Structural Reliability
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Lecture –37
Common Probability Distributions (Part - 08)

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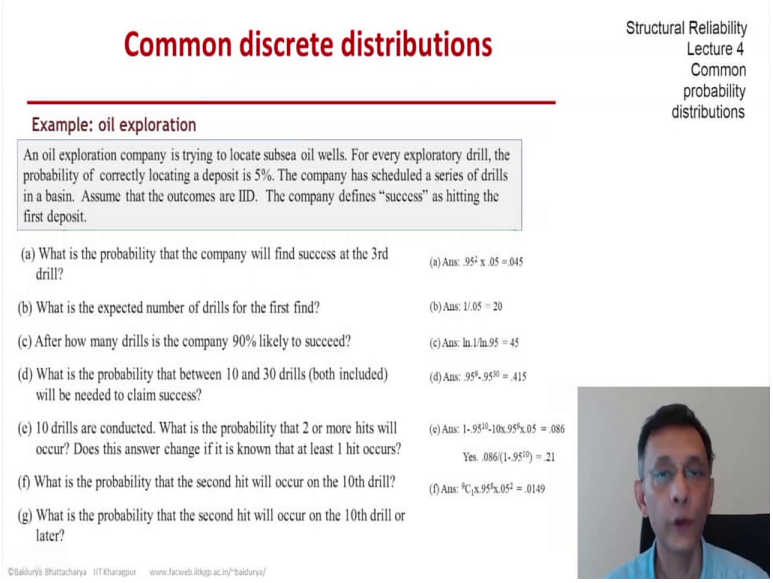

Our second set of problems involving sequence of IID Bernoulli trials, ask similar questions but in a different context. So, let us just spend a minute reading the question. So, as you see the success probability is 0.05 per trial. Let us look at the first question if you want to work through it please pause the video otherwise let me start going through the solution. So, this is a direct application of the geometric CDF and if you work through the numbers it is zero 0.045 the probability that the first success will occur on trial number 3.

The second question also is a straightforward application of the geometric random variable we are looking for the mean the mean of the geometric random variable and that as we know is 1 divided by p. So, the expected number of trials to success or the first success would be 20. The third question again is to do with a geometric CDF and if you work through the algebra and round it off the answer would be 45.

So, 45 trials would be needed. Now question number 4 part d that also is an application of the geometric CDF that 10, 11, 12 all the way up to 30 trials would be needed for the first success. So, we are looking at the difference of the geometric CDF. So, since it is 10 or more. So, we have to take the difference of the CDF at 30 and 9. So, as the CDF at 30 and the CDF of 9 if you take the difference the answer should be about 41.5%.

The next question is different because the number of trials is fixed. So, it is no longer geometric but it is a binomial random variable problem and what we are interested to know is that two or more of these 10 trials would be success. So, just simply plug in the binomial PMF and the answer is it's better to look at the complementary even the two or more. So, we subtract the probability of zero and the probability of one from 100% and the answer is 0.086.

Now it does matter that if one hit at least one hit is known to have occurred. So, it does change it is now a conditional probability. So, the numerator is still two or more hits because it is intersection and the denominator is one or more hits probability. So, the numerator is still 0.086 as we found before and in the denominator we put the probability of one or more hit. So, it's one minus probability of no hits.

So, the final answer comes to 21%. The next problem is being a little more specific that we it is not that we want two hits in 10 trials but we want the second hit on trial number 10. So, this is the negative binomial distribution problem and if you just apply the PMF you get the answer of 0.0149 the last question is looking at the complementary event. So, the second hit can occur any time tenth or later.

So, we are not interested that it happens on the 10th only. So, it is better to look at the complementary events. So, the equivalent statement is in the first nine trials either zero or one success will occur. So, let us just then add the two. So, the probability of zero hits in nine trials and the coverage of one hit in those nine trials if you add the two you get a probability of 99.2%.