AI1103-Assignment 5

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Download all python codes from

https://github.com/SHASHANK-1-ALL/AI1103-Assignment-5/blob/main/Assignment5.py

and latex-tikz codes from

https://github.com/SHASHANK-1-ALL/AI1103-Assignment-5/blob/main/Assignment5.tex

Question

A box contains 2 washers, 3 nuts and 4 bolts. Items are drawn from the box at random one at a time without replacement. The probability of drawing 2 washers first followed by 3 nuts and subsequently 4 bolts is

(A) $\frac{2}{315}$ (B) $\frac{1}{630}$ (C) $\frac{1}{1260}$ (D) $\frac{1}{2520}$

Solution

Let $X \in \{0,1,2\}$ be the random variable such that X=0 represents that we draw 2 washers, X=1 represents that we draw 3 nuts and X=2 represents that we draw 4 bolts, continuously without replacement.

Total number of objects :

$$N = 2+3+4 = 9 \tag{0.0.1}$$

Probability of occurrence of X=0 :

$$\Pr(X=0) = \frac{{}^{2}C_{2}}{{}^{9}C_{2}} \tag{0.0.2}$$

$$= \frac{1}{36} \tag{0.0.3}$$

Total number of objects after occurrence of X=0 :

$$N = 3+4 = 7 \tag{0.0.4}$$

Probability of occurrence of X=1 given that X=0 has already occurred :

$$\Pr(X=1|X=0) = \frac{{}^{3}C_{3}}{{}^{7}C_{3}} \tag{0.0.5}$$

$$= \frac{1}{35} \tag{0.0.6}$$

Total number of objects after occurrence of X=0 and X=1 :

$$N = 4 \tag{0.0.7}$$

Probability of occurrence of X=2 given that X=0 and X=1 has already occurred :

$$\Pr(X=2|(X=0,X=1)) = \frac{{}^{4}C_{4}}{{}^{4}C_{4}} \tag{0.0.8}$$

$$= 1 \tag{0.0.9}$$

Using Multiplication law of probability,
Required probability is given by :

$$\Pr(X=0,X=1,X=2) = \Pr(X=0)\times\Pr(X=1|X=0) \times\Pr(X=2|(X=0,X=1)) \tag{0.0.10}$$

$$\implies \Pr(X=0,X=1,X=2) = \frac{1}{36}\times\frac{1}{35}\times 1 \tag{0.0.11}$$

$$= \frac{1}{1260} \tag{0.0.12}$$

$\therefore$ The correct option is (C) $\frac{1}{1260}$.