

negative binomial random variable

- A generalization of the geometric distribution $\text{Pascal}(1,p)=\text{Geometric}(p)$
- It relates to the random experiment of repeated independent trials until observing r successes

- Discrete outcomes $\{1,2,3,\dots\}$

$$P(X = x | r, p) = \binom{x-1}{r-1} p^r (1-p)^{x-r}$$

- Two parameter
 - the number of success we are waiting for
 - the probability that a single experiment gives a "success"

- Shorthand notation: $X \sim \text{NegBin}(r, p)$

- $E(X) = \frac{r}{p}, \quad V(X) = \frac{r(1-p)}{p^2}$

negative binomial random variable