Myer

- **Elementary Statistics: Picturing the World,** 6th Edition, Ron Larson and Betsy Farber

- **Elementary Statistics,** 13th Edition, Mario F. Triola

Reference books

- **Probability Demystified**, Allan G. Bluman
- **Schaum's Outline of Probability and Statistics**
- **MATLAB Primer**, Seventh Edition
- **MATLAB Demystified** by McMahon, David

References

Readings for these lecture notes:

- Probability & Statistics for Engineers & Scientists, Ninth edition, Ronald E. Walpole, Raymond H. Myer

These notes contain material from the above book.

Negative Binomial Distribution [17]

Example: A couple decides they will continue to have children **until** they have **two males**. Assuming that **P(male) = 0.5**, what is the probability that their **second male** is their **fourth child**? Also implement it in Python.

Negative Binomial Distribution [18]

Solution: $b^*(x; k, p) = {}_{x-1}C_{k-1}\ p^k\ q^{x-k}$, x = k, k+1, k+2, …

Let x denotes **number of children** on which **k^{th} male** born.

Here **x = 4**, p = 0.5, **k = 2 (number of male)**

$$b^*(4; 2, 0.5) = {}_{4-1}C_{2-1}\ (0.5)^2\ (0.5)^{4-2}$$
$$= {}_3C_1\ (0.5)^2\ (0.5)^2$$
$$= 0.1875$$

stats.nbinom.pmf(k, n, p) calculates the probability mass function (PMF) of the negative binomial distribution. In this case:

k is the number of successes (in this case, the second male child).

n is the number of failures before success (in this case, 2).

p is the probability of success on each trial (in this case, 0.5).

```
import scipy.stats as stats
#  is the number of successes (in this case, the second male child).
k = 2
# is the number of failures before success (in this case, 2).
n = 2
#Probability of success(having a male child)
p = 0.5
#Probability
probability = stats.nbinom.pmf(k, n, p)
#Print
print(f"The probability that their second
male is their fourth child is
{probability:.4f}")
```