

CBCS Course

School of Studies in Statistics,
Vikram University Ujjain

M.A./M.Sc. III sem Statistics

Paper III: Statistical Quality Control & Reliability Theory

Topic: Distribution of between failure times
(with replacement, complete samples)

Suppose n items are under test with replacement and failure time distribution is exponential with mean life θ .

Let $X_{(1)} < X_{(2)} \dots < X_{(n)}$ be the ordered failure times of n items under test and let the failure time be exponentially distributed with mean life θ . The test starts at $X_{(1)} = 0$. A failed item is immediately replaced by a new one.

Let $w_1 = X_{(1)}$, $w_2 = X_{(2)} - X_{(1)}$, $w_3 = X_{(3)} - X_{(2)}$,
 $w_n = X_{(n)} - X_{(n-1)}$
be the between failure times.

Now, $w_1 \sim X_{(1)}$ is distributed as first order statistic $X_{(1)}$ in a sample of size n from exponential population.

Hence the pdf of w_1 is

$$g(w_1; \theta) = \frac{n}{\theta} e^{-nw_1/\theta}; 0 < w_1 < \infty$$

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Since failed item is immediately replaced, every time there are n items operative and by memory less property (3) above, of exponential distribution $\lambda_1, \lambda_2, \lambda_3, \dots, \lambda_n$ are identically & independently distributed G.W.

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