

Ex. Toss 4 coins.

$X =$ number of (H)

x	0	1	2	3	4
$P(X=x)$	$\frac{1}{16}$	$\frac{4}{16}$	$\frac{6}{16}$	$\frac{4}{16}$	$\frac{1}{16}$

$$P(X=0) = \left(\frac{1}{2}\right)^4$$

$$P(X=1) = \binom{4}{1} \left(\frac{1}{2}\right)^1 \left(\frac{1}{2}\right)^3 = \frac{4}{16}$$

number of
arrangements

probability
of success

prob
of
failure

H T T T

T H T T

T T H T

T T T H

$$P(X=2) = \binom{4}{2} \left(\frac{1}{2}\right)^2 \left(\frac{1}{2}\right)^2$$
$$= 6 \cdot \frac{1}{16}$$

$$P(X=3) = \binom{4}{3} \left(\frac{1}{2}\right)^3 \left(\frac{1}{2}\right)^1$$
$$= 4 \cdot \frac{1}{16}$$

Just for Binomial Distributions

mean: $E(X) = n p$ $\left\{ \begin{array}{l} \text{number of trials} \\ \text{prob. of success} \end{array} \right.$

variance: $\sigma^2 = n p q$ $\left\{ \begin{array}{l} \text{prob. of failure} \end{array} \right.$

For the 4 coins: $E(X) = 4 \cdot \frac{1}{2} = 2$

$$\sigma^2 = n p q = 4 \cdot \frac{1}{2} \cdot \frac{1}{2}$$
$$= 1$$

Combinations (no calculator)

$$\binom{n}{r} = \frac{n!}{r! (n-r)!}$$

$$\begin{aligned} \text{Ex. } \binom{5}{3} &= \frac{5!}{3! (5-3)!} = \frac{5 \cdot \cancel{4} \cdot \cancel{3} \cdot \cancel{2}}{\cancel{3} \cdot \cancel{2} \cdot 2} \\ &= 10 \end{aligned}$$

$$\begin{aligned} \text{Ex. } \binom{8}{4} &= \frac{8!}{4! 4!} = \frac{\cancel{8} \cdot \cancel{7} \cdot \cancel{6} \cdot \cancel{5} \cdot \cancel{4}!}{\cancel{4}! \cdot \cancel{4} \cdot \cancel{3} \cdot \cancel{2}} \\ &= 70 \end{aligned}$$

$$\begin{aligned} \text{Ex. } \binom{7}{5} &= \frac{7!}{5! 2!} = \frac{7 \cdot \cancel{6} \cdot \cancel{5}!}{\cancel{5}! \cdot \cancel{2}} \\ &= 21 \end{aligned}$$

$$\text{Ex. } \binom{10}{4} = \frac{10!}{4! 6!}$$

$$= \frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot \cancel{6!}}{4 \cdot 3 \cdot 2 \cdot \cancel{6!}} = 210$$

Ex Roll 6 dice,

$X =$ number of \square

$$P(X=3) = \binom{6}{3} \left(\frac{1}{6}\right)^3 \left(\frac{5}{6}\right)^3$$

\swarrow successes \swarrow fail

$$\frac{125}{2500} = 20 \cdot \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{5}{6} \cdot \frac{5}{6} \cdot \frac{5}{6}$$

$$\binom{6}{3} = \frac{\cancel{6} \cdot 5 \cdot 4 \cdot \cancel{3!}}{\cancel{3!} 3!} = 20 = \frac{2500}{6^6}$$

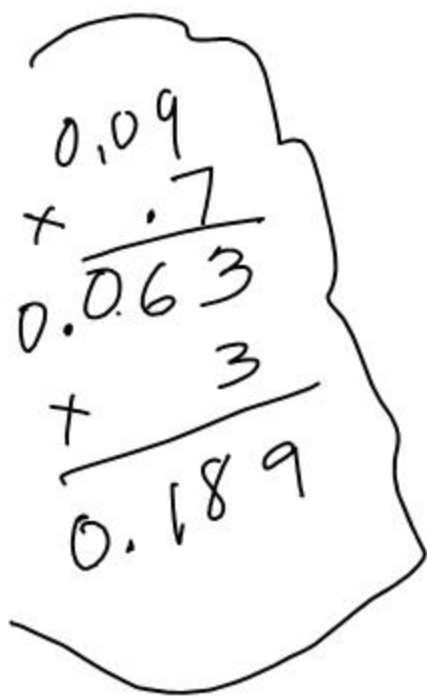
Ex. A bent coin lands $\text{\textcircled{H}}$ 0.3
of the times it is tossed.

X = number of heads when 3
coins are tossed.

$$P(X=2) = \binom{3}{2} (0.3)^2 (0.7)^1$$

$$= 3 \cdot (0.09) (0.7)$$

$$= 0.189$$



A hand-drawn box containing a vertical multiplication calculation:

$$\begin{array}{r} 0.09 \\ \times 0.7 \\ \hline 0.063 \\ + 3 \\ \hline 0.189 \end{array}$$

CW quiz 11-7-28
NO Calculator

Roll 5 dice. $X =$ number of \square

Find $P(X=2)$

HW

15B #10

15C #3

15D #3
