

Name _____

Ken

**MATH 119 EXAM 2
Fall 2018
Form A**

Show all work on this exam form. Free response questions REQUIRE that you show supporting work to get full credit.

Please round your answers to four digits after the decimal when possible. Make sure to BOX your final answers.

All questions are worth 5 points unless noted otherwise.

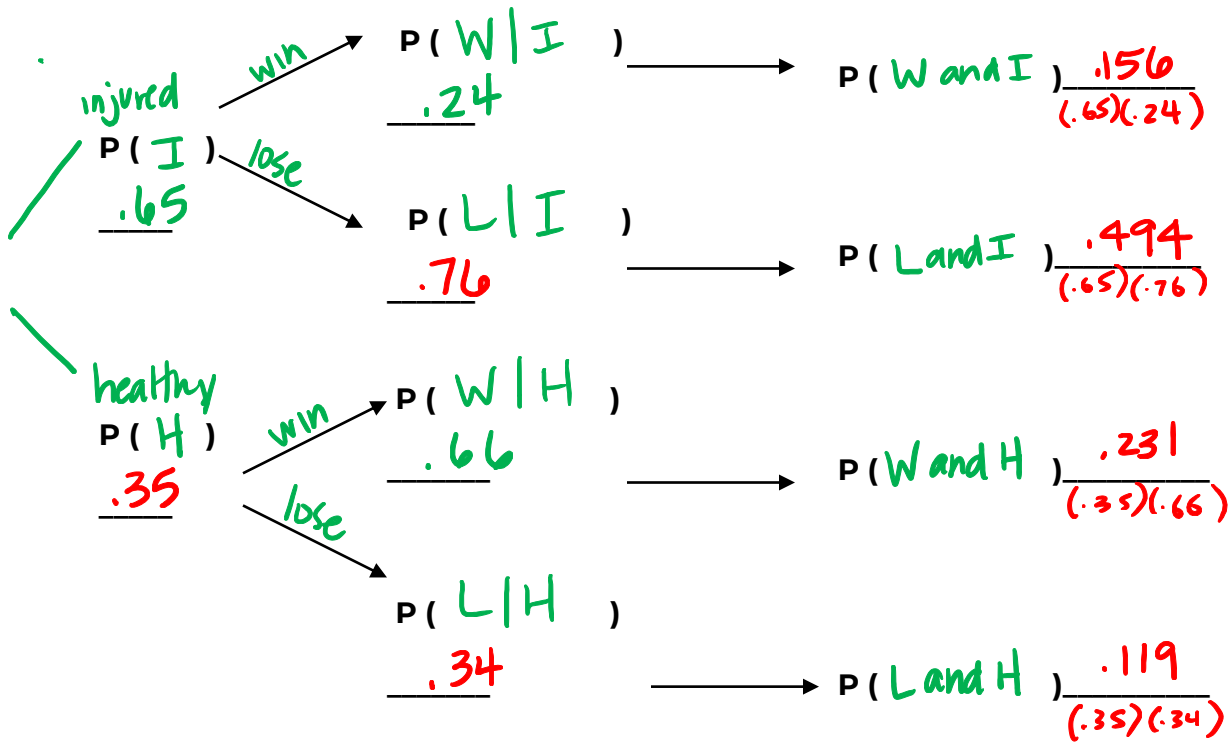
A

Use the following information for questions 1-3 (16 total points)

Suppose that Mission Bay High School's football team has a star quarterback named Joe Armstrong. Unfortunately, Joe is injury prone and is injured for 65% of the games. The team is much better with Joe and if he is healthy, they win 66% of their games. However, if he is injured (not healthy), they only win 24% of their games. Let I be the event that Joe is injured and let W be the event that the team wins their game.

$$P(I) = .65 \quad P(W|H) = .66 \quad P(W|I) = .24$$

1. Complete a diagram using the correct probability notation and values:



2. What is the probability that the team wins a game?

$$P(W) = .387$$

3. Given that the team won, what is the probability that Joe was healthy?

$$P(H|W) = \frac{P(H \text{ and } W)}{P(W)} = \frac{.231}{.387} = .5969$$

	W	L	
I	.156	.494	.65
H	.231	.119	.35
	.387	.613	1

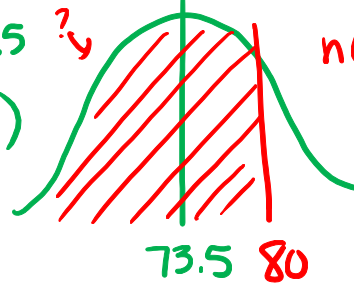
A

- $n=150$ $p=.49$
4. In the last election, only 49% of millennials voted. Suppose that we randomly sample 150 millennials and ask them if they voted in the last election (and that they answer truthfully).

Using the Normal Approximation to the Binomial, determine the probability that less than 80 of the sampled millennials will have voted in the last election.

$$\mu_x = np = 150(.49) = 73.5$$

$$\sigma_x = \sqrt{npq} = \sqrt{150(.49)(.51)} = 6.1225$$

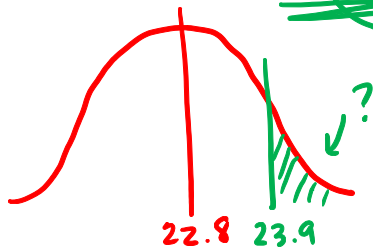


$$\text{normalcdf}(-E99, 80, 73.5, 6.1225) = .8558$$

Use the following information to answer questions 5 through 7

The U.S. Army reports that the distribution of head circumference among male soldiers is approximately normal with a mean of 22.8 inches and a standard deviation of 1.1 inches.

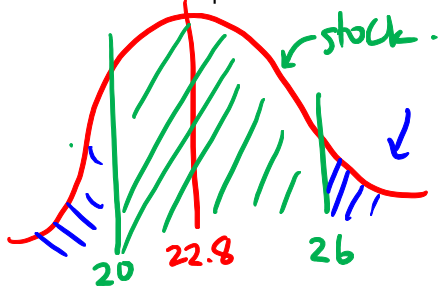
5. What is the probability that a randomly selected male soldier has a head circumference more than 23.9 inches?



$$\text{normalcdf}(23.9, E99, 22.8, 1.1)$$

$$=.1587$$

6. The army's helmet supplier regularly stocks helmets that fit male soldiers with head circumferences between 20 and 26 inches. Anyone with a head circumference outside that interval requires a customized helmet order. What percent of male soldiers require custom helmets?



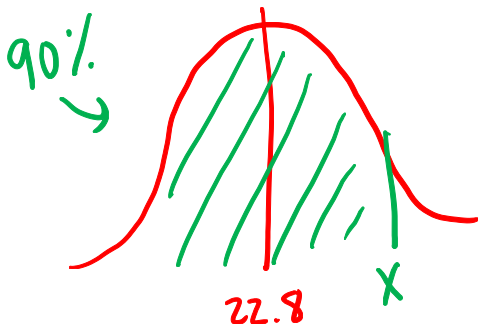
$$\text{custom} = 1 - \text{stock}$$

$$\text{normalcdf}$$

$$= 1 - \text{normalcdf}(20, 26, 22.8, 1.1)$$

$$=.0673 = 6.73\%$$

7. A soldier with a head circumference in the 90th percentile would have a head circumference of what value?



$$X = \text{invNorm}(.9, 22.8, 1.1)$$

$$= 24.2097 \text{ inches}$$

A

Use the following information for the questions 4-7 (20 total points)

Congress is comprised of the House of Representatives and the Senate. As of October 1st, Congress is 21% female (event F) and 59% Republican (event R). Six percent of the members of Congress are female and Republican.

Six → P(F and R)

8. Complete the contingency table for the problem. Fill in all cells with the appropriate probabilities.

	F	M	Total
R	.06	.53	.59
R ^c	.15	.26	.41
Total	.21	.79	1

9. What is the probability that a randomly selected member of Congress is male or ^{F^c} Republican?

$$P(M \text{ or } R) = P(M) + P(R) - P(M \text{ and } R) \\ = .79 + .59 - .53 = \boxed{.85}$$

10. Given a member of Congress is a female, what is the probability she is not a Republican?

$$P(R^c | F) = \frac{P(R^c \text{ and } F)}{P(F)} = \frac{.15}{.21} = \boxed{.7143}$$

11. Are the events R and F independent? Justify your answer using the probabilities above.

$$P(R \text{ and } F) \neq P(R) \cdot P(F)$$

$$.06 \neq (.59)(.21)$$

$$.06 \neq .1239$$

$$\text{No, since } P(R \text{ and } F) \neq P(R) \cdot P(F)$$

Republicans are less likely to be Female (11%) than non-Republicans (37%)!

A

BINOM

$$P = .69 \quad n = 10$$

12. It is known that 69% of eligible Baby Boomers voted in the last election. If we randomly select 10 Baby Boomers, what is the probability that at least 9 of them will have voted in the last election?

0 1 2 3 ... 8 9 10

$$1 - \text{binomcdf}(10, .69, 8)$$

or

$$\text{pdf}(9) + \text{pdf}(10)$$

$$= .1344$$

13. Some descriptive statistics for a set of test scores are shown below. For this test, a certain student has a standardized score of $z = -1.2$. What score did this student receive on the test?

DESCRIPTIVE STATISTICS

below avg

$X = ?$

Variable score	N	Mean	Median	TrMean	StDev	SE Mean
	50	1045.7	1024.7	1041.9	221.9	31.4
Variable score	Minimum	Maximum	Q1	Q3		
	628.9	1577.1	877.7	1219.5		

$$X = Z(\sigma) + \mu$$

$$-1.2(221.9) + 1045.7$$

$$= 779.42$$

- A. 266.28
 B. 779.42
 C. 1008.02
 D. 1083.38
 E. 1311.98

14. The probability that a new microwave oven will stop working in less than 2 years is 0.05. The probability that a new microwave oven is damaged during delivery and stops working in less than 2 years is 0.04. The probability that a new microwave oven is damaged during delivery is 0.10. Given that a new microwave oven is damaged during delivery, what is the probability that it stops working in less than 2 years?

- A. 0.05
 B. 0.06
 C. 0.10
 D. 0.40
 E. 0.50

$$P(SW) = .05$$

$$P(D \text{ and } SW) = .04$$

$$P(D) = 0.1$$

$$P(SW | D) = \frac{P(SW \text{ and } D)}{P(D)} = \frac{.04}{.1} = .4$$

A

15. An experiment has three mutually exclusive outcomes, A, B, and C. If $P(A) = 0.12$, $P(B) = 0.61$, and $P(C) = 0.27$, which of the following must be true?

- I. ~~A and C are independent~~ ← not possible $P(A \text{ and } C) = 0 \neq P(A) \cdot P(C)$
 II. $P(A \text{ and } B) = 0$ ✓
 III. $P(B \text{ or } C) = P(B) + P(C)$ ✓

- ~~A. I only~~
~~B. I and II only~~
~~C. I and III only~~
 D. II and III only ✓
~~E. I, II, and III~~

16. The XYZ Office Supplies Company sells calculators in bulk at wholesale prices. Next year's sales depend on market conditions, but executives use probability to find estimates of sales for the coming year. The following table contains estimates for next year's sales.

WHOLESALE SALES				
Number Sold	2,000	5,000	10,000	20,000
Probability	0.1	0.3	0.4	0.2

- a. How many calculators would XYZ Office Supplies Company expect to sell next year?

$$E(X) = 2000(.1) + 5000(.3) + 10000(.4) + 20000(.2)$$

$$= 9700 \text{ calculators}$$

- b. What profit does XYZ Office Supplies Company expect to make for the next year if the profit from each calculator sold is \$20?

$$9700 \times 20 = \$194,000$$

17. (4 points) Circuit boards are assembled by selecting 4 computer chips at random from a large batch of chips. In this batch of chips, 90 percent of the chips are acceptable. Let X denote the number of acceptable chips out of a sample of 4 chips from this batch. What is the most probable value of X?

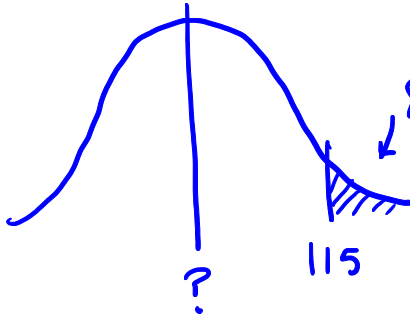
- A. 0 = .0001
 B. 1 = .0036
 C. 2 = .0486
 D. 3 = .2916
 E. 4 = .6561

$$90\% \text{ of } 4 = 3.6$$

$$\text{or } \text{binompdf}(4, .9, _)$$

A

18. (6 points) Scores on an IQ test are normally distributed with a standard deviation of 13. If only 8% of scores are above 115, what is the mean of the distribution?



$$\sigma = 13 \quad P(X > 115) = .08$$

$$\textcircled{1} Z = \text{invNorm}(.92, 0, 1) = 1.405$$

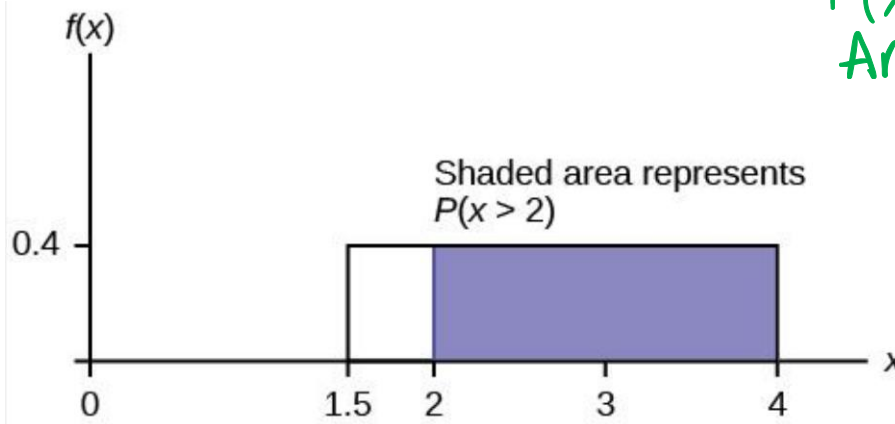
$$\textcircled{2} X = Z(\sigma) + \mu$$

$$115 = 1.405(13) + \mu$$

$$-18.265 \quad -18.265$$

$$\boxed{\mu = 96.735} \quad \text{no units on IQ.}$$

19. (4 points) Find the probability indicated below:



$$\begin{aligned} P(X > 2) &= \\ \text{Area} &= b \cdot h \\ &= 2(0.4) \\ &= \boxed{.8} \end{aligned}$$

20. There are 12 pieces of candy in the pumpkin bucket on the department chair's door. Of those 12 pieces, 3 are Snickers bars and the rest are gross. If I reach in and randomly select 2 pieces of candy to eat, what is the probability that both the pieces I grab are Snickers?

without replacement

$$\frac{\frac{3}{12}}{8} \cdot \frac{\frac{2}{11}}{8} = \boxed{.0455}$$

A

21. An electronic device contains two redundant components, A and B. The probabilities of failure for each component in any one year are 0.01 and 0.04, respectively. If both components fail, the device will fail. If the components fail independently of one another, what is the probability that the device will fail in one year?

$P(A \text{ and } B)$

$$= (.01)(.04) = \boxed{.0004}$$

$$P(A \text{ and } B) = P(A) P(B)$$

22. The distribution of the weights of loaves of bread from a certain bakery follows approximately a normal distribution. Based on a very large sample, it was found that 10 percent of the loaves weighed less than 15.34 ounces, and 20 percent of the loaves weighed more than 16.31 ounces. What are the mean and standard deviation of the distribution of the weights of the loaves of bread?

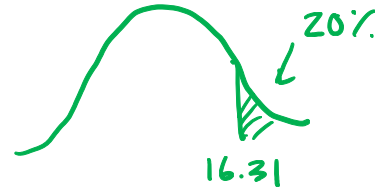
- A. 15.82, 0.48
- B. 15.82, 0.69
- C. 15.87, 0.50
- ☒ D. 15.93, 0.46
- E. 16.00, 0.50

Easy:
guess &
check



$$Z = \text{invNorm}(.1) = -1.28$$

$$15.34 = -1.28\sigma + \mu$$



$$Z = \text{invNorm}(.8) = .84$$

$$16.31 = .84\sigma + \mu$$

$$\rightarrow [15.34 = -1.28\sigma + \mu]$$

$$\frac{0.97}{2.12} = \frac{2.12}{2.12} \sigma \quad \sigma = .46$$

Goldilocks Survey (Optional)

Difficulty

I felt this exam was...

- A. too easy.
- B. too hard.
- C. just right.

Length

I felt this exam was...

- ☒ A. too long.
- B. too short.
- C. just right.

How many of the available sample exams did you take in preparation for this exam?