



**IIT Madras**  
ONLINE DEGREE

**Statistics for Data Science - 1**  
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**Week 10 - Tutorial 2**

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A survey of IITM students by the XYZ agency revealed that almost 80% disapprove the necessary attendance criteria of the institute. If 10 students are selected at random and asked their opinion, find the probability that the number who disapprove the attendance criteria is atmost 7.

$$\begin{aligned}
 p &= 0.80 & n &= 10 & X &= 0, 1, 2, \dots, 10 \\
 P(X \leq 7) &= 1 - (P(X=8) + P(X=9) + P(X=10)) \\
 &= 1 - \left[ {}^{10}C_8 (0.8)^8 (1-0.8)^{10-8} + {}^{10}C_9 (0.8)^9 (1-0.8)^{10-9} + {}^{10}C_{10} (0.8)^{10} (1-0.8)^{10-10} \right] \\
 &= 1 - \left[ {}^{10}C_2 (0.8)^2 (1-0.8)^{10-2} + {}^{10}C_1 (0.8)^1 (1-0.8)^{10-1} + {}^{10}C_0 (0.8)^0 (1-0.8)^{10-0} \right]
 \end{aligned}$$

A survey of IITM students by the XYZ agency revealed that almost 80% disapprove the necessary attendance criteria of the institute. If 10 students are selected at random and asked their opinion, find the probability that the number who disapprove the attendance criteria is atmost 7. So, how we can relate this problem to binomial distribution?

So, if you take 1 student, that student will either approve or disapprove the necessary attendance criteria. So, each trial has an 2 outcomes and the probability that the student will disapprove that criteria is 80%, that means 0.80 is the probability that the student disapprove that necessary attendance criteria.

So, how many students you have chosen? 10, so your  $n$  will 10. What you have been asked here? Find the number who disapprove the attendance criteria is atmost 7. That means you have to find the probability will  $X$  is the random variable that the student will, that the number of student who disapprove the attendance criteria, so the value is atmost 7.

So, value of  $X \leq 7$ . You can write this since you have 10 students. So, your  $X$  can take value 0, 1, 2, 3, ..., 10. You have been asked the value of less than equal to 7, you can write this in other way

$1 - [p(X = 8) + P(X = 9) + P(X = 10)]$ . So, what is the meaning here?  $P(X = 8)$  when  $X$  takes value 9, when  $X$  takes value 10. That means here what is the probability that 8 students will disapprove the necessary attendance criteria.

Here, the probability that the number like total 9 students will disapprove the attendance, necessary attendance criteria here a student will disapprove the necessary attendance criteria. So, now you can use here binomial. So, you can write this as 1 minus, see,  $n$  is 10 here,  $r$  will be your 8, so  $^{10}C_8$  probability of success that is probability who will disapprove the necessary 0.8, so  $(0.8)^r$ , that is  $1 - [^{10}C_8(0.8)^8(1 - 0.8)^2 + ^{10}C_9(0.8)^9(1 - 0.8) + ^{10}C_{10}(0.8)^{10}(1 - 0.8)^0]$ ,.

You can write this as  $1 - [^{10}C_8(0.8)^8(0.2)^2 + ^{10}C_9(0.8)^9(0.2) + ^{10}C_{10}(0.8)^{10}]$ , this will be your probability that the attendance criteria is disapproved by atmost 7 people. Thank you.

