

Math 461: Homework #4

Due on Friday, June 22 9:00AM

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Problem 1

A total of 46 percent of the voters in a certain city classify themselves as Independents, whereas 30 percent classify themselves as Liberals and 24 percent say that they are Conservatives. In a recent local election, 35 percent of the Independents, 62 percent of the Liberals, and 58 percent of the Conservatives voted. A voter is chosen at random.

Let

- I be the group of Independent voters.
- L be the group of Liberal voters.
- R be the group of Republican voters.
- V be the group of voters who actually voted.

Given

- $P(I) = .46$
- $P(L) = .30$
- $P(R) = .24$
- $P(V|I) = .35$
- $P(V|L) = .62$
- $P(V|R) = .58$

Then let

$$P(V) = P(I)P(V|I) + P(L)P(V|L) + P(R)P(V|R) = .4862$$

Given that this person voted in the local election, what is the probability that he or she is

(a) an Independent?

Solution

$$P(I|V) = \frac{P(I)P(V|I)}{P(V)} = .331139$$

(b) a Liberal?

Solution

$$P(L|V) = \frac{P(L)P(V|L)}{P(V)} = .382559$$

(c) a Conservative?

Solution

$$P(R|V) = \frac{P(R)(V|R)}{P(V)} = .286302$$

(d) What fraction of voters participated in the local election?

Solution

$$P(V) = .4862$$

Problem 2

Three cooks, A , B , and C , bake a special kind of cake, and with respective probabilities .02, .03, and .05, it fails to rise. In the restaurant where they work, A bakes 50 percent of these cakes, B 30 percent, and C 20 percent. What proportion of "failures" is caused by A ?

Solution

Let

- A be the group of cakes the first cook bakes
- B be the group of cakes the second cook bakes
- C be the group of cakes the third cook bakes
- F be the group of cakes which fail

Given

- $P(A) = .5$
- $P(B) = .3$
- $P(C) = .2$
- $P(F|A) = .02$
- $P(F|B) = .03$
- $P(F|C) = .05$

Then

$$P(F) = P(A)P(F|A) + P(B)P(F|B) + P(C)P(F|C) = .029$$

$$P(A|F) = \frac{P(A)P(F|A)}{P(F)} = 0.344$$