

Discrete Distribution Decision Flow Chart

In the following “flow chart”,

- we consider a discrete random variable X
- that arises from an experiment E .
- “binary trial” means a trial (part of an experiment) that can have two outcomes, called “success” and “failure”.
- “repeated independent identical binary trials” refers to a series of trials, each of which can have two outcomes (“success” and “failure”) with the different trials independent and the probability, p , of success the same in every trial.

start Is E a single binary trial and X the number of successes? If “yes”, X is **Bernoulli**. If “no”, go to **disc1**.

disc1 Is E repeated independent identical binary trials? If “yes”, go to **trials**. If “no”, go to **disc2**.

trials Is the number, n , of trials specified? If “yes”, go to **bin**. If “no”, go to **geom**.

bin Is X the number of successful trials? If “no”, X does not have a distribution discussed in class. If “yes”, X is **Binomial**. But if $p \ll 1$ and $x \ll n$, $P(X = x)$ is well-approximated by the Poisson distribution with $\lambda = np$. And if $np, n(1 - p) \gg 1$ and $x_1 - np, x_2 - np \ll np(1 - p)$, then $P(x_1 \leq X \leq x_2)$ is well-approximated by the normal distribution with mean np and variance $np(1 - p)$.

geom Is X the trial number of the first successful trial? If “yes”, X is **Geometric**. If “no”, X does not have a distribution discussed in class.

disc2 Is X the number of occurrences of some event in a specified time interval or in a specified region of space? If “yes”, go to **poiss**. If “no”, go to **hyper**.

poiss Do the events satisfy the four requirements of the Poisson distribution? If “yes”, X is **Poisson**. If “no”, X does not have a distribution discussed in class.

hyper Does E consist of selecting, at random, a sample from a set with two types (success and failure) of items in the set and is X the number of successes selected? If “yes”, X is **Hypergeometric**. If “no”, X does not have a distribution discussed in class.