Statistics

Spring 2023

Lecture 30

Feb 19-8:47 AM

Suppose You are taking an exam with 150 questions. Each question has 6 choices, and only one Correct choice per question.

Assume You are making random guesses and Sucess is to guess a Correct ans.

1) $n = \boxed{150}$ 2) $p = \boxed{\frac{1}{6}}$ 3) $q = 1 - p = \boxed{\frac{5}{6}}$

4) $\mu = np = 150\left(\frac{1}{6}\right) = \boxed{25}$

5) $\sigma^2 = npq = 150\left(\frac{1}{6}\right)\left(\frac{5}{6}\right) = \boxed{20.8\overline{3}} = \boxed{\frac{125}{6}}$

6) $\sigma = \sqrt{\sigma^2} = \sqrt{\frac{125}{6}} = \boxed{4.564}$

Round μ & σ to a whole #, then find

$\mu \to 25$, $\sigma \to 5$

7) 68% Range

$\mu \pm \sigma = 25 \pm 5 \Rightarrow \boxed{20 \text{ to } 30}$

8) Usual Range

95% Range

$\mu \pm 2\sigma = 25 \pm 2(5)$

$= 25 \pm 10$

$\Rightarrow \boxed{15 \text{ to } 35}$

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Find the prob. that we guess

9) exactly 30 correct answers.

$P(x=30) = \text{binompdf}(150, 1/6, 30) = \boxed{.046}$

10) fewer than 30 correct answers.

$P(x < 30) = P(x \le 29) = \text{binomcdf}(150, 1/6, 29) = \boxed{.838}$

29 30

11) more than 30 correct answers.

$P(x > 30) = P(x \ge 31) = 1 - P(x \le 30) = 1 - \text{binomcdf}(150, 1/6, 30)$

30 31

$= \boxed{.116}$

12) between 15 and 35 correct answers, inclusive.

$P(15 \le x \le 35) = \text{binomcdf}(150, 1/6, 35) - \text{binomcdf}(150, 1/6, 14) = \boxed{.979}$

Reduce by 1

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Geometric Prob. dist. SG 17

It is similar to binomial prob. dist. but

1) there is no n.

2) x is the number where first success happens.

3) $p \to$ Prob. of success, $q \to$ Prob. of failure

$p + q = 1$

$q = 1 - p$

$P(x) = p \cdot q^{x-1} \qquad x = 1, 2, 3, 4, \ldots$

Suppose we have a geometric Prob. dist with $p = .4$

$q = 1 - p = .6$

P(Success happens on 3rd trial)

$= P(x=3) = (.4)(.6)^{3-1} = .4(.6)^2 = \boxed{.144}$

using TI

2nd VARS

geometpdf(.4,3)

$p = .4$

$x = 3$

Paste

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Suppose you have .3 prob. to make a basket per shot in a basketball game.

$p = .3$ $\qquad q = 1 - p = .7$

P(make first basket on the 4th shot)

$= P(x = 4) = \text{geomet pdf}(.3, 4) = \boxed{.103}$

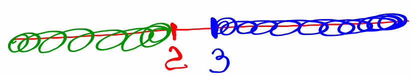
P(first made basket happens by the 4th shot)

$= P(x \leq 4) = \text{geomet cdf}(.3, 4) = \boxed{.760}$

P(first made basket happens after the 2nd shot)

$= P(x > 2) = P(x \geq 3) = 1 - P(x \leq 2) = 1 - \text{geometcdf}(.3, 2)$

$= \boxed{.49}$



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Mean $\mu = \dfrac{1}{p}$

Variance $\sigma^2 = \dfrac{q}{p^2}$

Standard deviation $\sigma = \sqrt{\sigma^2}$

Geometric Prob. Dist.

Consider a geometric Prob. dist. with $p = .2$

$\mu = \dfrac{1}{p} = \dfrac{1}{.2} = \boxed{5}$ $\qquad q = 1 - p = \boxed{.8}$

$\sigma^2 = \dfrac{q}{p^2} = \dfrac{.8}{.2^2} = \boxed{20}$ $\qquad \sigma = \sqrt{\sigma^2} = \sqrt{20} \approx 4.5$

$P(x = 2) = \text{geomet pdf}(.2, 2) = \boxed{.16}$

$P(x = 3$ or $x = 5) = \text{geomet pdf}(.2, 3) + \text{geomet pdf}(.2, 5)$

$= \boxed{.210}$

$P(x \leq 3) = \text{geomet cdf}(.2, 3) = \boxed{.488}$

$P(x \geq 3) = 1 - \text{geomet cdf}(.2, 2) = \boxed{.64}$

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Poisson Prob. Dist.

1) x is # of Successes in a fixed interval

2) $x = 0, 1, 2, 3, \ldots$

3) μ is the average # of Successes in that fixed interval.

$$P(x) = \frac{\mu^x}{x!} e^{-\mu}, \quad e \approx 2.718$$

Consider a poisson prob. dist. with $\mu = 4$ in a fixed interval.

$$P(x=3) = \frac{4^3}{3!} \cdot e^{-4} = \frac{64}{6} \cdot (2.718)^{-4} \approx \boxed{.196}$$

Now using TI

$\boxed{2nd}$ $\boxed{VARS}$ Poisson Pdf$(4, 3) = \boxed{.195}$

Lambda $\rightarrow \lambda = \mu = 4$

$x = 3$

$\boxed{Paste}$

Apr 10-8:04 AM

Suppose You work at a fast food and You get 25 orders in average per shift for Pickup.

Fixed interval $\rightarrow$ Per shift

Average in the fixed interval $\rightarrow \mu = 25$

P(You get 30 Orders) $= P(x = 30)$

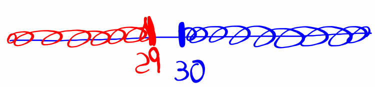
$= \text{Poissonpdf}(25, 30)$

$= \boxed{.045}$

P(You get at most 30 orders)

$P(x \le 30) = \text{Poissoncdf}(25, 30) = \boxed{.863}$

P(You get at least 30 orders)



$= P(x \ge 30) = 1 - P(x \le 29) = 1 - \text{Poissoncdf}(25, 29) = \boxed{.182}$

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Mean μ is given

Variance $\sigma^2 = \mu$

Standard deviation $\sigma = \sqrt{\sigma^2}$

Poisson Prob. dist.

Suppose in average, I have 16 students absent in all my classes per week.

Per week $\rightarrow$ fixed interval

SG 17

$\mu = 16$

$\sigma^2 = \mu = \boxed{16}$ $\quad \sigma = \sqrt{\sigma^2} = \sqrt{16} = \boxed{4}$

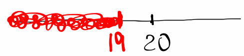
Usual Range $\Rightarrow \mu \pm 2\sigma = 16 \pm 2(4) \Rightarrow \boxed{8 \text{ to } 24}$

P(exactly 20 absences) $= P(x = 20)$

$= \text{Poisson Pdf}(16, 20) = \boxed{.056}$

P(fewer than 20 absences) $= P(x < 20) = P(x \le 19)$

$= \text{Poissoncdf}(16, 19) = \boxed{.812}$



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