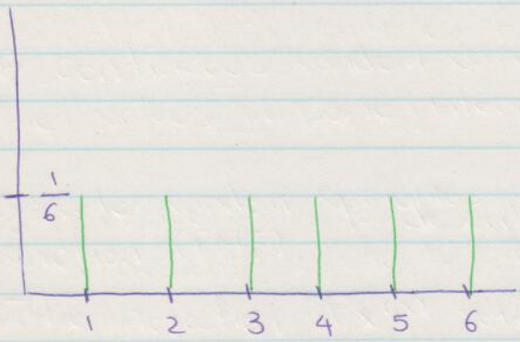
PMF Notes

Introduction:

- Used for discrete r.v.
- Denoted as $P_X(x)$ or $P(X=x)$
- E.g. Consider the probability of rolling a die.
  $P(X=1) = \frac{1}{6}$



Properties:

1. $\sum_i P(X=x) = 1$

2. $0 \leq P(X=x) \leq 1$

Distributions:

1. Bernoulli Distribution:
   - $P(X=1) = p$
   - $P(X=0) = 1-p$
   - $\begin{cases} q = 1-p, & \text{if } k=0 \\ p, & \text{if } k=1 \end{cases}$
   - $p^k (1-p)^{1-k}$

2. Binomial Distribution:
   - Is the number of successes in a sequence of n independent experiments, each asking a yes-no question and each with its own boolean-valued outcome.

   - Note: When n=1, we get Bernoulli Distribution.

   - Let k be the number of successes.
     Let n be the number of trials.

$$\binom{n}{k} p^k q^{n-k}$$

p^k: Probability of success
q^{n-k}: Prob of failure

3. Multi-nomial Distribution:
   - Is a generalization of the binomial dist.
   - Is the number of successes in a seq of n indep experiments, each with k mutually exclusive outcomes having probability p_i.
   - $\frac{n!}{X_1!\, X_2! \dots X_k!} p_1^{X_1} p_2^{X_2} \dots p_k^{X_k}$