Common discrete distributions **Prof. B. Bhattacharya, Dept. of Civil Engineering, IIT Kharagpur**			
Distribution	**PMF**	**CDF**	**Relation between parameters and moments**
Discrete uniform	$p_X(x) = \frac{1}{n},\ x = x_1, x_2, ..., x_n$	Step function of height $1/n$	$\mu = \frac{1}{n}\sum_{i=1}^{n} x_i,$ $\sigma^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \mu)^2$
Bernoulli	$p_X(x) = px + q(1-x),\ x = 0,1$ where, $p + q = 1$	Steps of height q and p at 0 and 1 respectively.	$\mu = p,$ $\sigma^2 = pq$
Geometric	$p_X(x) = q^{x-1}p,\ x = 1,2,3,....$ where, $p + q = 1$	$F_X(x) = 1 - q^x,\ i = 1,2,3,....$	$\mu = 1/p,$ $\sigma^2 = (1-p)/p^2$
Binomial	$p_X(x) = \binom{n}{x} p^x q^{n-x},\ x = 0,1,2,....,n$ where, $p + q = 1$	Not available in closed form	$\mu = np,$ $\sigma^2 = npq$
Multinomial	$p(x_1, x_2, ..., x_k; p_1, p_2, ..., p_k, n) = \frac{n!}{x_1!x_2!...x_k!} p_1^{x_1} p_2^{x_2} ... p_k^{x_k}$ $\sum_{i=1}^{k} p_i = 1, \sum_{i=1}^{k} x_i = n$	Not available in closed form	$\mu_i = np_i,$ $\sigma_i^2 = np_i q_i$
Negative binomial	$p_X(x) = \binom{x-1}{r-1} p^r q^{x-r},\ x = r, r+1, ...$ where, $p + q = 1$	Can be given in terms of binomial CDF	$\mu = r/p,$ $\sigma^2 = rq/p^2$
Hyper-geometric	$p_X(x) = \frac{\binom{d}{x}\binom{N-d}{n-x}}{\binom{N}{n}},\ x = 0,1,2,....,\min(d,n)$	Not available in closed form	$\mu = nd/N,$ $\sigma^2 = \frac{nd(N-d)}{N^2}\binom{N-n}{N-1}$
Poisson	$p_X(x) = e^{-\mu}\frac{\mu^x}{x!},\ x = 0,1,2,3,....$	Not available in closed form	$\mu = \mu,$ $\sigma^2 = \mu$
Zeta or Pareto	$p_X(x) = \frac{c}{x^{\alpha+1}},\ x = 1,2,3,....,\alpha > 0$ such that $c = 1/\zeta(\alpha+1)$ where $\zeta(s)$ = Reimann zeta fn. = $\sum_{k=1}^{\infty} 1/k^s,\ s > 1$	Not available in closed form	$\mu = \frac{\zeta(\alpha)}{\zeta(\alpha+1)}$