AI1110: Probability and Random Variable Assignment-2

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Question: 11.16.4.4

Problem Statement:
In a certain lottery 10,000 tickets are sold and ten equal prizes are awarded. What is the probability of not getting a prize if you buy

(a) one ticket
(b) two tickets
(c) 10 tickets.

Solution:
Given,
Tickets sold = 10,000
Prizes awarded = 10
Tickets with no awards = 10,000 - 10 = 9990

(a) If one ticket is bought,
'S_1'= Sample space = picking any one of the 10000 tickets.
'A'= Event of not choosing any one of the 10 prize tickets.

$$n(S_1) = {}^{10000}C_1 = 10000 \tag{1}$$
$$n(A) = {}^{9990}C_1 = 9990 \tag{2}$$
$$\therefore \Pr(A) = \frac{n(A)}{n(S_1)} = \frac{9990}{10000} \tag{3}$$
$$= \frac{999}{1000} \tag{4}$$

(b) If two tickets are bought,
'S_2'= Sample space = picking any two of the 10000 tickets.
'B'= Event of choosing any two tickets with no prize.

$$n(S_2) = {}^{10000}C_2 \tag{5}$$
$$n(B) = {}^{9990}C_2 \tag{6}$$
$$\therefore \Pr(B) = \frac{n(B)}{n(S_2)} \tag{7}$$
$$= \frac{{}^{9990}C_2}{{}^{10000}C_2} = \frac{9990 \times 9989}{10000 \times 9999} \tag{8}$$
$$= \frac{1108779}{1111000} \tag{9}$$

(c) If 10 tickets are bought,
'S_3'= Sample space = picking any 10 of the 10000 tickets.
'C'= Event of choosing any 10 tickets with no prize.

$$n(S_3) = {}^{10000}C_{10} \tag{10}$$
$$n(C) = {}^{9990}C_{10} \tag{11}$$
$$\therefore \Pr(C) = \frac{n(C)}{n(S_3)} \tag{12}$$
$$= \frac{{}^{9990}C_{10}}{{}^{10000}C_{10}} \tag{13}$$

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