

Assignment 1

AI1110: Probability and Random Variables
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12.13.6.13: Question. A bag consists of 10 balls each marked with one of the digits 0 to 9. If four balls are drawn successively with replacement from the bag, what is the probability that none is marked with the digit 0?

Answer: $\left(\frac{9}{10}\right)^4$.

Solution:

| Variable | Definition | Value |
|----------|---|-----------------------------|
| X | Number of balls marked with the digit 0 among the 4 balls drawn | 0 |
| p | Probability of drawing a ball marked 0 each time | $\left(\frac{1}{10}\right)$ |
| n | number of trials | 4 |

Here, we need that none of the balls are marked 0, i.e. $X = 0$

By binomial mass distribution function :

$$n = 4 \dots \dots (1)$$

$$p = \frac{1}{10} \dots \dots (2)$$

$$P(X = 0) = {}^nC_0 \times (p)^0 \times (1 - p)^4$$

$$P(X = 0) = {}^4C_0 \times \left(\frac{1}{10}\right)^0 \times \left(\frac{9}{10}\right)^4$$

$$P(X = 0) = 1 \times 1 \times \left(\frac{9}{10}\right)^4$$

$$P(X = 0) = \left(\frac{9}{10}\right)^4$$