Roulette Problem :

We are going to play 2 games of Roulette.

- First game is as follows :

odd	even	other
1	2	0
3	4	00
⋮	⋮	
35	36	

(Red) (Blue) (Green)

The player has 2 options (Red & Blue), and bets 1 rs. and if he chooses Red and the ball falls in other colours then he will lose 1 rs. and if the ball falls in red he will win 1 rs.

So, ~~if~~ we Let X be a r.v. takes values +1, -1.

$\therefore P(X=+1) = \frac{18}{38}$, $P(X=-1) = \frac{20}{38}$

$\therefore E(X) = 1 \cdot \frac{18}{38} - 1 \cdot \frac{20}{38} = -1/19$.

So, the Expected outcome is $-1/19$.

- 2nd Game is as follows :

col 1	col 2	col 3	others
1	13	25	0
2	14	26	00
⋮	⋮	⋮	
12	24	36	

(Red) (Blue) (Yellow) (Green)

The player has 3 options (Red, Blue, Yellow). If the player chooses Red and bets 1 r.s. Now if the ball falls in Red coloured number the he will win 2 rs. and if the ball falls in other colour the he will loose 1 rs.

So, Let X be a r.v. takes values +2, -1.

$\therefore P(X=+2) = \frac{12}{38}$, $P(X=-1) = \frac{26}{38}$

$\therefore E(X) = 2 \cdot \frac{12}{38} - 1 \cdot \frac{26}{38} = -1/19$.

We can see expectation from both the games are same.

So, player cannot Decide from this.

If we look at the variance of the first game

$$\text{Var}(X) = \frac{18}{38} + \frac{20}{38} - \left(-\frac{1}{19}\right)^2 = \frac{360}{361} = 0.99$$

and for 2nd game,

$$\text{Var}(X) = 4.\frac{12}{38} + 1.\frac{26}{38} - \left(-\frac{1}{19}\right)^2$$

$$= \frac{702}{361} = 1.944$$

So, variance in game 1 is lower than variance in game 2.

1. **Target** : The target is to maximize the stability of returns and minimizing the risk, Aiming for more consistent outcome over the long term.

2. **Which Game to Play?** : Based on the target Game 1 should be chosen.

3. **My chance is best for my Target** :

- From the Expectation, we see it is same $-\frac{1}{19}$, which implies, on avg. the player looses $\frac{1}{19}$th of the bet from both game
- From the variance we see, game 1 has less variance, and game 2 has higher variance. Which implies that
  - for the game 1, the outcomes are more concentrated around the expectation, which means this game is less risky and has consistent outcome
  - for the game 2, the outcome are more spreaded from the expectation, which implies that this game is more risky and has less consistent outcome

As the game 1 aligns with our Target so we choose game 1.