Cambridge International AS & A Level

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Mathematics 9709/52

Paper 5 Probability & Statistics 1 **May/June 2020**

Question No (2)

2 A total of 500 students were asked which one of four colleges they attended and whether they preferred soccer or hockey. The numbers of students in each category are shown in the following table.

	Soccer	Hockey	Total
Amos	54	32	86
Benn	84	72	156
Canton	22	56	78
Devar	120	60	180
Total	280	220	500

(a) Find the probability that a randomly chosen student is at Canton college and prefers hockey.

(b) Find the probability that a randomly chosen student is at Devar college given that he prefers soccer.

(c) One of the students is chosen at random. Determine whether the events 'the student prefers hockey' and 'the student is at Amos college or Benn college' are independent, justifying your answer.

Solution:

$(\boldsymbol{a})$

$Student\ at\ Canton\ college\ prefer\ hockey\ are\ 56.$

$Total\ number\ of\ students = 500$

$$P(Student\ Canton\ college\ and\ prefer\ hockey) = \frac{Possible\ options}{Total\ options}$$

$$= \frac{\mathbf{56}}{\mathbf{500}} = \mathbf{0.112}\ \boldsymbol{Ans}.$$

$(\boldsymbol{b})$

$$It\ is\ about\ the\ condition\ \ probability.$$

$$Probability\ of\ prefers\ Soccer = \frac{280}{500}$$

280 → $Student\ for\ Soccer$

500 → $All\ Student$

$$Devar\ college\ probability = \frac{120}{500}$$

$$Now\ by\ using\ conditional\ probability$$

$$P(Student\ at\ devar\ college\ , given\ that\ they\ prefer\ Soccer)$$

$$= \frac{\frac{120}{500} \quad \longrightarrow \quad Probabilty\ in\ Devar\ college\ for\ Soccer}{\frac{280}{500} \quad \longrightarrow \quad Probability\ for\ all\ soccer\ student}$$

$$= \frac{120}{500} \times \frac{500}{280} = \frac{120}{280}$$

$$= \boldsymbol{\frac{3}{7}}$$

$(\boldsymbol{c})$

$$P(Student\ prefers\ hockey) = P(H) = \frac{220}{500}$$

Total Hockey Student

$$= \frac{11}{25}$$

$$Probability\ formula$$

$$P(AUB) = P(A) + P(B)$$

$$P(Student\ is\ from\ Amos\ or\ Benn\ college) = P(AUB)$$

$$(Note: When\ there\ is\ \boldsymbol{or}\ in\ the\ condition\ we\ use\ union)$$

$$= P(A) + P(B)$$

$$P(A\ U\ B) = P(A) + P(B)$$

$Student\ from\ Amos\ College\ or$

$Student\ from\ Benn\ College$

$$P(A\ U\ B) = \frac{86}{500} + \frac{156}{500}$$

$$= \frac{242}{500} = \frac{121}{250}$$

$P(Student\ prefer\ hockey\ and\ from\ Amos\ or\ Benn\ Coleege)$

$$= P(H \cap (A \cup B))$$

$Amos\ college\ Hockey\ student$

$Benn\ College\ Hockey\ Student$

$$= \frac{32}{500} + \frac{72}{500}$$

$$= \frac{104}{500} = \frac{26}{125}$$

$$Since\ \frac{11}{25} \times \frac{121}{250} \neq \frac{26}{125}$$

$$\therefore \boldsymbol{P(H)X\ P(A \cup B))} \neq \boldsymbol{P(H\ \cap\ (A \cup B)\ )}$$

The events are not independent