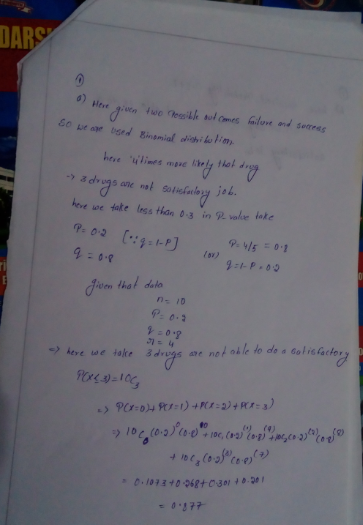
HYPOTHESIS TESTING CASESTUDY

The pharmaceutical company Sun Pharma is manufacturing a new batch of painkiller drugs, which are due for testing. Around 80,000 new products are created and need to be tested for their time of effect (which is measured as the time taken for the drug to completely cure the pain), as well as the quality assurance (which tells you whether the drug was able to do a satisfactory job or not).

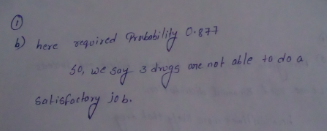
**Question 1:**

* The quality assurance checks on the previous batches of drugs found that — it is 4 times more likely that a drug is able to produce a satisfactory result than not.
* Given a small sample of 10 drugs, you are required to find the theoretical probability that at most, 3 drugs are not able to do a satisfactory job.

1. Propose the type of probability distribution that would accurately portray the above scenario, and list out the three conditions that this distribution follows.



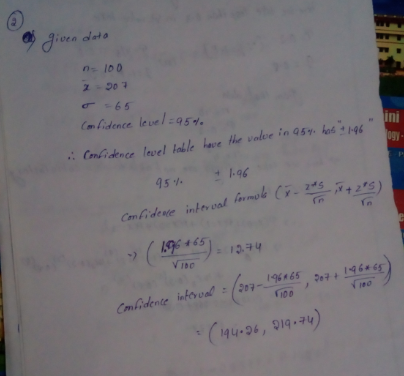
b.)  Calculate the required probability.



**Question 2:**

* For the effectiveness test, a sample of 100 drugs was taken. The mean time of effect was 207 seconds, with the standard deviation coming to 65 seconds. Using this information, you are required to estimate the interval in which the population mean might lie — with a 95% confidence level.

 a.) Discuss the main methodology using which you will approach this problem. State all the properties of the required method. Limit your answer to 150 words.



The main methodology that we would be using Central Limit Theorem to estimate the population mean in the form of an interval.

Hence based on the Central Limit Theorem, for a sampling distribution, we can say that

1. Sampling distribution’s mean (𝜇𝑥̅ ) = Population mean(𝜇) {unknown}

2. Sampling distribution’s standard deviation

(Standard Error) = 𝜎/√n.

Since we know only the samples standard deviation (S), we approximate the

population’s standard deviation (𝜎) with that of sample. n is the sample size

3. For n > 30, sampling distribution becomes a normal distribution

Given the sample’s size, mean and standard deviation, we can say that the confidence interval for 𝜇

lies in the range of ( 𝑋̅ -Z\*S/n,X+Z\*S/n).

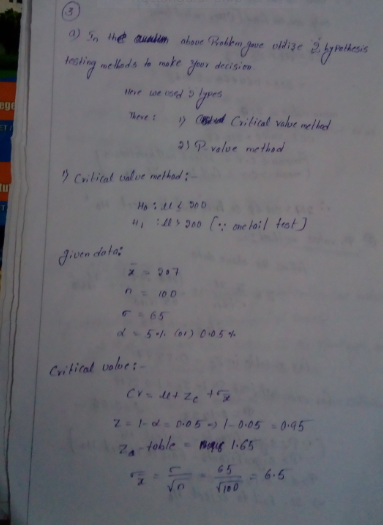
Here z\* is the z-score associated to 95% of the confidence level, 𝑋̅ is the sample’s mean and S is the standard Deviations.

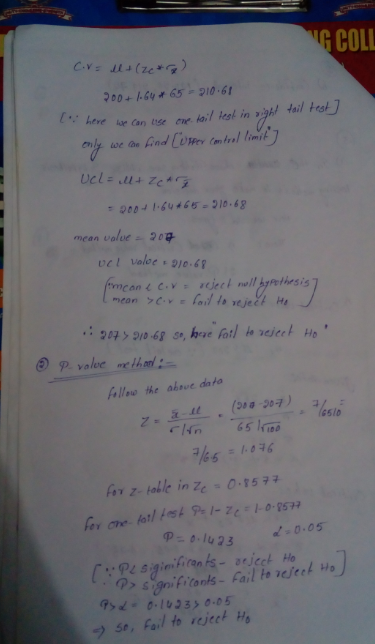
1. Find the required interval.

Confidence interval= (194.26,219.74).

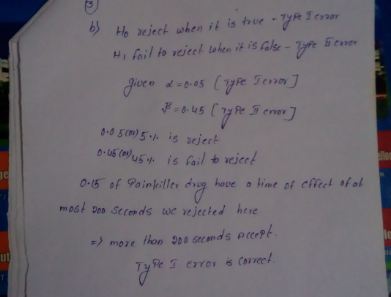
**Question 3**:

1. The painkiller drug needs to have a time of effect of at most 200 seconds to be considered as having done a satisfactory job. Given the same sample data (size, mean, and standard deviation) of the previous question, test the claim that the newer batch produces a satisfactory result and passes the quality assurance test. Utilize 2 hypothesis testing methods to make your decision. Take the significance level at 5 %. Clearly specify the hypotheses, the calculated test statistics, and the final decision that should be made for each method.





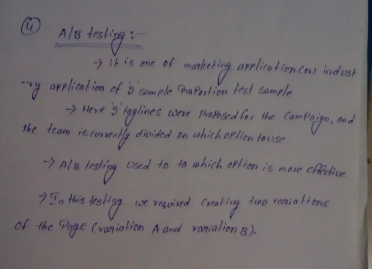
1. You know that two types of errors can occur during hypothesis testing — namely Type-I and Type-II errors — whose probabilities are denoted by α and β respectively. For the current sample conditions (sample size, mean, and standard deviation), the value of α and β come out to be 0.05 and0.45respectively.Now,adifferentsamplingprocedure(different sample size, mean and standard deviation) is proposed so that when the same hypothesis test is conducted, the values of α and β are controlled at 0.15 each.



**Question 4**:

Now, once the batch has passed all the quality tests and is ready to be launched in the market, the marketing team needs to plan an effective online ad campaign to attract new subscribers. Two taglines were proposed for the campaign, and the team is currently divided on which option to use.

Explain why and how A/B testing can be used to decide which option is more effective. Give a stepwise procedure for the test that needs to be conducted.



**AB testing step by step:**

How to Conduct A/B Test

1. Pick one variable to test.

2. Identify your goal.

3. Create a 'control' and a 'challenger.

4. Split your sample groups equally and randomly.

5. Determine your sample size (if applicable).

6. Decide how significant your results need to be.

7. Make sure you're only running one test at a time on any

Campaign.