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MATH 108
Spring 2024
HW 9: Due 02/28

"[Leonard] At least I didn't have to invent 26 dimensions just to make the math come out. [Sheldon] I didn't invent them. They are there. [Leonard] In what universe? [Sheldon] In all of them, that is the point."
— Sheldon Cooper & Leonard Hofstadter, Big Bang Theory

Problem 1. (10pts) A marketing firm is attempting to determine the effectiveness of their advertisements. After surveying 900 visitors to their clients website, 348 stated they saw an advertisement on their browser, 511 stated they saw an advertisement on their phone, and 97 said they had seen an advertisement on both.

(a) Find the probability that a randomly selected surveyed individual saw an advertisement on their browser or phone.

(b) Find the probability that a randomly selected surveyed individual saw an advertisement only on their phone.

(c) Find the probability that a randomly selected surveyed individual had not seen an advertisement.

(d) Find the probability that a randomly selected surveyed individual that saw an advertisement on their phone also saw an advertisement on their browser.

(e) Find the probability that a randomly selected surveyed individual saw an advertisement only on their browser.

Solution.

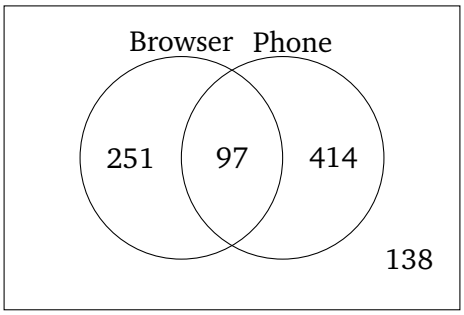
(a)
$$P(\text{Browser or Phone}) = \frac{348 + 511 - 97}{900} = \frac{251 + 97 + 414}{900} = \frac{762}{900} \approx 0.846667$$

(b)
$$P(\text{Only Phone}) = \frac{511 - 97}{900} = \frac{414}{900} \approx 0.46$$

(c)
$$P(\text{None}) = \frac{138}{900} \approx 0.153333$$

(d)
$$P(\text{Browser} \mid \text{Phone}) = \frac{P(\text{Browser and Phone})}{P(\text{Phone})} = \frac{97}{97 + 414} = \frac{97}{511} \approx 0.189824$$

(e)
$$P(\text{Only Browser}) = \frac{348 - 97}{900} = \frac{251}{900} \approx 0.278889$$



Problem 2. (10pts) A local college is trying to improve student academic performance at the institution. They examine the usage of various academic resources at the college, e.g. the tutoring center, library, etc. The tutoring center surveys students that use the facility over the course of the month. The survey results are shown below.

	0 Times	1–3 Times	≥ 4 Times	Total
On-Campus	697	55	12	764
Commuter	457	46	17	520
Total	1,154	101	29	1,284

Given the data above, answer the following:

(a) Find the probability that a randomly selected student did not use the center.

(b) Find the probability that a randomly selected student is a commuter.

(c) Find the probability that a randomly selected student did not use the center or is a commuter.

(d) Find the probability that a randomly selected student that used the center was an on-campus student.

(e) Find the probability that a randomly selected student used the center at least four times.

Solution.

(a)
$$P(\text{No Use}) = \frac{1154}{1284} \approx 0.898754$$

(b)
$$P(\text{Commuter}) = \frac{520}{1284} \approx 0.404984$$

(c)
$$P(\text{Not Use or Commuter}) = \frac{1154 + 520 - 457}{1284} = \frac{697 + 457 + 46 + 17}{1284} = \frac{1217}{1284} \approx 0.947819$$

(d)
$$P(\text{On-Campus} \mid \geq 1) = \frac{P(\text{On-Campus and } \geq 1)}{P(\geq 1)} = \frac{55 + 12}{101 + 29} = \frac{67}{130} \approx 0.515385$$

(e)
$$P(\geq 4) = \frac{29}{1284} \approx 0.0225857$$

Problem 3. (10pts) A local business is analyzing their sales of one of their more popular products—the Franley cup. They place the cup on sale a mere 8% of the time. If the cup is on sale, the business sells out of them 83% of the time. Otherwise, they sell out of the cup only 39% of the time.

(a) What percentage of the time does the business sell out of the cup?

(b) What percentage of the time does the business either place the cup on sale or sell out of the cup?

(c) What percentage of the time does the company not sell out of the cup?

(d) If the company sold out of the cup, what is the probability that the cup was on sale?

(e) What percentage of the time does the company not put the cup on sale but sell out of it anyway?

Solution.

(a)

$$P(\text{Sell Out}) = 0.0664 + 0.3588 = 0.4252$$

(b)

$$P(\text{Sale or Sell}) = 0.0664 + 0.0136 + 0.3588 = 0.4388$$

(c)

$$P(\text{Not Sell}) = 0.0136 + 0.5612 = 1 - P(\text{Sell}) = 1- = 1 - 0.4252 = 0.5748$$

(d)

$$P(\text{Sale} \mid \text{Sold}) = \frac{P(\text{Sale \& Sold})}{P(\text{Sold})} = \frac{0.0664}{0.0664 + 0.3588} = \frac{0.0664}{0.4252} = 0.156162$$

(e)

$$P(\text{Sell} \mid \text{Not Sale}) = \frac{P(\text{Sell \& Not Sale})}{P(\text{Not Sale})} = \frac{0.3588}{0.3588 + 0.5612} = \frac{0.3588}{0.92} = 0.39$$