

Introduction to Probability & Statistics
Prof Abhay Gopal Bhatt
Department of Statistics
Indian Statistical Institute Delhi
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Statistic

abhi hum jo abhi tak humne jo dekha hai wo humne kaafi saare probability models dekhe hain, random variables, discrete, continuous, unke PMFs, unke CDFs, unke madhya, prasarn, sah-prasarn bhi dekhe hain; ab hum dekhte hain jab hamare paas actual aakde aate hain koi jaach, survey ke through to sample le rahe hote hain, namoona ya pratidarsh le rahe hote hain, aur unke measurements hamare paas aate hain; so consider a sample observations in any random experiment ye random experiment coin toss bhi ho sakta hai, student marks ka survey bhi ho sakta hai; jaise example: 10 tosses of a coin me number of heads count karna, ya 5 students randomly choose karke unke maths ke marks lena; maan lijiye un 5 students ke marks aaye 71, 53, 92, 81, 87 ye sample 1; fir agar wahi experiment dobara karein aur dusre 5 students aaye jinke marks ho 90, 63, 72, 79, 77 ye sample 2; kyunki har baar random experiment ka outcome random hota hai, isliye values change hoti rehti hain; hum in observations ko small x_1, x_2, \dots, x_n se denote karte hain (after observation), aur unke corresponding random variables ko capital X_1, X_2, \dots, X_n se denote karte hain (before observation) ye uncertainty ko represent karta hai; jab actual data aa jata hai small x_1, x_2, x_n tab hum statistics define kar sakte hain, jaise sample mean: $\bar{x} = (x_1 + x_2 + \dots + x_n)/n$; sample 1 ke liye $\bar{x} = 76.8$, sample 2 ke liye $\bar{x} = 76.2$ dikhata hai ki \bar{x} bhi random hai, isliye use hum capital X -bar se represent karte hain jab uski random nature ki baat karte hain; isi tarah general definition: statistic koi bhi function hota hai sample data ka sample ke numbers par depend karta hai; x -bar ek statistic hai; inke distribution hum future me derive kar sakte hain; aur sample mean ke alawa aur bhi statistics use hote hain, jaise ki sample sum, sample variance, sample maximum, sample minimum, etc.; is prakaar jab hum sample data lete hain real observations se, tab probability ke concepts ko apply karke hum statistical inference kar paate hain.random variable okay to ye definition yahan pe khatam ho gaya: ye hai statistic. har example ke liye, agar sample me hamare paas values hain x_1, x_2, \dots, x_n , to hum calculate kaise karenge? x -bar hoga sum of values divided by n , aur x -bar ki value sample 1 ke liye 76.8 thi, sample 2 ke liye 76.2 thi to x -bar bhi random hota hai aur usse capital X -bar se denote karte hain; ek related statistic hai sample total, jo sirf $x_1 + x_2 + \dots + x_n$ hota hai; teesra important statistic hai sample variance, jo function hota hai sample data ka variance jaisa lekin isme PMF, PDF nahi aata, ye sirf numeric data ka function hota hai: $s^2 = \text{sum of } (x_i - \bar{x})^2 / (n - 1)$; dhyan rahe yahan divide by $n-1$ hota hai, n se nahi; iske specific mathematical reasons hain; kisi particular sample ke liye iski numeric value ko small s^2 se denote karte hain; hum numerator ko S_{xx} likhte hain jo hota hai sum of $(x_i - \bar{x})^2$, aur isko expand karne par milta hai $S_{xx} = (\text{sum of } x_i^2) - (\text{sum } x_i)^2 / n$, ya phir $S_{xx} = (\text{sum } x_i^2) - n \cdot \bar{x}^2$; isse sample variance hoga $s^2 = 1/(n-1) [(\text{sum } x_i^2) - n \cdot \bar{x}^2]$; aur phir sample standard deviation ya namoona manak vichlan hota hai $s = \sqrt{s^2}$; to is tarah hum sample mean, sample total, sample variance aur sample standard deviation

jaise statistics define karte hain jo actual sample observations ke function hote hain aur inhi concepts ka hum aage statistics me istimaal karenge.

$$1) \bar{X} = \frac{\sum_{i=1}^n X_i}{n}$$

$$2) T = \sum_{i=1}^n X_i$$

$$3) S^2 = \frac{\sum_{i=1}^n (X_i - \bar{x})^2}{n-1}$$