1. **Dental Work**
   1. P(Toothache)
      1. P(Toothache = false) = 0.576 + 0.144 + 0.008 + 0.072 = **0.8**
      2. P(Toothache = true) = 0.064 + 0.016 + 0.012 + 0.108 = **0.2**
   2. P(Cavity)
      1. P(Cavity = false) = 0.576 + 0.144 + 0.064 + 0.016 = **0.8**
      2. P(Cavity = true) = 0.008 + 0.072 + 0.012 + 0.108 = **0.2**
   3. P(Toothache | Cavity)
      1. P(Toothache = false | Cavity = false)
         1. = P(Toothache = false, Cavity = false) / P(Cavity = false)
         2. = (0.576+0.144)/(0.8)
         3. = **0.9**
      2. P(Toothache = true | Cavity = false)
         1. = P(Toothache = true, Cavity = false) / P(Cavity = false)
         2. = (0.064+0.016)/(0.8)
         3. = **0.1**
      3. P(Toothache = false | Cavity = true)
         1. = P(Toothache = false, Cavity = true) / P(Cavity = true)
         2. = (0.008+0.072)/(0.2)
         3. = **0.4**
      4. P(Toothache = true | Cavity = true)
         1. = P(Toothache = true, Cavity = true) / P(Cavity = true)
         2. = (0.012 + 0.108) / (0.2)
         3. = **0.6**
2. **Prove Equivalence**
   1. P(X/\Y) = P(X)P(Y)
   2. P(Y|X) = P(Y)
   3. P(X|Y) = P(X)
      1. Presuming the values are independent, In order to prove equivalence, we will need to use symmetry to help solve our issue.

P(X/\Y) = P(X) P(Y)

Apply our Product rule to our 2nd option gives us

P(X/\Y) = P(X|Y) P(Y)

Which can also be written as

P(X/\Y)=P(X) P(Y)

P(X|Y) P(Y) = P(x)P(Y)

The above equation specifies:

P(X|Y) = P(X)

So now the result has proved that the value of the equations is independent, and equivalent.

1. **Coin flip**
   1. If the probability x is known, then successive flips of the coin are independent of each other, since we know that each flip of the coin will land heads with probability x. More formally, if F1 and F2 are to represent the results of two successive flips, we will have:

P(F1 = heads, F2 = heads|x) = x \* x = P(F1 = heads|x)P(F2 = heads|x)

* 1. If we do not know the value of x, the probability of each successive flip will be dependent on the results of all previous flips. This is because each of the successive flips will give us a better estimate of the probabilities of each outcome.

1. **Disease**

If 10,000 people take the test, there is a 1% chance of testing positive if you DON'T have the disease.

P (test|disease) = 0.99

P (¬test|¬disease) = 0.99

P (disease) = 0.0001

P (disease|test) = P (test|disease)P (disease) /

( P (test|disease)P (disease) + P (test|¬disease)P (¬disease))

= 0.99 × 0.0001 / (0.99 × 0.0001 + 0.01 × 0.9999)

= .009804

1. **Hit and Run problem**
   1. There are two colors of taxis in the city, and a taxi may be blue or green, however, the witness claims that the taxi was blue. The reliability of the color is 75%. So we will suppose that B denotes blue, and BL will denote the locked blue

Thuc, the equation can be written as

P(LB|B)=.75

P(~LB|~B)=.75

The reliability equation for locked blue over blue with respect to probability as is given:

P(B|LB)aP(LB|B) P(B)a0.75P(B)

P(~B|LB)aP(LB|~B) P(~B)a0.25(1- P(B))

The prior probability of the taxi being blue cannot be decided, we use laplace’s principle of indifference to check probability. We suppose the probability of being blue is 1, as well as the probability of locked blue as being 1, but we are still missing information to determine the exact color.

So the exact probability of the car being blue cannot be determined.

* 1. When we are given the nine out of 10 are green figure, that provides that the odds of being a blue taxi are .01

The values of our different probabilities are now applied into our formula

P(B|LB)=(.075/(.075+.225))

P(B|LB)=.25

P(~B|LB)=a0.25\*0.9a0.0225

P(~B|LB)=(0.225/(0.075+.225))

P(~B|LB)=0.75

From this, we can tell that the probability of green over blue is greater.