



IIT Madras
ONLINE DEGREE

Statistics for Data Science - 1
Professor. Usha Mohan
Department of Management Studies
Indian Institute of Technology, Madras
Week 10 - Tutorial 5

(Refer Slide Time: 0:14)



A satellite system consists of 10 components and can work properly if at least 4 of the 10 components are in working condition. If each component is independently in working condition with probability 0.7, what is the probability that the system works properly?

$$\begin{aligned}
 X & \sim 0, \dots, 10 \\
 P(X \geq 4) &= 1 - P(X \leq 3) \\
 &= 1 - [P(X=0) + P(X=1) + P(X=2) + P(X=3)] \\
 &= 1 - \left[{}^{10}C_0 (0.7)^0 (0.3)^{10} + {}^{10}C_1 (0.7)^1 (0.3)^9 + {}^{10}C_2 (0.7)^2 (0.3)^8 \right. \\
 &\quad \left. + {}^{10}C_3 (0.7)^3 (0.3)^7 \right]
 \end{aligned}$$

A satellite system consists of 10 components and can work properly if at least 4 of the 10 components are in working condition. If each component is independently in working condition with probability 0.7, what is the probability that the system works properly? So, what condition we have so that the system work properly, at least 4 out of the 10 components are in working condition.

So, let us define the random variable let X be a random variable that number of component, how many number of components are working. So, here we have 10 component, so the our X can take the value from 0 to 10. So, what we have to find basically is at least 4 out of 10 that means what is the probability that $X \geq 4$. This we can write as $1 - P(X \leq 3)$. And this 1 further can be write as $P(X = 0), P(X = 1), P(X = 2) + P(X = 3)$.

So, this will be our value that the system will work properly. Now, we can see this $1 - P(X = 0)$ that means out of 10, so ${}^{10}C_0$. So, probability of success what we have is 0.7, 0.7, 0, $(1 - 0.7)$, 0.3 power and $-r$ that is $(10 - 0)$ that is 10. Now, $1 - [{}^{10}C_0 (0.7)^0 (0.3)^{10} + {}^{10}C_1 (0.7)^1 (0.3)^9 +$

$^{10}C_2(0.7)^2(0.3)^8]$ so this will be our required probability that our system, our satellites itself will work properly. Thank you.

