

# Probability&RV

## Assignment-04

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### download Python code from

[https://github.com/Anuradha-Uggi/Assignments-AI5002-Probability-and-Random-Variables/blob/main/Prob\\_ass04/rvsp\\_urn\\_balls.py](https://github.com/Anuradha-Uggi/Assignments-AI5002-Probability-and-Random-Variables/blob/main/Prob_ass04/rvsp_urn_balls.py)

### Download Latex code from

[https://github.com/Anuradha-Uggi/Assignments-AI5002-Probability-and-Random-Variables/blob/main/Prob\\_ass04/UrnBalls.tex](https://github.com/Anuradha-Uggi/Assignments-AI5002-Probability-and-Random-Variables/blob/main/Prob_ass04/UrnBalls.tex)

### I. QUESTION(Prob-3,8)

Six balls are drawn successively from an urn containing 7 red and 9 black balls. Tell whether or not the trials of drawing balls are Bernoulli trials when after each draw the ball drawn is

- (i) replaced
- (ii) not replaced in the urn.

### II. SOLUTION

Properties to be satisfied if a trial needs to be a Bernoulli trial:

1. Number of trials should be finite.
2. Each trial should have outcomes of success and failure.
3. If  $P$  is the success probability then failure probability should be  $1-P$ .
4. Probability of success should not vary with trial.

#### Case(i): Replaced

Number of red balls = 7

Number of black balls = 9

Let  $X$  be the random variable that indicates probability of success and failure.

Let

$$P(x = 1)$$

is the probability of success let's take it as picking a red ball.

and

$$P(x = 0)$$

is the probability of failure let's take it as picking a black ball.

Now let's verify whether in this case the trials are Bernoulli trials or not. Success Probability is given by

$$P(x = 1) = \frac{7}{16}$$

and it's the same for any red ball drawn since the drawn ball is replaced. So we can state that the Success Probability remains constant over all trials. and corresponding Failure Probability is

$$P(x = 0) = \frac{9}{16} = 1 - P(x = 1)$$

which is also constant for all trials. Now we can claim that as it satisfies all properties of Bernoulli trials therefore trials under Replaced case are Bernoulli trials.

#### Case(ii): Not Replaced

Now let's check all Satisfactory Criteria of Bernoulli trials. In this case Success Probability is given by

$$P(x = 1) = \frac{7}{16}$$

and similarly for Second Trial the probability of drawing a red ball from the urn consisting Initial Number of balls less one which is already drawn is

$$P(x = 1) = \frac{6}{15}$$

Corresponding Failure Probabilities are

$$P(x = 0) = \frac{9}{16}$$

and for 2nd trial

$$P(x = 0) = \frac{8}{15}$$

From above observations we can state that the probability of success and corresponding failure is varying in each trial therefore under Not Replaced case Trials are not Bernoulli Trials.

### III. CONCLUSION

Case(i): Drawn balls are Replaced into the Urn here Trials are Bernoulli Trials

Case(ii): Drawn balls are not Replaced into the Urn and here Trials are not Bernoulli Trials.