Sample Statistics	Discrete RV	Properties
$\boldsymbol{Mean} = \bar{X} = \frac{\sum_{i=1}^{n} x_i}{n}$ $\boldsymbol{Var} = s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$ $\boldsymbol{Std} = s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$ $\boldsymbol{Cov} = s_{xy} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{n-1}$ $\boldsymbol{Corr} = r_{xy} = \frac{s_{xy}}{s_x s_y}$	$\boldsymbol{E[X]} = \sum_i x_i P(X = x_i)$ $\boldsymbol{Var(X)} = E[(X - E[X])^2]$ $= E[X^2] - E[X]^2$ $\boldsymbol{Cov(X,Y)} =$ $= E[XY] - E[X]E[Y]$	$\boldsymbol{E[aX + bY + c]} = aE[X] + bE[Y] + c$ $\boldsymbol{E[X \cdot Y]} = E[X] \cdot E[Y] + Cov(X,Y)$ $\boldsymbol{Var(aX + c)} = a^2 Var(X)$ $\boldsymbol{Var(X + Y)} = Var(X) + Var(Y) + 2Cov(X,Y)$

	Variable: **k**		
↓Fixed↓	# Successes	# Trials/Time until success	↓Fixed↓
1 trial	$\boldsymbol{Ber(p)}$ $P(X = 1) = p$	$\boldsymbol{Geo(p)}$ $P(X = k) = (1-p)^{k-1}p$	**1** success
n trials	$\boldsymbol{Bin(n,p)}$ $P(X = k) = \binom{n}{k} p^k (1-p)^{n-k}$	$\boldsymbol{NegBin(r,p)}$ $P(X = k) = \binom{k-1}{r-1} p^r (1-p)^{k-r}$	**r** successes
Interval of Time $\boldsymbol{\lambda: expected}$ $\boldsymbol{\#\ occurences}$	$\boldsymbol{Poi(\lambda)}$ $P(X = k) = e^{-\lambda}\frac{\lambda^k}{k!}$	$\boldsymbol{Exp(\lambda)}$ $P(k_1 < X < k_2) = \int_{k_1}^{k_2} \lambda e^{-\lambda x} dx$	Interval of time to 1st success $\boldsymbol{\lambda: rate\ of}$ $\boldsymbol{occurence}$

Example: Randomly filling a quiz with 4 options for each question. On average we answer 6 questions per minute.

	Variable: **k**		
↓Fixed↓	# Successes	# Trials/Time until success	↓Fixed↓
1 trial	$\boldsymbol{Ber(p)}$: Prob of correct answer to next question	$\boldsymbol{Geo(p)}$: # of questions until we get the first correct answer	**1** success
n trials	$\boldsymbol{Bin(n,p)}$: Prob of correctly answering any 3 out of 4 questions	$\boldsymbol{NegBin(r,p)}$: # of questions until we get 3 correct answers	**r** successes
Interval of Time $\boldsymbol{\lambda: expected}$ $\boldsymbol{\#\ occurances}$	$\boldsymbol{Poi(\lambda)}$: Prob of answering four questions in 20 seconds. (λ = 2, because 6 in 60 secs -> 2 in 20 secs)	$\boldsymbol{Exp(\lambda)}$: Prob of spending from 5 to 8 seconds to answer next question. (λ = 6 / 60 = 0.1)	Interval of time to 1st success $\boldsymbol{\lambda: events/time}$