

**Introduction to Probability & Statistics**  
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**Week - 1**  
**Lecture - 4**  
**Determining Probabilities**

Ab hum dekhte hain ki yeh jo ghatnaon ki probabilities hain unka maan systematically kaise nikaalein. Determining probabilities systematically ka ek standard tareeka hota hai jisme sabse important example wahi hota hai jahan random experiment ke saare possible outcomes equally likely hote hain. Main in sab terms ko ek ek karke explain karunga. Pehle hum aise experiments dekhte hain jinke sample space yaani Omega finite hote hain ya countably infinite hote hain. Sample space kya hota hai Kisi random experiment ke saare outcomes ka samuchay. Aaj hum dono cases dekhenge finite Omega aur countably infinite Omega. Finite Omega ko hum likh sakte hain:  $\omega_1, \omega_2, \omega_3, \dots$ . Countably infinite Omega ko bhi isi tarah likh sakte hain:  $\omega_1, \omega_2, \omega_3$  aur aage anant tak.

$$\Omega = \{\omega_1 + \omega_2 + \omega_3 \dots \omega_n\}$$

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Humne ab tak jitne examples dekhe, unme Omega hamesha finite tha jaise coin toss H T dice roll 1 se 6 ya 52 playing cards me se ek card select karna. Par ab pehli baar hum ek aisa example dekhte hain jisme Omega countably infinite hai. Pehla example Ek coin lo aur use baar baar uchhalo jab tak ki pehli baar heads na aa jaye. Yani toss a coin repeatedly until the first heads appears. Agar pehle toss me H aa gaya to experiment wahi khatam, outcome sirf H. Agar pehle toss me T aaya to experiment rukti nahi, phir se toss karenge. Doosre toss me agar H aaya to outcome T H. Agar phir T aaya to teesra toss, aur yeh process tab tak chalega jab tak H na aa jaye. Is tarah Omega me outcomes honge: H, T H, T T H, T T T H aur aise hi anant tak. Yani koi bhi number of Ts followed by one H. Yeh ek countably infinite sample space ka perfect example hai. Isi tarah doosra example Factory me components ek ek karke assembly line se aa rahe hain. Har component ko check kiya jaata hai defective D ya not defective N. Jaise hi koi defective component milta hai machinery roki jaati hai, adjustments ki jaati hain aur experiment wahi khatam. To outcomes honge D N D N N D N N N Daise hi anant tak. Yani jab tak N milta rahega, experiment chalta rahega jaise hi D mila, experiment khatam. Yeh sample space bhi countably infinite hai. Dono experiments alag hain par unka sample space bilkul same type ka hai ek sequence of success until failure jaisa pattern jisme possible outcomes anant hain aur unhe ek ek karke list kiya ja sakta hai.