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Objective:

Demonstrate the Renewal Process. WAP to find the expected waiting time until the nth renewal in case of a renewal process with renewal cycle length distributed

1. normally with mean μ and standard deviation σ, (μ > 3σ)
2. exponentially with parameter λ.

Demonstrate it by taking suitable values for (a) and (b) both.

Theory:

A Renewal Process is a general case of Poisson Process in which the inter arrival time of the process or the time between failures does not necessarily follow the exponential distribution. A counting process N(t) that represents the total number of occurrences of an event in the time interval (0,t) is called a renewal process. If the time between failures are independent and identically distributed random variables.

The probability that there are exactly n failures occurring by time t can be written as,

> P{N(t) = n} = P{N(t) ≥ n} – P{N(t) >n}

And,

> Tk = Wk + Wk-1

Code & Output:

1. Normally with mean μ and standard deviation σ, (μ > 3σ)

```
n = int(input('Enter value of n: '))
mu = int(input('Enter value of μ: '))
sigma = input('Enter value of σ: ')
ans = n*mu
print('Expected waiting time until the', n, 'th renewal = ', ans)
```

```
Enter value of n: 87
Enter value of μ: 3
Enter value of σ: 0.6
Expected waiting time until the 87 th renewal =  261
```

2. Exponentially with parameter λ

```
n = int(input('Enter value of n: '))
l = float(input('Enter value of λ: '))
ans = n/l
print('Expected waiting time until the', n, 'th renewal = ', ans)
```

```
Enter value of n: 122
Enter value of λ: 0.245
Expected waiting time until the 122 th renewal =  497.9591836734694
```

Result:

Demonstrated the Renewal Process and calculated the expected waiting time until the nth renewal.

Discussion:

Calculation of the expected waiting time until the nth renewal in case of a renewal process with renewal cycle length distributed normally with mean μ and standard deviation σ and exponentially with parameter λ are being calculated through above formula.