

Cambridge International AS & A Level

Mathematics

9709/52

Paper 5 Probability & Statistics 1

October/November 2024

Question No(1)

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At a college, the students choose exactly one of tennis, hockey or netball to play. The table shows the numbers of students in Year 1 and Year 2 at the college playing each of these sports.

	Tennis	Hockey	Netball
Year 1	16	22	12
Year 2	24	18	28

One student is chosen at random from the 120 students. Events X and N are defined as follows:

X: the student is in Year 1

N: the student plays netball.

(a) Find $P(X|N)$

(b) Find $P(N|X)$

(c) Determine whether or not X and N are independent events.

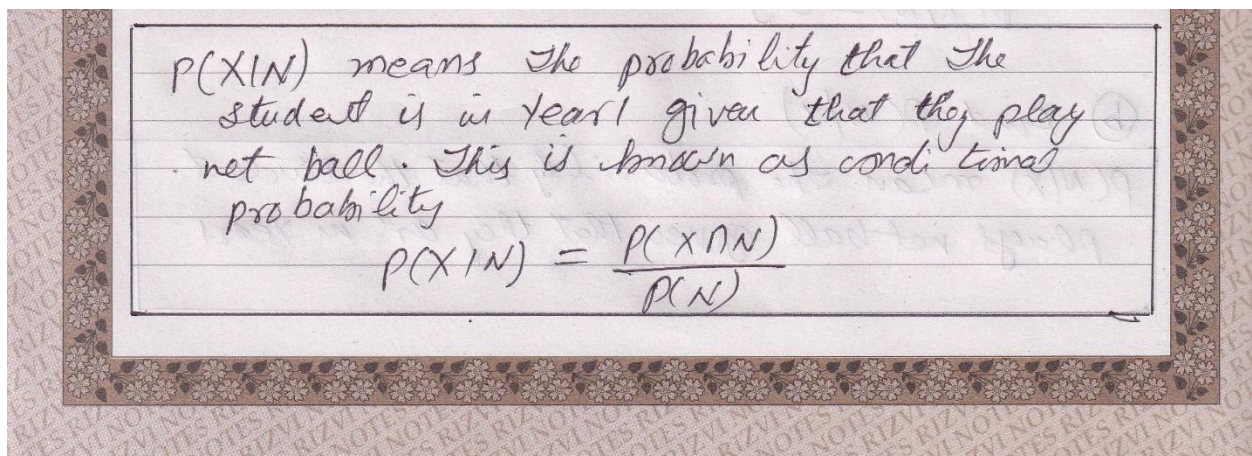
One of the students who plays netball takes 8 shots at goal. On each shot, the probability that she will succeed is 0.15, independently of all other shots.

(d) Find the probability that she succeeds on fewer than 3 of these shots.

Solution:

(a)

Find $P(X|N)$



Given data:

Total Students = 120

Total netball players in Year 1 and Year 2
 $= 12 + 28 = 40$

netball players in Year 1 = 12

$$P(X/N) = \frac{P(X \cap N)}{P(N)}$$

$$P(X \cap N) = \frac{12}{120}$$

∴ Student in Year 1
are 12

$$P(N) = \frac{40}{120}$$

∴ netball students
in Year 1 and Year 2
are 40

$$P(X/N) = \frac{12/120}{40/120}$$

$$= \frac{12}{40}$$

$$P(X/N) = \frac{3}{10}$$

$$P(X/N) = 0.3$$

⑥ Find $P(N/X)$

$P(N/X)$ mean the probability that the student plays netball given that they are in Year 1

DATE :-

(3)

Given data:

total Year 1 students = 50

netball players in year 1 = 12

$$P(N/X) = \frac{P(N \cap X)}{P(X)}$$

Here $P(N \cap X) = \frac{12}{120}$

$$P(X) = \frac{50}{120}$$

now $P(N/X) = \frac{P(N \cap X)}{P(X)}$

$$= \frac{12/120}{50/120}$$

$$= \frac{12}{50}$$

$$= \frac{6}{25}$$

$$P(N/X) =$$

© Determine whether or not X and N are independent events

Solution

Two events X and N are independent if and only if

$$P(X \cap N) = P(X) \cdot P(N)$$

Total no of students = 120

$$P(X) = \frac{50}{120} = \frac{5}{12}$$

$$P(N) = \frac{40}{120} = \frac{1}{3}$$

$$P(X \cap N) = \frac{12}{120} = \frac{1}{10}$$

Now

$$\begin{aligned} P(X) \cdot P(N) &= \frac{5}{12} \cdot \frac{1}{3} \\ &= \frac{5}{36} \end{aligned}$$

$$\text{and } P(X \cap N) = \frac{1}{10}$$

$$\Rightarrow P(X) \cdot P(N) \neq P(X \cap N)$$

So X and N are not independent

(d)

Binomial probability Formula

$$P(X=k) = \binom{n}{k} p^k (1-p)^{n-k}$$

Given data

number of shots, $n=8$ probability of success on each shot, $p=0.15$ probability of failure on each shot, $q=1-p$

$$= 1 - 0.15$$

$$q = 0.85$$

By given condition

$$P(X < 3) = P(X=0) + P(X=1) + P(X=2)$$

$$= \binom{8}{0} (0.15)^0 (0.85)^8 + \binom{8}{1} (0.15)^1 (0.85)^{8-1} + \binom{8}{2} (0.15)^2 (0.85)^{8-2}$$

$$P(X < 3) = \binom{8}{0} (p)^0 (q)^{8-0} + \binom{8}{1} p^1 (q)^{8-1} + \binom{8}{2} p^2 (q)^{8-2}$$

$$P(X < 3) = 0.2725 + 0.3855 + 0.2381$$

$$P(X < 3) = 0.896$$