University of Zurich[UZH]

The Binomial Distribution

Big picture: Session 1

Group 2: Jan Hohenheim, Holly Vuarnoz, Sophie Haldemann, Andrea Staub, Guillaume Morlet and Emanuel Mauch

Introduction

- Derived by Jacob Bernoulli, posthumously published in 1713
- Discrete probability distribution
- Describes the number of successes x in a sequence of n independent experiments, each with a binary outcome: success (with probability p) and failure (with probability $1 - p$)
- For $n = 1$, the Binomial distribution is a Bernoulli distribution

Properties

Probability mass function:

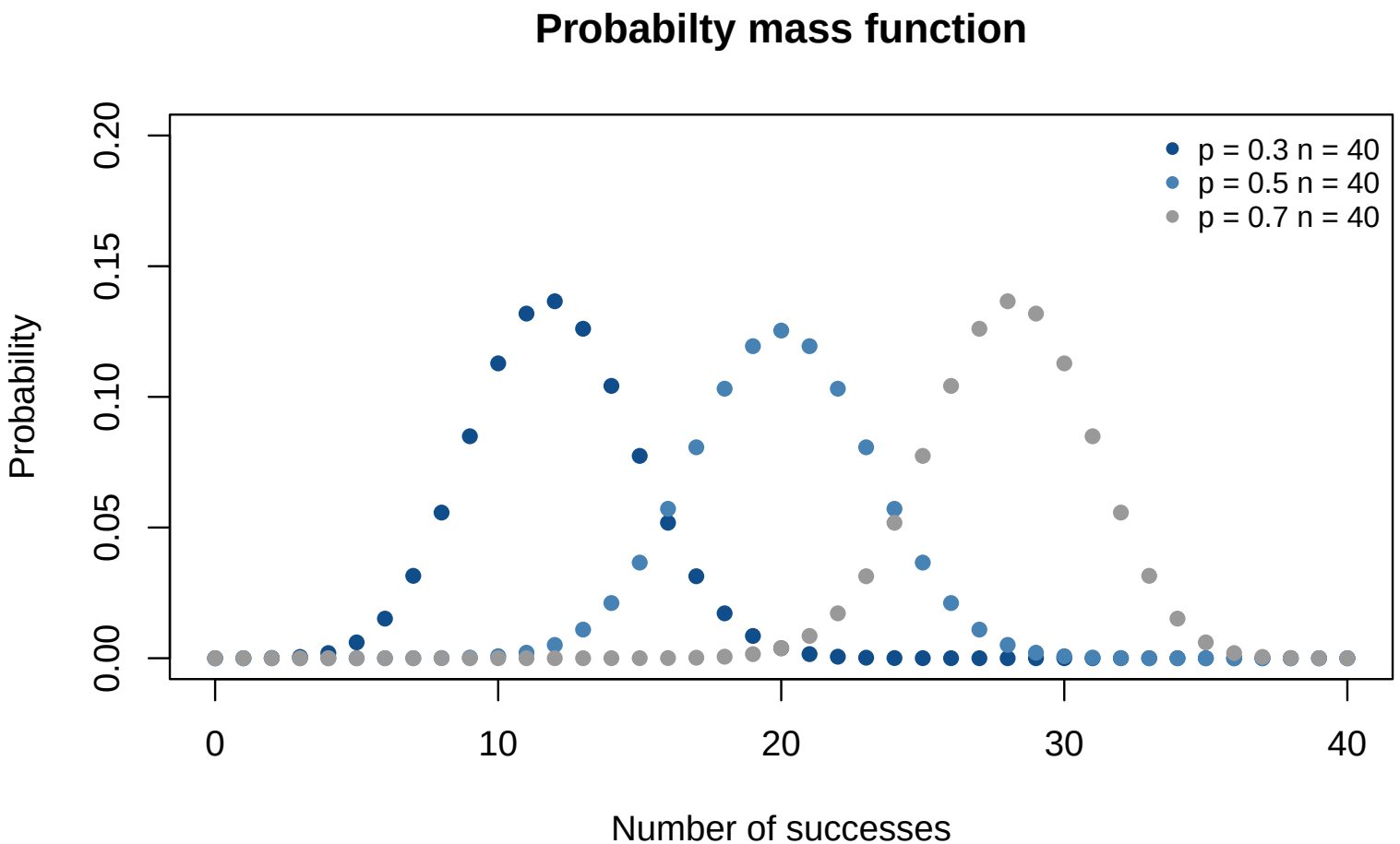
$$f(x; n, p) = P(X = x) = \binom{n}{x} p^x (1-p)^{n-x}$$

Expectation and Variance:

$$E[X] = np \qquad Var[X] = np(1-p)$$

Functions in R: `dbinom` (PMF), `pbinom` (CDF), `qbinom` (Quantile function), `rbinom` (MC sampling)

Example


Probabilty mass function
p = 0.3 n = 40
p = 0.5 n = 40
p = 0.7 n = 40
Probability
0.00
0.05
0.10
0.15
0.20
0
10
20
30
40
Number of successes

References

Held, L. and Sabanes Bove, D. (2014). *Applied Statistical Inference: Likelihood and Bayes*. Springer. https://doi.org/10.1007/978-3-642-37887-4.