Problem

There are 3 urns labeled X, Y, and Z.

- Urn X contains 4 red balls and 3 black balls.
- Urn Y contains 5 red balls and 4 black balls.
- Urn Z contains 4 red balls and 4 black balls.

One ball is drawn from each of the 3 urns. What is the probability that, of the 3 balls drawn, 2 are red and 1 is black?

Solution

Probability of drawning a red ball:

- Urn X has a 4/7 probability of drawning a red ball.
- Urn Y has a 5/9 probability of drawning a red ball.
- Urn Z has a 1/2 probability of drawning a red ball.

Probability of drawning a black ball:

- Urn X has a 3/7 probability of drawning a black ball.
- Urn Y has a 4/9 probability of drawning a black ball.
- Urn Z has a 1/2 probability of drawning a black ball.

$$P(A) = P(Red, Red, Black) + P(Red, Black, Red) + P(Black, Red, Red)$$

$$= \frac{4}{7}\frac{5}{9}\frac{1}{2} + \frac{4}{7}\frac{4}{9}\frac{1}{2} + \frac{3}{7}\frac{5}{9}\frac{1}{2}$$

$$= \frac{20}{126} + \frac{16}{126} + \frac{15}{126} = \frac{51}{126} = \frac{17}{42}$$