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In [6]:
```
1 import math
```

1

A lot of 150 semiconductor chips contains 12 that are defective. Two are selected randomly, without replacement, from the lot.

a.

What is the probability that the first one selected is defective?

$$P(Defective) = \frac{12}{150} = .08$$

b.

What is the probability that the second one selected is defective given that the first one was defective?

$$P(SecondDefective|FirstDefective) = \frac{11}{149} = .0738$$

c.

What is the probability that both are defective?

In [2]:
```
1 math.comb(12,2) / math.comb(150,2)
```

Out[2]: 0.005906040268456376

A:

$$\frac{\binom{12}{2}}{\binom{150}{2}} = .0059$$

B:

2.

Suppose that $P(B|A)$ = 0.35, $P(B|A')$ = 0.25, and $P(A)$ = 0.7. What is $P(B)$?

Answer:

$$P(B) = P(B|A) * P(A) + P(B|A') * P(A') = 0.35 * 0.7 + .25 * (1 - 0.7) = .245 + .075$$

3.

A friend of mine is giving a dinner party. His current wine supply includes 7 bottles of Zinfandel, 5 of Merlot, and 10 of Cabernet, all from different wineries.

a.

If they want to serve 3 bottles of Zinfandel and serving order is important, how many ways are there to do this?

$$\binom{7}{3} = P(7,3) = \frac{7!}{4!} = \frac{7 \cdot 6 \cdot 5 \cdot 4!}{4!} = 7 \cdot 6 \cdot 5 = 210$$

b.

If 6 bottles of wine are randomly selected from the total number of bottles for serving, how many ways are there to do this?

In [3]:

```
1 import math
2 print(math.comb(22,6))
```

```
74613
```

since it is not mentioned that order matters we use combination here

$$\binom{22}{6} = C(22,6) = \frac{22!}{16! * 6!} = 74613$$

C.

If 6 bottles are randomly selected, how many ways are there to obtain two bottles of each variety?

In [4]:
```
1 math.comb(7,2) * math.comb(5,2) * math.comb(10,2)
```

Out[4]: 9450

Based on the Multiplication Rule and since order does not matter so combination we have

$$\binom{7}{2} * \binom{5}{2} * \binom{10}{2} = 21 * 10 * 45 = 9450$$

d.

If 6 bottles are randomly selected, what is the probability of selecting two bottles of each variety?

In [5]:
```
1 9450/74613
```

Out[5]: 0.12665353222628764

based on B and C we should just calculate the

$$P = \frac{C}{B} = \frac{9450}{74613} = 0.1266$$

4

At a certain gas station, 70% of the customers use regular gas ($A1$) and 30% use premium ($A2$). Of those customers using regular gas, only 25% fill their tanks (event B). Of those customers using premium, 88% fill their tanks.

a.

What is the probability that the next customer will request premium gas and fill their tank ($A2 \cap B$)?

$$P(A2 \cap B) = P(B|A2) * P(A2) = 0.88 * 0.3 = \mathbf{0.264}$$

b.

What is the probability that the next customer fills the tank?

$$P(B) = P(B|A1) * P(A1) + P(B|A2) * P(A2) = .25 * .7 + .88 * .3 = \mathbf{.439}$$

c.

If the next customer fills the tank, what is the probability that premium gas is requested?

$$P(A2|B) = ?$$

$$P(A2|B) = \frac{P(B|A2) * P(A2)}{P(B)} = \frac{.88 * .3}{.439} = \mathbf{.601}$$