

Continuous Random Variables

A continuous r.v. takes values from an uncountable set. $\mathbb{R}$, the real numbers.

Ex: weight of a randomly chosen person
waiting time until arrival of next packet.

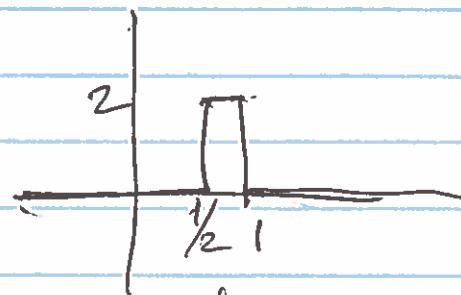
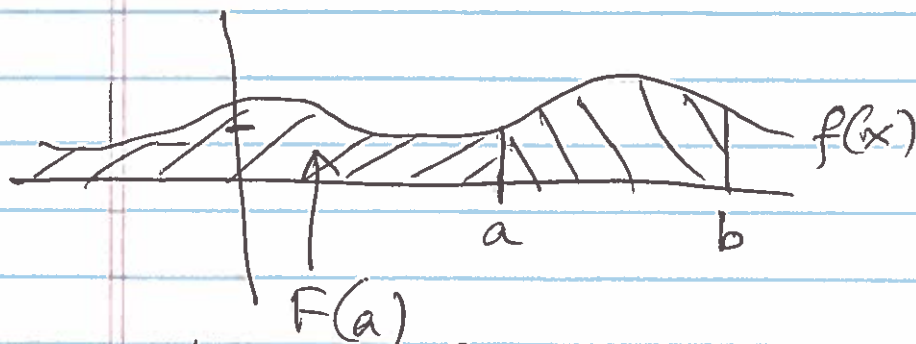
Defn: $f: \mathbb{R} \rightarrow \mathbb{R}$ is a ~~probability density~~
probability density function (pdf) (density),
iff $\forall x, f(x) \geq 0$ and $\int_{-\infty}^{+\infty} f(x) dx = 1$.

(Normalized to 1, like a PMF.)

Defn: The cumulative distribution function (CDF)

$F: \mathbb{R} \rightarrow \mathbb{R}$ associated with the pdf f is

$$F(a) = P(X \leq a) = \int_{-\infty}^a f(x) dx$$



Note: (1) $P(a < X \leq b) = F(b) - F(a) = \int_a^b f(x) dx$
 $= P(X \leq b) - P(X \leq a)$

(2) $f(x) = \frac{d}{dx} F(x)$.

(3) Densities are not probabilities: they may be > 1 .

(4) $P(X = a) = F(a) - F(a) = 0$.