Assignment 2

AI1110: Probability and Random Variables

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11.16.1.12: One urn contains two black balls (labelled B1 and B2) and one white ball. A second urn contains one black ball and two white balls (labelled W1 and W2). Suppose the following experiment is performed. One of the two urns is chosen at random. Next a ball is randomly chosen from the urn. Then a second ball is chosen at random from the same urn without replacing the first ball.

(a) Write the sample space showing all possible outcomes
(b) What is the probability that two black balls are chosen?
(c) What is the probability that two balls of opposite colour are chosen?

Solution:

Probability of an event E, written as $\Pr(E)$

$$\Pr(E) = \frac{\text{Number of outcomes favourable to } E}{\text{Total Number of possible outcomes in sample space}} \tag{1}$$

Let the white ball in first urn be 'W' and the black ball in second urn be 'B'.

(a) Sample Space S:

$$\{B_1B_2, B_2B_1, B_1W, WB_1, B_2W, WB_2, W_1W_2, W_2W_1, W_1B, BW_1, W_2B, BW_2\} \tag{2}$$

$$\therefore n(S) = 12 \tag{3}$$

(b) Let E be event that 2 black balls are chosen, The favourable outcomes are $\{B_1B_2, B_2B_1\}$

$$\Pr(E) = \frac{2}{12} \tag{4}$$

$$= \frac{1}{6} \tag{5}$$

$$\therefore \Pr(E) = \frac{1}{6} \tag{6}$$

(c) Let E be event that balls of opposite colours are chosen, The favourable outcomes are $\{B_1W, WB_1, B_2W, WB_2, W1_B, BW_1, W_2B, BW_2\}$

$$\Pr(E) = \frac{8}{12} \tag{7}$$

$$= \frac{2}{3} \tag{8}$$

$$\therefore \Pr(E) = \frac{2}{3} \tag{9}$$