ISE 2211 • Exam II • 17 September 2021 NAME SOLUTION

1. Historical data suggests that the probability that Joe Tritschler will put any type of Poisson-process problem on a stats exam is 37.6%. (Contributing factors to this probability will not be discussed at this time.) Let the binomially-distributed random variable *X* represent the number of Poisson-process exam problems. What is the probability that you will NEVER have to take an exam with a Poisson-process problem if you end up having to take this course a total of six times? How about the probability that you will have at least *two* exams with Poisson problems?

$$f(0) = \cancel{\binom{6}{0}}^{=1} \cancel{0.376^0}^{=1} (1-0.376)^{6-0}$$ +3

$$= 0.624^6 = 0.05903 \text{ or } 5.9\%$$

multiplication rule!

$$f(x \geq 2) = 1 - f(x<2) = 1 - [f(0) + f(1)]$$ +2

$$f(1) = \binom{6}{1} \cdot 0.376^1 (1-0.376)^{6-1} = 0.2134$$ +2

$$\frac{6!}{1!(6-1)!} = 6$$ +1

$$\therefore f(x \geq 2) = 1 - (0.05903 + 0.2134)$$

$$= 0.7275 \text{ or } 72.75\%$$ +1

Compute the expected value and variance of the number of Poisson-process exam problems you will get if you take the course six times. Include units with both answers.

+2

$$\mu = np = 6 \cdot 0.376 = 2.256 \text{ Poisson-problem exams}$$

$$\sigma^2 = np(1-p) = 6 \cdot 0.376 (1-0.376)$$

$$= 1.408 \text{ (Poisson-problem exams)}^2$$

+2

Formulae:

$f(x) = \binom{n}{x} p^x (1-p)^{n-x}$

$\mu = np$

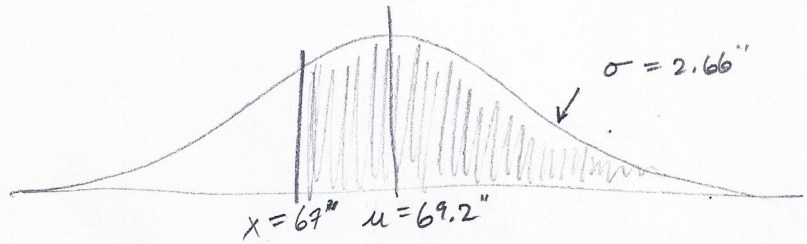
$\sigma^2 = np(1-p)$

$\binom{n}{r} = \frac{n!}{r!\,(n-r)!}$

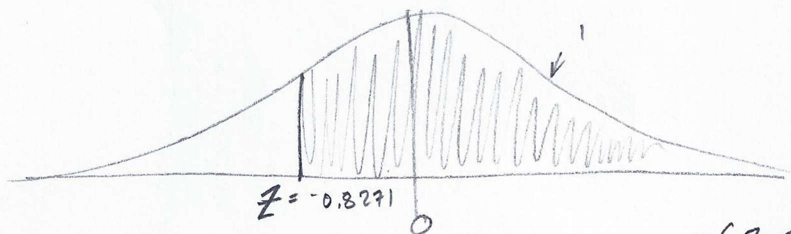
2. The average adult male in the United States has a height of 69.2" with a standard deviation of 2.66". Joe Tritschler is 67" tall. Determine the probability that any random adult male in the United States will be taller than Joe Tritschler. Clearly indicate this probability on sketches of both the normal and standard-normal distributions.

$$Z = \frac{X - \mu}{\sigma}$$

$$Z = \frac{67 - 69.2}{2.66} = -0.8271$$ +1



+4



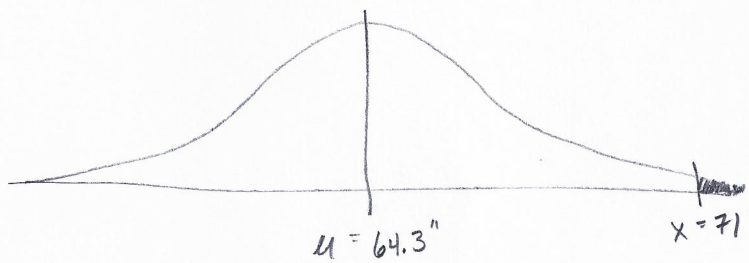
$P(Z < -.83)$ from table +1

$$P(Z > -0.8271) = 1 - P(Z < -0.8271) = 1 - .203269 = 0.7967$$ +1

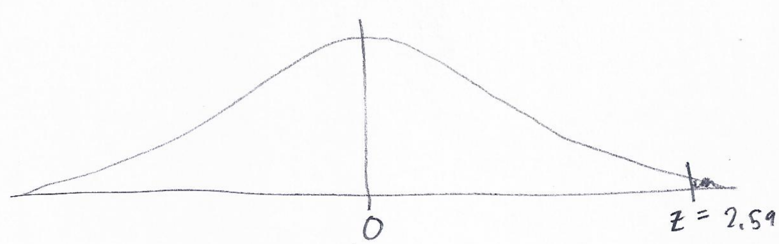
or ~80% +1

On the other hand, the average adult female in the USA has a height of 64.3" with a standard deviation of 2.58". A certain person with whom Joe Tritschler happens to cohabitate is 71" tall. Compute the probability that a randomly-selected adult female in the USA will be taller than this person. Indicate the probability on sketches of the normal and standard-normal distributions.

$$Z = \frac{71 - 64.3}{2.58} = 2.597 \quad (!)$$ +1



+4



$P(Z < 2.60)$ from table +1

$$P(Z > 2.597) = 1 - P(Z < 2.597) = 1 - 0.995339 = 0.004661$$ +1

or 0.4661 % +1