EXAMPLE: Two standard, fair dice are rolled.

Let X be the sum of the numbers on the dice.

random variable

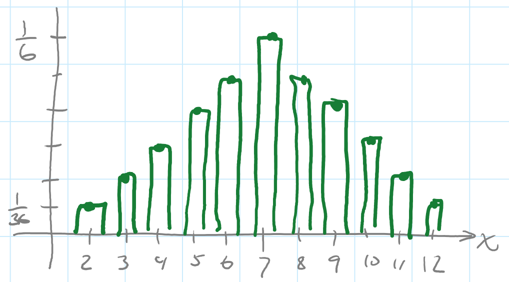
	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

pmf: probability mass function

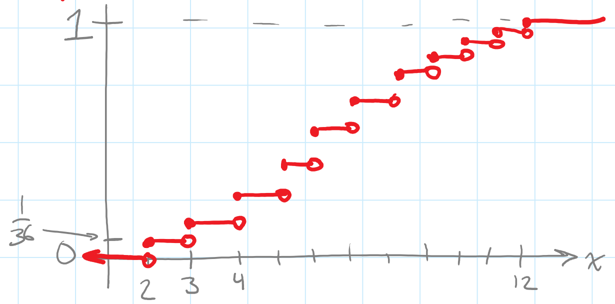
Value x	2	3	4	5	6	7	8	9	10	11	12
$p(x)=P(X=x)$	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$
$F(x)=P(X\le x)$	$\frac{1}{36}$	$\frac{3}{36}$	$\frac{6}{36}$	$\frac{10}{36}$	$\frac{15}{36}$	$\frac{21}{36}$	$\frac{26}{36}$	$\frac{30}{36}$	$\frac{33}{36}$	$\frac{35}{36}$	1

cdf: cumulative distribution function

plot the pmf:



plot the cdf:



Expected Value: $E(X) = \underbrace{\sum_x x\,p(x)}_{\text{sum of values times their probabilities}} = 2\cdot\frac{1}{36} + 3\cdot\frac{2}{36} + 4\cdot\frac{3}{36} + \cdots + 11\cdot\frac{2}{36} + 12\cdot\frac{1}{36} = 7$

Variance: $Var(X) = \sum_x \left(x - E(X)\right)^2 p(x)$

shortcut formula: $Var(X) = E(X^2) - \left(E(X)\right)^2$

$Var(X) = \underbrace{\frac{329}{6}} - (7)^2 = \frac{35}{6}$

$E(X^2) = \sum_x x^2 p(x) = 2^2\cdot\frac{1}{36} + 3^2\cdot\frac{2}{36} + 4^2\cdot\frac{3}{36} + \cdots + 12^2\cdot\frac{1}{36} = \frac{329}{6}$

squared values

probabilities