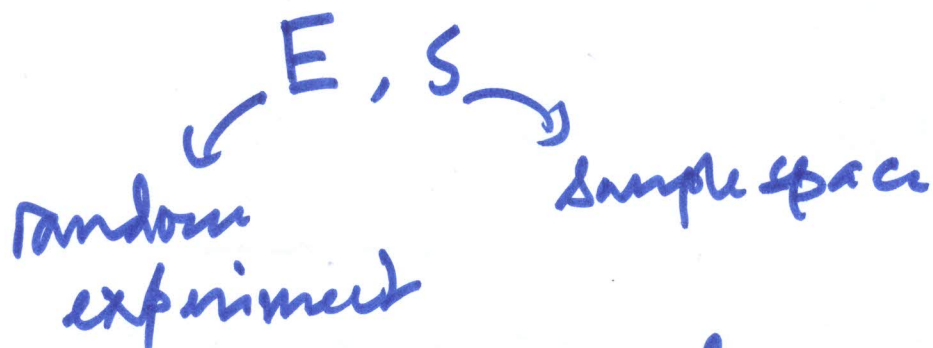


L-11

Probability & Statistics.

Bivariate ~~random~~ probability distributions.



one measurement:

$$X: S \rightarrow \mathbb{R}$$

$$s \mapsto X(s) = x$$

$P(X=x)$, $P(X \leq x)$
 \swarrow pmf/pdf \searrow cdf

two measurements

Exp. $X \rightarrow$ measures height of a student
 $Y \rightarrow$ measures weight of a student.

$$S_x = \text{range set of } X, \quad S_y = \text{range set of } Y$$

Q. How X is related to Y .

Exp. $X \rightarrow$ rank in school before joining IIT

$Y \rightarrow$ score in JEE.

Suppose $Z \rightarrow$ measures your CGPA in first year.

Q $Z = u(X, Y)$?

We want to analyze a pair of random variables (X, Y) .

$$(X, Y) \in S_X \times S_Y$$

Assume X, Y are both discrete r.v.s

Joint probability mass function

$$f(x, y) = p(x, y) = P(X=x, Y=y)$$

Then $f(x, y)$ must satisfy

(i) $0 \leq f(x, y) \leq 1$

(ii) $\sum_{(x, y) \in S_X \times S_Y} f(x, y) = 1$

(iii) $A \subseteq S_X \times S_Y, P((X, Y) \in A) = \sum_{(x, y) \in A} f(x, y)$

