Q1. Consider an example where a pack contains 4 blue, 2 red and 3 black pens. If a pen is drawn at random from the pack, replaced and the process repeated 2 more times, what is the probability of drawing 2 blue pens and 1 black pen?

## Here, total number of pens = 9 (4+2+3)

## Probability of drawing 1 blue pen = 4/9

## [SINCE IT IS WITH REPLACEMENT]

## Probability of drawing another blue pen = 4/9

## Probability of drawing 1 black pen = 3/9

## [ PROBABILITY OF DRAWING 1 BLUE PEN AND ANOTHER 1 BLUE PEN AND 1 BLACK PEN WILL BE= P(Blue)\* P(Blue)\*P(Black)]

## Probability of drawing 2 blue pens and 1 black pen = 4/9\*4/9\*3/9= 48/729=16/243​

Q2. In a class, 40% of the student’s study math and science. 60% of the student’s study math. What is the probability of a student studying science given he/she is already studying math?

**Probability of student studying MATHS: P(M)= 60/100= 0.6**

**Probability of student studying MATHS and SCIENCE: P(M∩S) = 40/100=0.4**

**Probability of student studying SCIENCE: P(S)**

**[CONDITIONAL PROBABILITY (prob of A given B has already occurred is P(A/B) = P(A∩B)/P(B)]**

**Probability of student studying SCIENCE if he is already studying MATHS:**

**P(S/M) = (P(M∩S) / P(M)) = 0.4/0.6 = 2/3**

Q3. A box contains 4 Choco-bars and 4 ice creams. Tom eats 3 of them, by randomly choosing. What is the probability of choosing 2 Choco-bars and 1 ice cream?

**Total number of ice creams and Choco-bars =8**

**Tom eats 3 of them, by randomly choosing.**

**Probability of choosing one Choco-bar = 4/8= ½**

**[SINCE IT IS WITHOUT REPLACEMENT]**

**Probability of choosing another Choco-bar = 3/7**

**Probability of choosing one ice-cream= 4/6= 2/3**

**Probability of choosing 2- Choco-bars and 1 ice cream = ½\*3/7\*2/3= 1/7**

Q4. State if the below statement is true or false also give the reason why

1. A p-value of 0 .08 is more evidence against the null hypothesis than a p-value of .04.

**Here, we have 2 p-values:**

**The greater p-value: 0.08 &**

**Smaller p-value: 0.04**

**Significance level (α): The significance level, also denoted as alpha or α, is the probability of rejecting the null hypothesis when it is true. For example, a significance level of 0.05 indicates a 5% risk of concluding that a difference exists when there is no actual difference.**

[GENERALLY, **SIGNIFICANCE LEVEL (α) IS CONSIDERED AS 5%, α=0.05]**

**IF p-value is less than α (p- value< α): REJECT THE NULL**

**IF p-value is greater than α(p-value> α): FAIL TO REJECT THE NULL.**

**[To reject the NULL, we need to get p-value < 0.05]**

**NOW, the greater p-value (0.08) is not greater than 0.05. So, in order to reject the NULL, we need to have a value less than 0.05.**

**The smaller p-value (0.04) is less than 0.05. So, here we reject the NULL.**

**False.  A small p-value means the value of the statistic we observed is unlikely to have occurred when the null hypothesis is true.  Hence, a 0.04 p-value means it is even more unlikely the observed statistic would have occurred when the null hypothesis is true than a .08 p-value.   The smaller the p-value, the stronger the evidence against the null hypothesis.**

Q5. What is Null Hypothesis? Also explain the adjacent/alternate hypothesis?

NULL HYPOTHESIS:

**Definition**: **The null hypothesis is a typical statistical theory which suggests that no statistical relationship and significance exists in a set of given single observed variable, between two sets of observed data and measured phenomena.**

### **KEY TAKEAWAYS:**

* **A null hypothesis is a type of conjecture used in statistics that proposes that there is no difference between certain characteristics of a population or data-generating process.**
* **The alternative hypothesis proposes that there is a difference.**
* **Hypothesis testing provides a method to reject a null hypothesis within a certain confidence level. (Null hypotheses cannot be proven, though.)**

**ALTERNATE HYPOTHESIS:**

**Definition: In statistical hypothesis testing, the alternative hypothesis is a position that states something is happening, a new theory is preferred instead of an old one. It is usually consistent with the research hypothesis because it is constructed from literature review, previous studies.**

**Example:**  **IF your null is “I'm going to win up to $1000” then your alternate is “I'm going to win more than $1000.” Basically, you're looking at whether there's enough change (with the alternate hypothesis) to be able to reject the null hypothesis.**