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BSCS601

**1.Exponential Distribution**

Formula:P(T > t) = e^(-λt)

Example: A machine breaks down every 8 hours on average. What is the probability it lasts more than 5 hours before the next breakdown?

Solution:

λ = 1/8 = 0.125

t = 5

P(T > 5) = e^(-0.125 × 5) = e^(-0.625)

= 0.5353 or 53.53%

**2.Normal Distribution**

Formula: Z = X - μ / σ

Example: The average height of adult men is 70 inches with a standard deviation of 3 inches. What is the probability that a randomly selected man is taller than 73 inches?

Solution:

μ = 70, σ = 3, x = 73

Z = (73 - 70) / 3 = 1

P = 1 - 0.84134 = 0.1587 or 15.87%

**3.Poisson Distribution**

Formula: P(X = k) = (λ^k × e^−λ) / k!

Example: A call center receives 4 calls per minute. What is the probability it receives exactly 2 calls in one minute?

Solution:

λ = 4, k = 2

P(2) = (4² × e^−4) / 2! = (16 × 0.0183) / 2

= 0.1464 or 14.64%

**4.Binomial Distribution**

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

Example: A student answers multiple-choice questions with a 60% success rate. What is the probability they answer 4 out of 6 questions correctly?

Solution:

n = 6, k = 4, p = 0.6

C(6,4) = 15

P = 15 × (0.6)^4 × (0.4)^2 = 15 × 0.1296 × 0.16

= 0.3110 or 31.10%

**5.Triangular Distribution**

Formula: E[X] = (a + b + c) / 3

Example: A delivery task has estimated times: min = 3 hours, most likely = 5 hours, max = 9 hours. What is the expected time?

Solution:

a=3, b=5, c=9

(3 + 5 + 9) / 3 = 17 / 3

= 5.67 hours

**6.Lognormal Distribution**

Formula: Median=eμ

Example: If the log of an investment value is normally distributed with a mean of 9 and a standard deviation of 0.4, what is the median value?

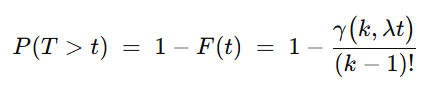
Solution:

Median= eμ =e10

e = 2.71828:

Median = 2.7182810 = 22026.47

**7.Gamma Distribution**

Formula:

Example: Floods happen at a rate of 1 per year. What’s the probability the 3rd flood occurs after 4 years?

Solution: α = 3, λ = 1 → scale = 1

P(X > 4) = 1 - CDF[Gamma(3,1), 4]

Using WolframAlpha: CDF = 0.7619

P = 1 - 0.7619 = 0.2381 or 23.81%

**8.Beta Distribution**

Formula: E[X] = a / a+b

Example: Out of 10 users, 7 liked a feature. Use a Beta(7, 4) distribution. What’s the expected success rate?

Solution:

a=7, b=4

Expected = 7 / (7 + 4) = 7 / 11

= 0.6364 or 63.64%

**9.Weibull Distribution**

Formula: P(T>t) =e −(t/λ)k

Example: A device has a shape = 1.5 and scale = 500. What’s the probability it lasts more than 600 hours?

Solution:

t = 600, λ = 500, k = 1.5

P(T > t) = e^−(600/500)^1.5 = e^−(1.2)^1.5 = e^−1.3145

= 0.2686 or 26.86%

**10.Uniform Distribution**

Formula: P(a<X<x)= (x-a) / (b-a)

Example: Pick a number randomly between 5 and 15. What’s the probability it’s less than 9?

Solution:

x=9, a=5, b=15

P (5<X<9) = 9-5 / 15 - 5

P(5<X<9) = 4/10 = 0.4

P(X<9) = 0.4 or 40%