Pepy's Problem

- 6 dice are tossed @ least 1 is 6

$$P(x \geq 1) = 1 - P(x = \emptyset)$$

$$P(x=\emptyset) = \binom{6}{0}\left(1-\frac{1}{6}\right)^6 \left(\frac{1}{6}\right)^{\emptyset} = \left(\frac{5}{6}\right)^6$$

$$1 - \left(\frac{5}{6}\right)^6 = \boxed{0.665} \star$$

- 12 dice, @ least 2 are 6

$$P(x \geq 2) = 1 - P(x=\emptyset) - P(x=1)$$

$$P(x=\emptyset) = \binom{12}{\emptyset}\left(1-\frac{1}{6}\right)^{12}\left(\frac{1}{6}\right)^{\emptyset} = \left(\frac{5}{6}\right)^{12} = 0.112$$

$$P(x=1) = \binom{12}{1}(1-1/6)^{11}(1/6) = (12)(5/6)^{11}(1/6)$$

$$\approx 0.269$$

$$1 - 0.112 - 0.269 = \boxed{0.619}$$

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- 18 fair dice, 3 6's

$P(x \geq 3) = 1 - P(x=0) - P(x=1) - P(x=2)$

$P(x=0) = \binom{18}{0}\left(\frac{5}{6}\right)^{18}\left(\frac{1}{6}\right)^{0} = \left(\frac{5}{6}\right)^{18} = 0.0376$

$P(x=1) = \binom{18}{1}(5/6)^{17}(1/6) = 0.135$

$P(x=2) = \binom{18}{2}(5/6)^{16}(1/6)^{2} = 0.230$

$1 - 0.0376 - 0.135 - 0.230 =$ **0.597**

* the first proposition has the greatest chance of success.

Geometric Urn

- 100 balls, some are red & others black
- draw w/ replacement
- # of draws needed to get first red ball
- $E(x) = 20 = 1/p$
- $p = 0.05 \rightarrow$ 5% of balls are red
- reasonable estimate:
  - 5 red balls
  - 95 black balls

Dragon Dice

- pick # 1-6
- rolls 3 dice
- K = 1, 2, or 3 times, she wins K galleons
- loses a galleon if the # doesn't come up
- Expected outcome?

P(1 success) = +1 galleon
P(2 ") = +2 "
P(3 ") = +3 "
P(0 ") = -1 "

- Probability that die 1 has the # = 1/6
- " " die 2 " " 4 = 1/6
- " " die 3 " " " = 1/6
- " " die 1 & 2 have the # = $\left(\frac{1}{6}\right)\left(\frac{1}{6}\right)$
- " " die 1 & 2 & 3 " " " = $(1/6)^3$
- " " no die has the # = $(5/6)^3$

- P(1 success) = 1/6 = 0.167
- P(2 ") = 1/36 = 0.0278
- P(3 ") = 1/216 = 0.0046
- P(∅ ") = 0.579

- E[galleons] = (1)(0.167) + (2)(0.0278) + (3)(0.0046)
  - (1)(0.579)
  = -0.343 galleons