Homework 1

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CS 513

HW1

HW 1.1

Jerry and Susan have a joint bank account

Jerry goes to the bank 20% of the days

Susan goes there 30% if the days

Together they are at the bank 8% of the days

1. Susan was at the bank last Monday. What's the prob that Jerry was there too
   1. P(Jerry | Susan) = P(Jerry and Susan) / P(Susan) = 0.08 / 0.3 = 0.26
2. Last Friday, Susan wasn't at the bank. What's the prob that Jerry was there
   1. P(Jerry | !Susan) = P(Jerry and !Susan) / P(!Susan) = (0.2 - 0.08) / 0.70 = 0.17
3. Last Wednesday at least one of them was at the bank. What is the prob that both were there?
   1. P(Jerry) + P(Susan) - P(Jerry and Susan) = 0.3 + 0.2 - 0.08 = 0.42
   2. P(Jerry n Susan) / P(Jerry) U P(Susan) = 0.08 / 0.42 = 19.05

HW 1.2

Harold and Sharon are studying for a test

Harold's chance of getting a "B" are 0.8

Sharon's chances of getting a "B" are 0.9

The prob of at least one of them getting a "B" is 0.91

\* If A and B are independent \* P(A|B) = P(A) or (P and B) = P(A)P(B)

\* Harold and Sharon's grades are independent \*

P(Harold) = 0.8, P(!Harold) = 0.2

P(Sharon) = 0.9, P(!Sharon) = 0.1

P(Harold AND Sharon) = P(Harold) + P(Sharon) – P(At least one of them) = (0.8 + 0.9) - 0.91 = 0.79

1. What is the prob that only Harold gets a "B"
   1. P(only Harold) = P(Harold) – P(Both) = 0.8 – 0.79 = 0.01
2. What is the prob that only Sharon gets a "B"
   1. P(only Sharon) = P(Sharon) – P(Both) = 0.9 – 0.79 = 0.11
3. What is the prob that both won't get a "B"
   1. P(neither) = 1 – P(both) = 1 – 0.91 = 0.09

HW 1.3

Jerry and Susan have a joint bank account

P(Jerry) = 0.2

P(Susan) = 0.3

P(Jerry and Susan) = 0.08

Are the event "Jerry is at the bank" and "Susan is at the bank" independent?

P(Jerry AND Susan) has to equal P(Jerry) \* P(Susan) for them to be independent

P(Jerry AND Susan) = 0.08

P(Jerry) \* P(Susan) = 0.2 \* 0.3 = 0.06

0.08 != 0.06

Therefore, they are NOT INDEPENDENT

\* Independent Variable => When the occurrence of one event will NOT control the happening of the other event in an experiment then it is termed as an independent event \*

HW 1.4

You roll 2 dice

\*A and B are conditionally independent if

P( (A and B) / C) = P(A|C)\*P(B/C)

1. Are the events "the sum is 6" and "the second die shows 5" independent? NO
   1. P(A) = P("The sum is 6") = 5/36
   2. P(B) = P("the second die shows 5") = 1/6
   3. P(A AND B) = P("the sum is 6" AND "the second die shows 5") = 1/6 \* 1/6 = 1/36
   4. P(A)\*P(B) = P("The sum is 6")\*P("the second die shows 5") = (5/36 \* 1/6)
   5. **P("The sum is 6")\*P("the second die shows 5") != P("the sum is 6" AND "the second die shows 5"), therefore they are DEPENDENT**
2. Are the events "the sum is 7" and "the first die shows 5" independent? YES
   1. P("the sum is 7") = 6/36 = 1/6
   2. P("the first die shows 5") = 1/6
   3. P("the sum is 7" AND "the first die shows 5") = 1/6 \* 1/6 = 1/36
   4. P("the sum is 7")\*P("the first die shows 5") = 1/6 \* 1/6 = 1/36
   5. **P("the sum is 7" AND "the first die shows 5") = P("the sum is 7")\*P("the first die shows 5"), therefore they are INDEPENDENT**

HW 1.5

P(TX) = 0.6

P(NJ) = 0.1

P(AK) = 1 - P(TX) + P(NJ) = 1 – 0.7 = 0.3

P(Oil | Tx) = 0.3

P(Oil | NJ) = 0.2

P(Oil | NJ) = 0.1

\* P(A and B) = P(A|B)P(B) = P(B|A)P(A)\*

1. Probability of finding oil
   1. P(Oil and TX) = P(Oil | TX) \* P(TX) = 0.3 \* 0.6 = 0.18
   2. P(Oil and AK) = P(Oil | AK) \* P(AK) = 0.2 \* 0.3 = 0.06
   3. P(Oil and NJ) = P(Oil | NJ) \* P(NJ) = 0.1 \* 0.1 = 0.01
   4. P(Finding oil) = P(Oil and TX) or P(Oil and AK) or P(Oil and NJ) = 0.25
2. The company decided to drill and found oil. What is the probability that they drilled in TX?
   1. P(TX | Oil) = P(TX and Oil) / P(Oil) = P(Oil and TX) / P(Oil) = 0.18 / 0.25 = 0.72

HW 1.6

**Survived** Top=Cabin

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1st | 2nd | 3rd | Crew | Sub Total |
| Adult | 197 | 94 | 151 | 212 | 654 |
| Child | 6 | 24 | 27 | - | 57 |
| Sub Total | 203 | 118 | 178 | 212 | 711 |

Left=Age

**Not Survive** Top=Cabin

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1st | 2nd | 3rd | Crew | Sub Total |
| Adult | 122 | 167 | 476 | 673 | 1438 |
| Child | - | - | 52 | - | 52 |
| Sub Total | 122 | 167 | 528 | 673 | 1490 |

Left=Age

**Total** Top=Cabin

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1st | 2nd | 3rd | Crew | Sub Total |
| Adult | 319 | 261 | 627 | 885 | 2092 |
| Child | 6 | 24 | 79 | - | 109 |
| Sub Total | 325 | 285 | 706 | 885 | 2201 |

Left=Age

1. What is the probability that a passenger did not survive?
   1. Total Passenger Deaths / Total Passengers = 1490 / 2201 = 0.68
2. What was the probability that a passenger was staying in 1st class
   1. Total Passengers in 1st class / Total Passengers = 325 / 2201 = 0.15
3. Given that the passenger survived, what is the probability the passenger was in 1st class
   1. P(1st | Survive) = P(1st n Survive) / P(survive) = 203 / 711 = .285
4. Are survival and staying in first class independent?
   1. P(survive) = 711/2201 = 0.32
   2. P(1st class) = 325/2201 = 0.147
   3. P(survive and first class) = P(survive)\*P(first class) = 0.047
   4. P(survive n first class) = 203/2201 = 0.09
   5. P(survive n first class) != P(survive and first class) therefore they are **NOT INDEPENDET**
5. Given that a passenger survived, what is the prob that the passenger was staying in the first class and the passenger was a child?
   1. P(1st class n child | survived) = P(1st class n child n survived) / P(survived) = 6/711 = 0.0084
6. Given that a passenger survived, what is the prob that the passenger was an adult?
   1. P(adult | survived) = P(adult n survived) / P(survived) = 654 / 711 = 0.92
7. Given that a passenger survived, are age and staying in the first class independent
   1. P(age u 1st class | survived) = P(age u 1st class u survived) / P(survived) = 711 / 711
   2. P(1st class | survived) = P(1st class u survived) / P(survived) = 203 / 711 = 0.29
   3. P(age u 1st class | survived) n P(1st class | survived) = 203 / 711 = 0.29
   4. Therefore, age and staying in first class **are INDEPENDET**