

STAT 157 – Contingency Tables Worksheet

Two hundred Canadian students are going on an exchange trip. The students are either from BC or Quebec and data about their mother tongue is summarized in the table below.

	English	French	other	
BC	72	1	27	100
QC	8	79	13	100
	80	80	40	200

Calculate the probability that if a student were randomly selected from this group,

1. that the student is from BC;

$$P(BC) = \frac{n(BC)}{n_{\text{tot}}} = \frac{100}{200} = \frac{1}{2} \text{ or } 50\%$$

2. that the student's mother tongue is English and they are from BC;

$$P(E \cap BC) = \frac{n(E \cap BC)}{n_{\text{tot}}} = \frac{72}{200} = 36\%$$

3. that the student's mother tongue is English or they are from BC;

$$\begin{aligned}
 P(E \cup BC) &= P(E) + P(BC) - P(\text{both}) \\
 &= \frac{80}{200} + \frac{100}{200} - \frac{72}{200} \\
 &= \frac{108}{200} = 54\%
 \end{aligned}
 \quad \left| \quad
 \begin{aligned}
 P(E \cup BC) &= \frac{n(E \cup BC)}{n_{\text{tot}}} \\
 &= \frac{8 + 72 + 1 + 27}{200} \\
 &= 54\%
 \end{aligned}$$

4. that if the student's mother tongue is English, that they are from BC;

$$P(BC | E) = \frac{n(\text{both})}{n(E)} = \frac{72}{80} = 90\%$$

5. that if the student was from BC, that student's mother tongue is English.

$$P(E | BC) = \frac{n(\text{both})}{n(BC)} = \frac{72}{100} = 72\%$$

Are the events "student is from BC" and "student's mother tongue is English" independent? Explain your answer.

$$\begin{aligned}
 P(E) &\stackrel{?}{=} P(E | BC) & P(BC) &\stackrel{?}{=} P(BC | E) & P(E \cap BC) &\stackrel{?}{=} P(E)P(BC) \\
 P(E) &= \frac{80}{200} = 40\% & & & & \\
 P(E | BC) &= 72\% & & & & \\
 & \left. \vphantom{\begin{matrix} P(E) \\ P(E | BC) \end{matrix}} \right\} \text{not same} & & & & \\
 \therefore & \text{dependent} & & & &
 \end{aligned}$$