

- Let  $X$  and  $Y$  be two real random variables with **joint CDF**  $F_{XY}(x, y) = \Pr\{X \leq x, Y \leq y\}$ .
- Marginal CDF of  $X$ :  $F_X(x) = F_{XY}(x, \infty)$
- A nonnegative function  $f_{XY}(x, y)$  is called a **joint pdf** of  $X$  and  $Y$  if

$$F_{XY}(x, y) = \int_{-\infty}^x \int_{-\infty}^y f_{XY}(u, v) dv du$$

- **Conditional pdf** of  $Y$  given  $\{X = x\}$ :

$$f_{Y|X}(y|x) = \frac{f_{XY}(x, y)}{f_X(x)}$$

- **Conditional CDF** of  $Y$  given  $\{X = x\}$ :

$$F_{Y|X}(y|x) = \int_{-\infty}^y f_{Y|X}(v|x) dv$$