Stat 50 - Elementary Statistics — Winter 2020

Quiz 5: 4.3, 5.1, 5.2 — Dr. Jorge Basilio

NAME (PRINT): SOLUTIONS

SCORE: 26/26

SIGNATURE: ____________________

Directions

- YOU ARE ALLOWED TO USE A CALCULATOR ON THIS EXAM. (Ti83/Ti83+/Ti84/Ti84+/Ti84+CE-T, or scientific calculator)
- Handwriting should be neat and legible. If I cannot read your writing, zero points will be given.
- Make sure to ALWAYS SHOW YOUR WORK; you will not receive any partial credits unless work is clearly shown. *If in doubt, ask for clarification.*
- Leave answers in exact form (as simplified as possible), unless told otherwise.
- Put a $\boxed{\text{box around your final answer}}$ where applicable.

Quiz (~~X~~ 26 points)

Problem 1: 12 pts

(a) (2 pts) What are the two requirements for a **probability distribution**?

① $\sum P(x) = 1$ ② $0 \le P(x) \le 1$ for each x

(b) A couple plans to have three children. Let X be the random variable corresponding to the number of girls the couple will have.

(i) (2 pt) Using set notation, write the **sample space** of the "experiment" of having 3 kids. *(Hint: use the G or B notation. So one outcome is GBG, for example)*

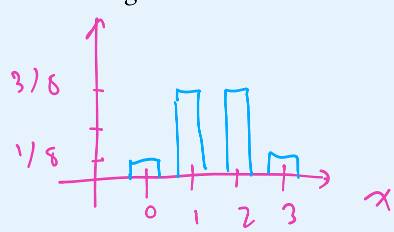
$S = \{\underbrace{GGG}_{x=3}, \underbrace{GGB, GBG, BGG}_{x=2}, \underbrace{GBB, BBG, BGB}_{x=1}, \underbrace{BBB}_{x=0}\}$ $(2^3 = 8)$

(ii) (1 pt) Give all the **values** x can take.

$x = 0, 1, 2, 3$ X = # girls in 3 kids

(iii) (3 pts) Find the **probability distribution** of X given as a table of values.

x	P(x)
0	1/8
1	3/8
2	3/8
3	1/8



(iv) (2 pts) Find the **mean** number of girls the couple can have.

$$\mu = \sum x \cdot P(x) = 0 \cdot \frac{1}{8} + 1 \cdot \frac{3}{8} + 2 \cdot \frac{3}{8} + 3 \cdot \frac{1}{8} = \frac{12}{8} = 1.5$$

$\boxed{\mu = 1.5 \text{ Girls}}$

(v) (2 pts) How many girls can the couple **expect** to have?

↳ mean = expectation

"We expect 1.5 Girls out of 3 kids"

$\left(P(x) = nC_x \cdot p^x \cdot q^{n-x} \right)$

Problem 2: ~~10~~ 14 pts

(a) (1 pt) State the four requirements for a → Two **binomial probability distribution**.

① fixed # of trials (n) ② trials are independent ③ Each outcome has 2 categories (S or F) ④ Prob of "success" is constant (p)

(b) (1 pt) Give the **calculator syntax** that computes the binomial probability distribution: $P(x) =$ binompdf(n, p, x)

P(x) = prob. that exactly x successes out of n.

(c) We survey 5 PCC students and ask "Do you want to transfer to a four-year college?" Assume that 85% of PCC students want to transfer to a four-year college.

this is a binomial

X = out of 5 PCC students how many want transfer.

(i) (2 pts) What is the **probability** that all 5 students want to transfer?

$P(5) = \text{binompdf}(\overset{n}{5}, \overset{p}{0.85}, \overset{x}{5}) = \boxed{0.444}$

$n = 5,\ p = 0.85,\ x = 5$

$x = 0, 1, 2, 3, 4, \boxed{5}$

(ii) (2 pts) What is the **probability** that 3 or 4 students want to transfer?

$x = 0, 1, 2, \boxed{3, 4}, 5$

$P(3 \text{ or } 4) = P(3) + P(4)$

$= \text{binompdf}(5, 0.85, 3) + \text{binompdf}(5, 0.85, 4) = \boxed{0.530}$

(iii) (2 pts) What is the **probability** that at least one student wants to transfer?

$P(x \geq 1) = 1 - P(0)$

$= 1 - \text{binompdf}(5, 0.85, 0)$

$= 0.9999\ldots = \boxed{1.00}$

$x = 0\ \boxed{1\ 2\ 3\ 4\ 5}$

(iv) (2 pts) What is the **probability** that no more than 3 student want to transfer?

$x = \boxed{0\ 1\ 2\ 3}\ 4\ 5$

Use binomcdf

$P(x \leq 3) = \text{binomcdf}(\overset{n}{5}, \overset{p}{0.85}, \overset{x}{3})$

$= \boxed{0.165}$

(d) According to the U.S. Office of Adolescent Health, nearly $\overset{p}{\text{90\%}}$ of adult smokers in America started smoking before turning 18 years old.

binomial prob dist

(i) (2 pts) If $\overset{n}{\text{1000}}$ adult smokers are randomly selected, how many would we **expect** to have started smoking before turning 18 years old? $(M \to E)$

↳ μ

$\mu = n \cdot p = 1000 \cdot 0.9 = \boxed{900 \text{ people started smoking before 18yo}}$

$n = 1000 \quad p = 0.9$

(ii) (2 pts) Would it be **unusual** (significantly low or high) to observe 800 smokers who started smoking before turning 18 years old in a sample of 1000 adult smokers?

unusual → Prob ≤ 0.05

→ $x \leq \bar{x} - 2\sigma$ (sig low)

$x \geq \bar{x} + 2\sigma$ (sig high)

- $x = 900 + 2(9.5) = 919$
- $x = 900 - 2(9.5) = 881.$
- $x = 800 < 881.$

"yes, it would be unusual for 800 smokers to start b4 18yo."

$\sigma = \sqrt{n \cdot p \cdot q}$ $(q = 1 - p)$ $\sigma = \sqrt{1000 * 0.9 * 0.1} = 9.5$