

CIVIL SERVICES (MAIN) EXAMINATION-2025

Management Paper 11

A train is scheduled to arrive at a station at a random time between 09:00 AM and 09:30 AM. The actual arrival time is equally likely to be any moment within this interval.

Define a suitable probability density function (PDF). (ii) What is the probability that the train will arrive before 09:13 AM? (iii) Find the expected arrival time and the variance of the arrival time. (iv) Given that the train has not arrived by 09:11 AM, what is the expected arrival time?

Ans: Probability density function gives an idea about the likelihood of probability for continuous data over a given range of area under the curve. Probability density function is obtained by differentiating Cumulative distribution function & cumulative distribution function is obtained by integrating probability density function.

The function of valid probability function $f(x) \geq 0$

Total area under curve $\int f(x) dx = 1$

The function $f(x)$ should be continuous.

(ii) Since the train arrives between 9:00 AM & 9:30 AM. The continuous period is of 30 minutes

Probability of train arriving before 9:13 AM = $13/30 = 0.43$

(iii) Expected Arrival Time = $\text{mean} = 0 + 30/2 = 15$

Expected arrival time = 9:15 AM

Variance of continuous uniform distribution

$$= (b-a)^2 / 12$$

$$= (30-0)^2 / 12$$

$$= 900 / 12 = 75 \text{ minutes}^2$$

$$\sqrt{75} = 8.66 \text{ minutes}$$

(iv) $11 + 30/2 = 20.5$ minutes