Questions: Conditional probability

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Summary

A selection of questions to test your understanding of conditional probability, the multiplication rule, and independence.

*Before attempting these questions it is highly recommended that you read* [*Guide: Conditional probability*](../studyguides/conditionalprobability.qmd)*.*

## Q1

Answer the following using the definition of conditional probability.

**1.1.** In a deck of $52$ cards, one card is drawn at random. Let $A$ be the event that the card is a heart, and $B$ the event that the card is red. What is the probability that the card is a heart, given that it is red?

**1.2.** In a university class, $60\%$ of students are left-handed and $25\%$ of left-handed students play the piano. What is the probability that a randomly chosen student plays the piano, given that they are left-handed?

**1.3.** In the workforce of Cantor’s Confectionery, $30\%$ of employees speak French and $15\%$ of employees take both French and Spanish. Let $A$ be the event that an employee takes Spanish, and $B$ the event that the employee takes French. What is the probability that an employee takes Spanish, given that they take French?

**1.4.** The table below shows survey results from a school about whether students bring a packed lunch and whether they are sixteen:

|  | Sixteen | Not sixteen | Total |
| --- | --- | --- | --- |
| **Packed lunch** | 0.25 | 0.15 | 0.40 |
| **No packed lunch** | 0.35 | 0.25 | 0.60 |
| **Total** | 0.60 | 0.40 | 1.00 |

Let $A$ be the event that a student is sixteen, and $B$ the event that they bring a packed lunch. What is the probability that the student is sixteen, given they bring a packed lunch?

## Q2

Use the multiplication rule to solve the following problems.

**2.1.** A Cantor’s Confectionery Lagrange Lucky Dip bag contains $3$ green sweets and $2$ yellow sweets. Two sweets are picked one after the other without replacement. What is the probability that both sweets are green?

**2.2.** In the Cantor’s Confectionery factory, the probability that a box of Bayes Biscuits passes inspection is $0.9$, and the probability it passes a second inspection given it passed the first is $0.95$. What is the probability that a box of Bayes Biscuits passes both inspections?

**2.3.** A coin is flipped, and then a die is rolled. The probability of getting heads on the coin is $1/2$, and the probability of rolling a $6$ on the die is $1/6$. What is the probability of getting heads and rolling a $6$?

**2.4.** In a survey of the general populace, $70\%$ of people like tea and $60\%$ of tea-drinkers also like coffee. What is the probability that a randomly chosen person likes both tea and coffee?

## Q3

Decide whether the following events are independent.

**3.1.** In a study, $P\left(A\right)=0.4$, $P\left(B\right)=0.3$, and $P\left(A∩B\right)=0.12$. Are $A$ and $B$ independent? Justify your answer.

**3.2.** Suppose $P\left(A\right)=0.3$ and $P\left(A∣B\right)=0.3$. Are $A$ and $B$ independent? Justify your answer.

**3.3.** Suppose $P\left(A\right)=0.5$, $P\left(B\right)=0.4$, and $P\left(A∩B\right)=0.1$. Are $A$ and $B$ independent? Justify your answer.

**3.4.** Suppose $P\left(A\right)=0.6$ and $P\left(A∣B\right)=0.2$. Are $A$ and $B$ independent? Justify your answer.

[After attempting the questions above, please click this link to find the answers.](../answers/as-conditionalprobability.qmd)

## Version history and licensing

v1.0: initial version created 05/25 by Sophie Chowgule as part of a University of St Andrews VIP project.

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