

## MATH 120: Quiz 5 - 3/18/2022

Suppose the probability that a U.S. resident has traveled to Canada is 0.2, to Mexico is 0.1, and to both countries is 0.02.

- What is the probability that a randomly chosen U.S. resident has not traveled to either country?
- What is the probability that a person who has been to Mexico, has also visited Canada.
- Are traveling to Mexico and to Canada statistically independent, disjoint, neither, or both?

[Show steps/reasons. Answers alone will receive little, if any, credit]

### Solution

One way to organize the information is using a Venn diagram that shows disjoint/ non-overlapping probabilities. Let C=Canada, M=Mexico.

The intersection region is 0.02, since that is the probability of travel to both countries.

$$P(C)=0.2, P(M)=0.1.$$

That leaves  $0.2 - 0.02 = 0.18$ , and  $0.1 - 0.02 = 0.08$  for the other regions shown in the Venn diagram.



- Probability that the person has not traveled to either country =  $1 - P(C \text{ or } M)$

$$\text{From the Venn diagram: } P(C \text{ or } M) = 0.18 + 0.02 + 0.08 = 0.28$$

$$\text{Therefore, the answer is: } = 1 - 0.28 \quad \boxed{= 0.72}$$

- Probability that a person who has been to Mexico, has also visited Canada:

This is asking for the conditional probability  $P(C|M)$

$$\text{From the Venn diagram, } P(C|M) = \frac{0.02}{0.1} \quad \boxed{= 0.2}$$

- Are traveling to Mexico and to Canada independent, disjoint, neither, or both?

They are clearly NOT disjoint, since  $P(C \text{ and } M) \neq 0$ .

For independence, we must check whether  $P(C|M) = P(C)$ , or whether  $P(M|C) = P(M)$ .

From part (b) we know  $P(C|M) = 0.2$ . Also, the question gives us  $P(C) = 0.2$ .

It follows that traveling to Mexico and to Canada are statistically independent.

**Grading:** Total points possible = 6.

2 points for each of the three parts (a), (b), and (c).

For (a): 1pt=Venn diagram with disjoint probabilities; OR,

demonstrate use of correct general addition rule.

1pt=plugin correct numbers and show how to get answer.

For (b): 1pt=state correct conditional probability interpretation of question.

1pt=plugin correct numbers and show how to compute answer.

For (c): 0.5pt = say they are not disjoint (it is okay if reason is missing here).

1pt=state correct condition to check for independence.

0.5pt=get correct answer for independence.