3A Discrete RV

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A.1   Intro

Random Variable   is a function whose domain is a sample space, and whose range is a real numbers.

Discrete Random Variable   is a r.v. whose range is a finite or countably infinite set.

A.2 Example

1. Throw a die: $\{1\} \rightarrow 1$

2. Throw two dice at once and add: $\{2, 5\} \rightarrow 7$

A.3 PMF and CDF

- **Probability Mass Function:** (pmf) of a discrete RV is defined as
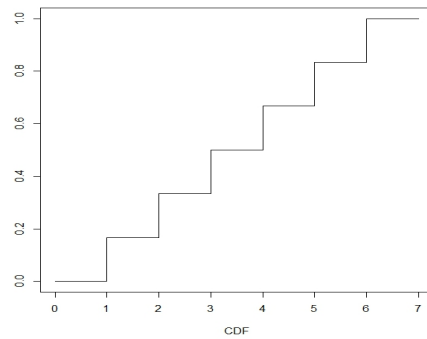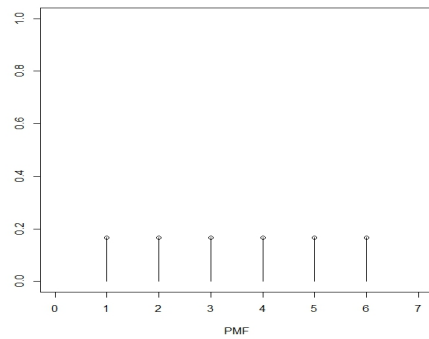
  $$p(x) = P(X = x)$$

- **Cumulative Distribution Function:** (cdf) of a discrete random variable X is defined as

  $$F(x) = P(X \leq x)$$
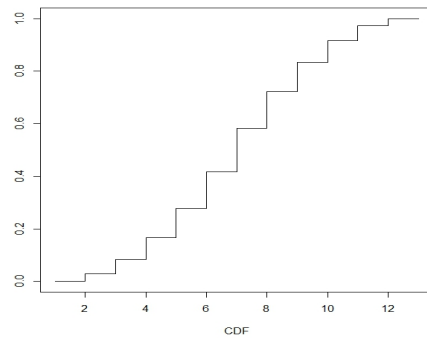
A.4 Ex: Roll a Die Once

		1	2	3	4	5	6
	x						
pmf	$P(X = x)$	1/6	1/6	1/6	1/6	1/6	1/6
CDF	$P(X \le x)$	1/6	2/6	3/6	4/6	5/6	6/6

PMF

CDF

A.5   Ex: Roll a Die Twice

	x	2	3	4	5	6	7	8	9	10	11	12
pmf	$P(X = x)$	1/36	2/36	3/36	4/36	5/36	6/36	5/36	4/36	3/36	2/36	1/36
CDF	$P(X \leq x)$	1/36	3/36	6/36	10/36	15/36	21/36	26/36	30/36	33/36	35/36	36/36

PMF

CDF
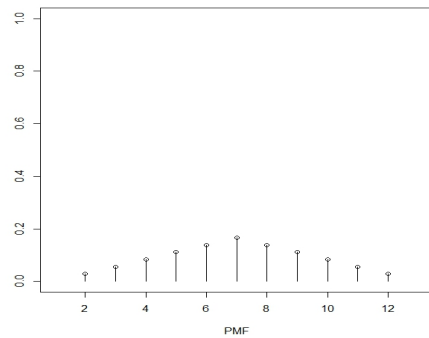
A.6 PMF and CDF

- You can calculate CDF from PMF, or vice versa.

- CDF always start at 0, and end at 1.

- pmf at any point must be ≥ 0.

- If you add all values of pmf, it must add up to 1.

A.7 Ex: get CDF from pmf

Given pmf:

$$p(x) = P(X = x) = \frac{i}{55} \text{ for } x = 1, \ldots, 10$$

Cauculate:

$$F(4) = P(X \le 4)$$

$$P(2 \le X \le 4)$$

$$P(X > 4)$$

A.8 Ex: get pmf from CDF

Given the CDF:

$$F(1) = .2, \quad F(2) = .35, \quad F(3) = .60, \quad F(4) = .90, \quad F(5) = .95, \quad F(6) = 1$$

Calculate

$P(X > 3)$

$P(2 \leq X \leq 5)$

$P(2 < X < 5)$

$p(2)$