Definitions

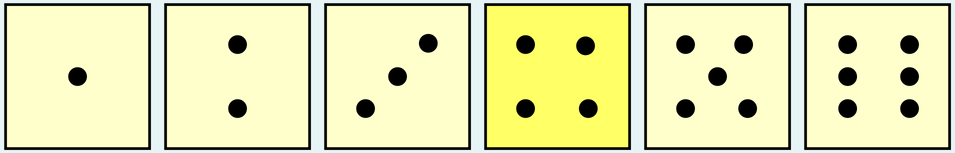
- **Discrete** variables produce outcomes that come from a counting process (e.g. number of classes you are taking).

- **Continuous** variables produce outcomes that come from a measurement (e.g. your annual salary, or your weight).

Discrete Random Variables

- Can only assume a countable number of values

Examples:



- **Roll a die twice**
  Let X be the number of times 4 occurs
  (then X could be 0, 1, or 2 times)

- **Toss a coin 5 times.**
  Let X be the number of heads
  (then X = 0, 1, 2, 3, 4, or 5)

Portfolio Expected Return and Expected Risk

- Investment portfolios usually contain several different funds (random variables)
- The expected return and standard deviation of two funds together can now be calculated.
- Investment Objective: Maximize return (mean) while minimizing risk (standard deviation).

Portfolio Example

Investment X: $\mu_X = 50$ $\sigma_X = 43.30$

Investment Y: $\mu_Y = 95$ $\sigma_Y = 193.21$

$\sigma_{XY} = 8250$

Suppose 40% of the portfolio is in Investment X and 60% is in Investment Y:

$$E(P) = 0.4(50) + (0.6)(95) = 77$$

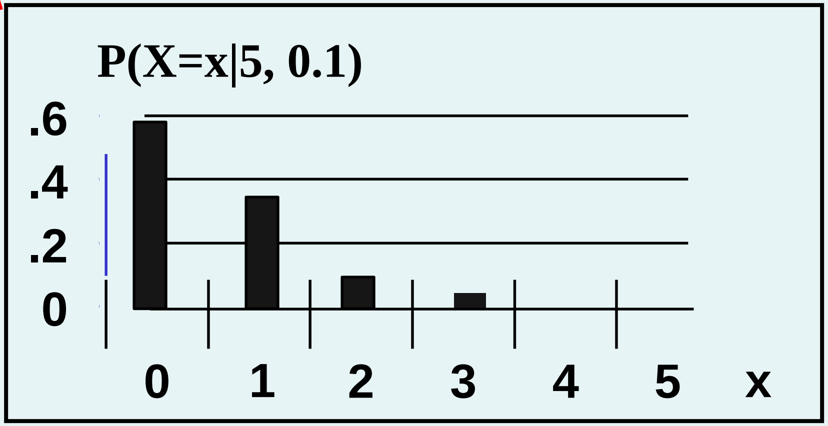
$$\sigma_P = \sqrt{(0.4)^2(43.30)^2 + (0.6)^2(193.71)^2 + 2(0.4)(0.6)(8{,}250)}$$
$$= 133.30$$

The portfolio return and portfolio variability are between the values for investments X and Y considered individually

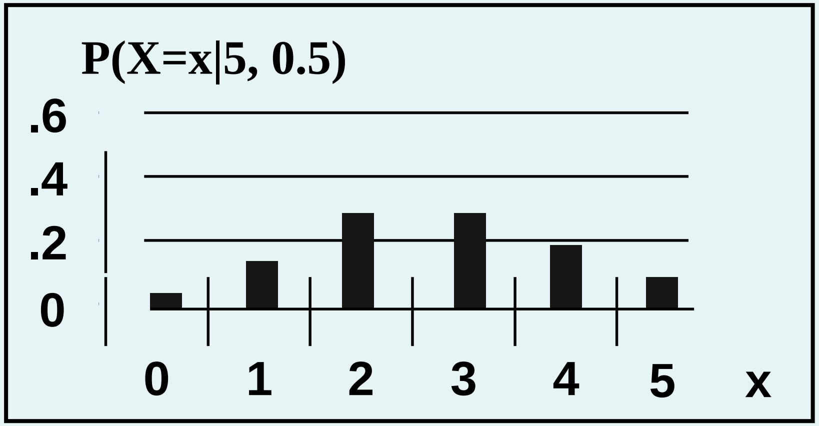
The Binomial Distribution Shape

- The shape of the binomial distribution depends on the values of π and n

- Here, n = 5 and π = .1



- Here, n = 5 and π = .5



The Binomial Distribution Using Binomial Tables (Available On Line)

n = 10									
x	…	π=.20	π=.25	π=.30	**π=.35**	π=.40	π=.45	π=.50	
0	…	0.1074	0.0563	0.0282	0.0135	0.0060	0.0025	0.0010	10
1	…	0.2684	0.1877	0.1211	0.0725	0.0403	0.0207	0.0098	9
2	…	0.3020	0.2816	0.2335	0.1757	0.1209	0.0763	0.0439	8
3	…	0.2013	0.2503	0.2668	**0.2522**	0.2150	0.1665	0.1172	7
4	…	0.0881	0.1460	0.2001	0.2377	0.2508	0.2384	0.2051	6
5	…	0.0264	0.0584	0.1029	0.1536	0.2007	0.2340	0.2461	5
6	…	0.0055	0.0162	0.0368	0.0689	0.1115	0.1596	0.2051	4
7	…	0.0008	0.0031	0.0090	0.0212	0.0425	0.0746	0.1172	3
8	…	0.0001	**0.0004**	0.0014	0.0043	0.0106	0.0229	0.0439	**2**
9	…	0.0000	0.0000	0.0001	0.0005	0.0016	0.0042	0.0098	1
10	…	0.0000	0.0000	0.0000	0.0000	0.0001	0.0003	0.0010	0
	…	π=.80	**π=.75**	π=.70	π=.65	π=.60	π=.55	π=.50	**x**

Examples:

$n = 10$, $\pi = 0.35$, $x = 3$: $P(X = 3|10, 0.35) = 0.2522$

$n = 10$, $\pi = 0.75$, $x = 8$: $P(X = 8|10, 0.75) = 0.0004$

Poisson Distribution Formula

$$P(X = x \mid \lambda) = \frac{e^{-\lambda}\lambda^{x}}{X!}$$

where:

x = number of events in an area of opportunity

λ = expected number of events

e = base of the natural logarithm system (2.71828...)