# SciPy Discrete Distribution Matrix

| Distribution | Syntax Tips | MEAN | VAR | PMF | CDF |
|---|---|---|---|---|---|
| Bernoulli | `p` is the probability<br>`k` is the event | $p$ | $p(1-p)$ | $1-p$ for $k=0$<br>$p$ for $k=1$ | $0$ for $k=0$<br>$1-p$ for $0 \leq k < 1$<br>$1$ for $k \geq 1$ |
| `bern_dist = scs.bernoulli(p=0.5)`<br><br>`bern_sample = scs.bernoulli.rvs(p=0.5, loc=0, size=100)` | | `bern_dist.mean()` | `bern_dist.var()` | `bern_dist.pmf(k=1)` | `bern_dist.cdf(x=0.75)` |
| Binomial | `p` is the probability<br>`n` is the total number of events<br>`k` is the # of successful events | $np$ | $np(1-p)$ | $\binom{n}{k}p^k(1-p)^{n-k}$ | $(n-k)\binom{n}{k}\int_0^{1-p} t^{n-k-1}(1-t)^k \mathrm{d}t$ |
| `binom_dist = scs.binom(n=50, p=0.5)`<br><br>`binom_dist_sample = scs.binom.rvs(n=50, p=0.5, loc=0, size=20)` | | `binom_dist.mean()` | `binom_dist.var()` | `binom_dist.pmf(k=25)` | `binom_dist.cdf(x=25)` |
| Poisson | `mu` is $\lambda$<br>`loc` is typically $0$ | $\lambda$ | $\lambda$ | $\frac{\lambda^k e^{-\lambda}}{k!}$ | $e^{-\lambda}\sum_{k=0}^{\infty}\frac{\lambda^i}{i!}$ |
| `pois_dist = scs.poisson(mu=3, loc=0)`<br><br>`pois_sample = scs.poisson.rvs(mu=3, loc=0, size=20)` | | `pois_dist.mean()` | `pois_dist.var()` | `pois_dist.pmf(k=2)` | `pois_dist.cdf(x=2)` |
| Geometric | `k` is the # of trials until the first success<br>`loc` is 1 for this these equations | $1/p$ | $\frac{1-p}{p^2}$ | $(1-p)^{k-1}p$ | $1-(1-p)^k$ |
| `geom_dist = scs.geom(p=0.25, loc=0)`<br><br>`geom_sample = scs.geom.rvs(p=0.25, loc=0, size=20)` | | `geom_dist.mean()` | `geom_dist.var()` | `geom_dist.pmf(k=4)` | `geom_dist.cdf(x=4)` |

### References

Mathematical equations are copied from Wikipedia.