

# Assignment 6

## Probability and random Variables

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# Example Question

## Papoulis book example 4.5

A telephone call occurs at random in the interval  $(0, 1)$ . In this experiment, the outcomes are time distances  $t$  between 0 and 1 and the probability that  $t$  is between  $t_1$  and  $t_2$  is given by

$$P\{t_1 \leq t \leq t_2\} = t_2 - t_1$$

We define the random variable  $x$  such that

$$x(t) = t \quad 0 \leq t \leq 1$$

# Explanation

Thus the variable  $t$  has a double meaning: It is the outcome of the experiment and the corresponding value  $x(t)$  of the random variable:  $x$ . We shall show that the distribution function  $F(x)$  of  $x$  is a ramp as in Fig. 4-4. If  $x > 1$ , then  $X(t) \leq x$  for every outcome of. Hence,

$$F(x) = P\{X \leq x\} = P\{0 \leq t \leq 1\} = P(S) = 1$$

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If  $0 \leq x \leq 1$ , then  $X(t) \leq x$  for every  $t$  in the interval  $(0, x)$ . Hence,  

$$F(x) = P\{X \leq x\} = P\{0 \leq t \leq x\} = x \quad 0 \leq x \leq 1$$

If  $x < 0$ , then  $\{X \leq x\}$  is the impossible event for  $x(t) \geq 0$ . Hence,  

$$F(x) = P\{X \leq x\} = 0 \quad x < 0$$