

Due Wednesday, June 29, 2022 (11:59 pm)

Directions: This homework set should be turned in individually. Each problem may be presented in typed or hand-written form. Clearly show all steps and box any specific answers (do not box graphs) to receive full credit. You may use Excel or other software to assist with creating plots or solving formulas. If you use software to solve formulas, you must include the actual formula and indicate which numbers were used to find your final answer.

*Tried to note times when rounding might cause a difference in answers

Assigned problems

Problem 1: In testing a certain kind of truck tire over rugged terrain, it is found that 25% of the trucks fail to complete the test run without a blowout. Of the next 15 trucks tested, find the probability that

- (a) from 3 to 6 have blowouts; **0.707**
- (b) fewer than 4 have blowouts; **0.459**
- (c) more than 5 have blowouts. **0.151 or 0.148 using the table**

$X \sim \text{Bernoulli}(n, p)$ where n is 15 and p is 0.25, use pmf to solve

$P(3 \leq x \leq 6) =$

$$\frac{15!}{3!15-3!} (0.25)^3 (0.75)^{15-3} + \frac{15!}{4!15-4!} (0.25)^4 (0.75)^{15-4} + \frac{15!}{5!15-5!} (0.25)^5 (0.75)^{15-5} + \frac{15!}{6!15-6!} (0.25)^6 (0.75)^{15-6} = 0.225 + 0.225 + 0.165 + 0.092 \approx 0.707$$

$P(x < 4) =$

$$\frac{15!}{3!15-3!} (0.25)^3 (0.75)^{15-3} + \frac{15!}{2!15-2!} (0.25)^2 (0.75)^{15-2} + \frac{15!}{1!15-1!} (0.25)^1 (0.75)^{15-1} + \frac{15!}{0!15-0!} (0.25)^0 (0.75)^{15-0} = 0.225 + 0.155 + 0.066 + 0.013 \approx 0.459$$

$P(x > 5)$ or $1 - P(x \leq 5)$, since we've already calculated those values

$$1 - (0.165 + 0.225 + 0.225 + 0.155 + 0.066 + 0.013) = 0.151$$

Using the table, you get 0.148 which is due to me rounding

Problem 2: A government task force suspects that some manufacturing companies are in violation of federal pollution regulations with regard to dumping a certain type of product. Twenty firms are under suspicion but not all can be inspected. Suppose that 3 of the firms are in violation.

- (a) What is the probability that inspection of 5 firms will find no violations?
 - a. **0.39912**
- (b) What is the probability that the plan above will find two violations?
 - a. **0.13157**

$N = 20$

3 in violation

- a) This is a hypergeometric distribution
 - a. $X \sim H(20, 3, 5) = (\text{Combination}(3,0) * \text{combination}(20-3, (5-0)))/C(20,5) = 1*6188/15504 = 0.39912$
- b) Same equation as used in part a but x is now 2 instead of 0
 - a. $X \sim H(20, 3, 5) = (\text{Combination}(3,2) * \text{combination}(20-3, (5-2)))/C(20,5) = 3*680/15504 = 0.13157$

Problem 3: Find the value of z if the area under a standard normal curve

- (a) to the right of z is 0.3622
 - a. **0.35**
 - (b) to the left of z is 0.1131
 - a. **-1.2**
 - (c) between 0 and z , with $z > 0$, is 0.4838
 - a. **2.14**
 - (d) between $-z$ and z , with $z > 0$, is 0.9500
 - a. **1.96**
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- a) $1 - \text{the value} = 0.6378$ which matches best with 0.35
 - b) Look at table
 - c) z value $- 0.5 = 0.9838$. $z = 2.14$
 - d) $P(Z > z) = 1 - 0.95/2 = 0.0250$
 - a. So $P(Z < z) = 0.95 + 0.025 = 0.975$ which give $z = 1.96$

Problem 4: A research scientist reports that mice will live an average of 40 months when their diets are sharply restricted and then enriched with vitamins and proteins.

Assuming that the lifetimes of such mice are normally distributed with a standard deviation of 6.3 months, find the probability that a given mouse will live

- (a) more than 32 months;
 - a. **0.989 or 0.898 depending which way you round**
- (b) less than 28 months;
 - a. **0.0287**
- (c) between 37 and 49 months.
 - a. **0.6066**
 - i. Approximate: changes slightly depending on rounding

(Normal distribution 4.5, ex 4.45)

Time is months

Mean is 40

Std. De is 6.3

- a) $32 - 40 / 6.3 = -1.269$ then look at z table and do $1 - \text{table value}$ since more than

- a. Rounded up to -1.27 would be 0.898 instead of 0.989
- b) $28-40/6.3 = -1.90$ then look at z table
- c) 37: $37-40/6.3 = -0.476$ and 49: $49-40/6.3 = 1.428$. Which gives z values of .3156 (used -0.48) and .9222 (used 1.42). Subtract them.
 - a. If 49 months had been rounded up to 1.43 its z value would've been 0.9236 for the z value which would given an answer of 0.608