ALEJANDRA DE OSMA
SPRINT_3
CMS_380

GEOMETRIC URN.

DEFINING THE EXPECTED VALUE OF A GEOMETRIC DISTRIBUTION

↳ $E[x] = \frac{1}{p}$

- GIVEN DATA
  - URN CONTAINS SOME RED BALLS AND BLACK BALLS
  - EXPECTED VALUE OF DRAWS TO OBTAIN RED = 20

↓

$E[x] = 20$, solving FOR P → $20 = \frac{1}{P}$

$\therefore \; P = \frac{1}{20}$

$\underline{P = 0.05}$ //

↓

USING PROBABILITY OF RED TO FIND # OF RED AND BLACK BALLS

$RED = 100 \cdot P \implies 100 \cdot 0.05$

$RED = 5$

↓

$BLACK = TOTAL - RED$

$BLACK = 100 - 5$

$BLACK = 95$

∴ WE WOULD EXPECT THE URN TO HAVE:

5 RED BALLS AND 95 BLACK BALLS.

ALEJANDRA DE OSMA
SPRIN_3
CMS_380

DRAGON DICE

GAME :

PICK A NUMBER (1, 2, 3, 4, 5, 6) = GUESS
ROLL 3 SIX SIDED DICE

$$\left.\begin{array}{l}\text{IF 1 DIE == GUESS } +1\\ \text{IF 2 DICE == GUESS } +2\\ \text{IF 3 DICE == GUESS } +3\end{array}\right\}\text{ SUCCESS}$$

IF 0 DICE == GUESS −1 ⟶ LOSS

$E[x]$ = WHEIGHTED SUM OF THE PROBABILITIES OF THE 4 OUTCOMES

↓

- EVENT 1 ⟶ GUESS == ALL THREE DICE

  $P(\text{EVENT } 1) = 1/216 \text{ or } \left(1/6 \cdot 1/6 \cdot 1/6\right)$

- EVENT 2 ⟶ GUESS == TWO DICE

  $P(\text{EVENT } 2 = ((1 \cdot 1 \cdot 5) \cdot (1 \cdot 5 \cdot 1) \cdot (5 \cdot 1 \cdot 1))/216 \text{ or } 15/216$

- EVENT 3 ⟶ GUESS $\neq$ ~~ONE~~ ALL DIECE

  $P(\text{EVENT } 3) = (5 \cdot 5 \cdot 5/216 \rightarrow 5^3/216 = 125/216$

- EVEN 4 ⟶ ~~GUESS ≠ ALL THREE DICE~~ GESS == ONE DIE

  $P(\text{EVENT } 4) = 1 - P(\text{EVENT } 1) - P(\text{EVENT } 2) - P(\text{EVENT } 3)$

  $P(\text{EVENT } 4) = 1 - (1/216) - (15/216) - (125/216) = 75/216$

$\therefore E[x] = 3 \cdot P(\text{EVENT } 1) + 2P(\text{EVENT } 2) + P(\text{EVENT } 4) - P(\text{EVENT } 3)$

$E[x] = \cancel{4}\ 3(1/216) + 2(15/216) + (125/216) - (75/216)$

$E[x] = -17$

HERMIONE'S ~~GAME~~ EXPECTED OUTCOME ⟶ −17\$.

ALEJANDRA DE OSMA
SPRINT – 3
CMS_380

NEWTON – PEPYS PROBLEM

BINOMIAL DISTRIBUTION

$B(n,k) = \binom{n}{k}(1-p)^{n-k} \cdot p^k$

P(AT LEAST 1 6 APPEARS): # OF DICE = 6

$= 1 - b(6,0)$

$= 1 - 0.33 \Rightarrow \underline{0.665102}$

P(AT LEAST 2 SIXES APPEAR): # OF DICE 12

$= 1 - b(12,0) - b(12,1)$

$= 1 - 0.112157 - 0.269176$

$= 1 - 0.381333$

$= \underline{0.618667}$

P(AT LEAST 3 SIXES APEAR) # OF DICE 18

$= 1 - b(18,0) - b(18,1) - b(18,2)$

$= 1 - 0.037561 - 0.135220 - 0.229874$

$= \underline{0.597346}$

EVENT WITH HIGHER PROBABILITY OF SUCCESS IS:

OBTAINING AT LEAST ONE SIX WHEN SIX INDEPENDENT DICE ARE TOSSED

SUCCESS RATE ≈ 66.5% WHICH PROVES NEWTON WAS CORRECT!