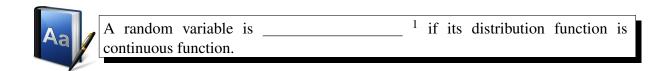
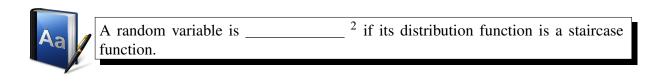
EEL 4930 Stats – Lecture 22

CONTINUOUS RANDOM VARIABLES

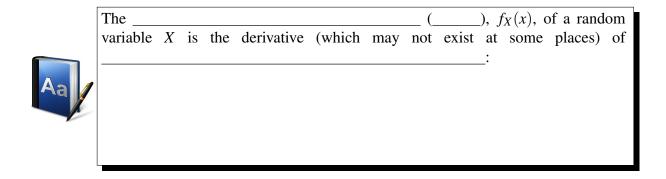


• Continuous random variables do not have probability at any discrete points.I.e., $P(X = x) = 0 \ \forall x \in \mathbb{R}$



- Discrete random variables have all of the probability concentrated at a discrete set points.
- It is possible to have a random variable for which some of the probability is concentrated at individual points and some of the probability is distributed over continous ranges
- These are called ______3 random variables and will not be covered in this class
- For discrete RVs, we can see how the probability is distributed across the values by using the PMF, $P_X(x) = P(X = x)$
- For continous RVs, $P_X(x) = 0$ for all x
- So how to see how the probability is distributed across the values?
- Solution: see how the **probability density** is distributed instead of the probability:

PROBABILITY DENSITY FUNCTION



• Properties:

1.
$$f_X(x) \ge 0, -\infty < x < \infty$$

2.
$$F_X(x) = \int_{-\infty}^x f_X(t) dt$$

3.
$$\int_{-\infty}^{+\infty} f_X(x) dx = 1$$

4.
$$P(a < X \le b) = \int_a^b f_X(x) dx, a \le b$$

5. If g(x) is a nonnegative piecewise continuous function with finite integral

$$\int_{-\infty}^{+\infty} g(x) dx = c, -\infty < c < +\infty,$$

then $f_X(x) = \frac{g(x)}{c}$ is a valid pdf.

Pf omitted.

- Note that if f(x) exists at x, then $F_X(x)$ is continuous at x and thus $P[X = x] = F(x) F(x^-) = 0$
- Recall that this does not mean that x never occurs, but that the occurrence is extremely unlikely