# Probability: Assignment 3

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CC22RESCH11003

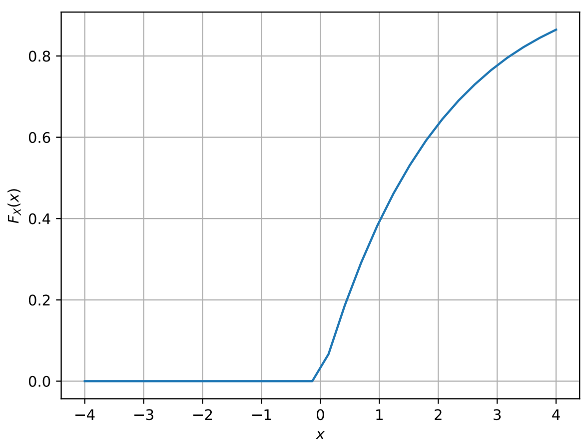


Fig. 1.1. The CDF of $X$

## 1 From Uniform to Other

1.1 Generate samples of

$$V = -2\ln(1-U) \tag{1.1.1}$$

and plot its CDF.
**Solution:**

```
Assignment 3/codes/uxrand.py
Assignment 3/codes/coeffs.h
```

1.2 Find a theoretical expression for $F_V(x)$.
**Solution:** We know from **1.2** that

$$F_U(x) = \Pr(U \le x) = \begin{cases} 0 & \text{for x} < 0 \\ x & x \in [0,1] \\ 1 & \text{for x} > 1 \end{cases}$$

$$0 \le U \le 1 \implies 1-0 \ge 1-U \ge 1-1$$
$$\implies -\infty \le ln(1-U) \le 0$$
$$\implies \infty \ge -2ln(1-U) \ge 0$$
$$\implies 0 \le -2ln(1-U) \le \infty \implies 0 \le V \le \infty$$

So, $V$ is in $[0,\infty)$and is an increasing function such that for $u \in U$ and $v \in V$ we have

$$v = -2ln(1-u)$$
$$\frac{-v}{2} = ln(1-u)$$
$$1-u = e^{\frac{-v}{2}}$$
$$u = 1-e^{\frac{-v}{2}}$$

Accordingly, $F_V(v) = F_V(1-e^{\frac{-v}{2}})$

$$F_V(x) = \Pr(V \le x) = \begin{cases} 0 & \text{for x} < 0 \\ 1-e^{\frac{-v}{2}} & \text{for x} \ge 0 \end{cases}$$