1. **Exponential Distribution**

Problem:

A support desk gets calls every 10 minutes on average. What is the probability the next call arrives in more than 15 minutes?

Solution:

Formula: P (T>t) = e−λt

λ = average rate of calls per minute

t = time in minutes in testing (15 minutes)

e = euler’s number (2.71828)

λ = 1 call / 10 minutes = 0.1 calls per minute

= P (T>15) = e−0.1x15

= P (T>15) = e−1.5

= P (T>15) = 2.71828-1.5

= **0.2231 or 22.31%**

1. **Normal Distribution**

Problem:

Test scores are normally distributed with a mean (μ) = 75 and standard deviation (σ) = 10. What is the probability a student scores above 85?

Solution:

Formula: Z= X−μ​ / σ

μ​ = 75 (mean)

σ = 10 (standard deviation)

x = 85 (probability)

Z= X−μ​ / σ = 85 – 75 / 10

= 10 / 10

= 1

From Z-table look for the corresponding value of 1

P = 1 – 0.84134

**= 0.1587 or 15.87%**

1. **Poisson Distribution**

Problem:

A site gets 3 requests per minute. What’s the probability it gets exactly 5 requests in one minute?

Solution:

Formula: P(X=k) = λk ⋅ e−λ​ / k!

λ = 3 (requests per minute)

k = 5 (probability)

P (5) = 35 x 2.71828-3 / 5!

P (5) = 243 x 0.0498 / 120

P (5) = 12.10 / 120

**P (5) = 0.1008 or 10.08%**

1. **Binomial Distribution**

Problem:

A player makes a shot with 70% accuracy. What’s the probability she makes exactly 3 shots out of 5?

Solution:

Formula: P(X=k) = C(n,k) ⋅ pk ⋅ (1−p)n−k

n = 5 (total shots)

k = 3 (success shots)

p = 0.7 or 70% (probability)

1 – p = probability of missing shots

I use combination formula before I integrate it directly with the binomial formula

C(5,3)= 5! / 3!(5−3)! ​

= 5!⋅4!⋅3!​ / 3!⋅2!

= 20/2 ​=10

P = 10 x 0.73 x (1-0.7)5-3

P = 10 x 0.343 x 0.32

P = 10 x 0.343 x 0.09

**P = 0.3087 or 30.87%**

1. **Triangular Distribution**

Problem:

Estimated task time:

Minimum: 2 hours

Most likely: 4 hours

Maximum: 6 hours

What’s the expected time?

Solution:

Formula: Expected Time= a+b+c / 3​

a = 2 hours, b = 4 hours, c = 6 hours

Expected Time = 2 + 4 + 6 / 3

Expected Time = 12 / 3

**Expected Time = 4**

1. **Lognormal Distribution**

Problem:

Log(salary) is normally distributed:

Mean = 10

Std dev = 0.5

What is the median salary?

Solution:

Formula: Median=eμ

Medial = 2.7182810

**Median = 22,026**

1. **Gamma Distribution**

**Problem:**

Earthquakes happen at 2 per year.

What is the probability the 3rd earthquake happens after 2 years?

Solution:

Formula: P(X>2) = 1 − P(X≤2)

Shape (α or k) = 3 (because we are waiting for the 3rd event),

Rate (λ) = 2 per year,

The scale is 0.5.

I use WolframAlpha - CDF[GammaDistribution[3, 0.5], 2]

P(X≤2) = 0.7619

P(X>2) = 1 − 0.7619

**= 0.2381 or 23.81%**

1. **Beta Distribution**

Problem:

Out of 5 testers, 3 liked a new drink. Use a Beta (4, 3) distribution. What’s the expected success rate?

Solution:

Formula: Expected rate= α / α+β

α = 4, β = 3

= 4 / 4 + 3

= 4 / 7

**= 0.5714 or 57.14%**

1. **Weibull Distribution**

Problem:

A lightbulb has a Shape = 2, Scale = 1000

What is the chance it lasts more than 1200 hours?

Solution:

Formula: P(T>t) =e−(t/λ)k

t = 1200

λ = 1000

k = 2

P(T>t) =2.71828−(1200/1000)2

P(T>t) =2.71828−(1.2)2

P(T>t) =2.71828−(1.44)

**P(T>t) = 0.2369 or 23.69%**

1. **Uniform Distribution**

Problem: Pick a number randomly between 10 and 20. What’s the probability it’s less than 13?

Solution:

Formula: P(a<X<b)= b−a​ / total range

Total Range = 10 to 20 = 10

a = 13, b = 10

P = 13 – 10 / 10

P = 3 / 10

**P = 0.3 or 30%**