2.16 PB & J

Suppose 80% of people like peanut butter, 89% like jelly, and 78% like both.

Given that a randomly sampled person likes peanut butter, what's the probability that he also likes jelly?

**9% Prefer Neither**

**Peanut**

**Butter 2%**

**PB & J**

**78%**

**Jelly 11%**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Jelly 11% | PB & J 78% | Peanut Butter 2% | Neither 9% | 100% |
| .11 | .78 | .02 | .09 | 1 |

Let A = The Event the subject likes both   
Let B = The event the subject likes PB   
P[B] = .80   
P[A] = .78   
P[A n B] = .78   
  
Find P[A|B]   
  
Since P[A|B] = P[A n B] \ P[B] = .78 / .8 or .39 / .4 = .975 or 97.5%

2.18 Health coverage, relative frequencies

The Behavioral Risk Factor Surveillance System (BRFSS) is an annual telephone survey designed to identify risk factors in the adult population and report emerging health trends. The following table displays the distribution of health status of respondents to this survey (excellent, very good, good, fair, poor) conditional on whether or not they have health insurance.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Health Status** | | | | | | | |
| **Self (Male)** |  | **Excellent** | **Very Good** | **Good** | **Fair** | **Poor** | **Total** |
| **NO** | 0.0230 | 0.0364 | 0.0427 | 0.0192 | 0.0050 | 0.1262 |
| **Yes** | 0.2099 | 0.3123 | 0.2410 | 0.0817 | 0.0289 | 0.8738 |
| **Total** | 0.2329 | 0.3486 | 0.2838 | 0.1009 | 0.0338 | 1.0000 |

1. Are being in excellent health and having health coverage mutually exclusive?
   * 0.0230/002329 = 1.0126 not mutually exclusive
2. What is the probability that a randomly chosen individual has excellent health?
   * 0.2329
3. What is the probability that a randomly chosen individual has excellent health given that he has health coverage?
   * 0.2099
4. What is the probability that a randomly chosen individual has excellent health given that he doesn't have health coverage?
   * 0.230
5. Do having excellent health and having health coverage appear to be independent?

Yes, one does not depend on the other

2.20 Assortative mating

Assortative mating is a nonrandom mating pattern where individuals with similar genotypes and/or phenotypes mate with one another more frequently than what would be expected under a random mating pattern. Researchers studying this topic collected data on eye colors of 204 Scandinavian men and their female partners. The table below summarizes the results. For simplicity, we only include heterosexual relationships in this exercise.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Partner ( Female)** | | | | | |
| **Self (Male)** |  | **Blue** | **Brown** | **Green** | **Total** |
| **Blue** | 78 | 23 | 13 | **114** |
| **Brown** | 19 | 23 | 12 | **54** |
| **Green** | 11 | 9 | 16 | **36** |
| **Total** | **108** | **55** | **41** | **204** |

1. What is the probability that a randomly chosen male respondent or his partner has blue eyes?

108 + 114 = 222 -78 = 144

1. What is the probability that a randomly chosen male respondent with blue eyes has a partner with blue eyes?

78/114 = 68.4%

1. What is the probability that a randomly chosen male respondent with brown eyes has a partner with blue eyes? What about the probability of a randomly chosen male respondent with green eyes having a partner with blue eyes? 19/54 = 35.2% and 11/36 = 30.5%
2. Does it appear that the eye colors of male respondents and their partners are independent? Explain your reasoning.

Not mutually exclusive, they are independent because they do not match or need to be be same in order to make the statement True

2.26 Twins

About 30% of human twins are identical, and the rest are fraternal. Identical twins are necessarily the same sex {half are males and the other half are females. One-quarter of fraternal twins are both male, one-quarter both female and one-half are mixes: one male, one female. You have just become a parent of twins and are told they are both girls. Given this information, what is the probability that they are identical?

30% identical of which 15% are males 15% are females

70% fraternal of which 17.5% are males 17.5 are female

Out of 32.5% which can be female, only 15 percent of that percentage can be identical. Leaving the answer to being .15/.325 = 46%