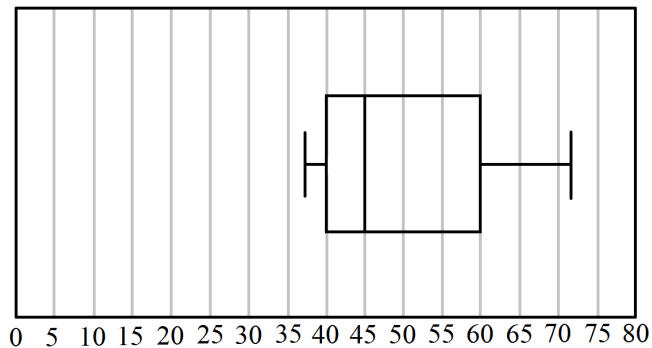## QUESTION 1

The following box plot shows the ages of all the faculty and staff at Rickards High School.

Let:

$$A \quad = \quad \text{the value of the third quartile}$$
$$B \quad = \quad \text{the interquartile range}$$
$$C \quad = \quad \text{the median}$$
$$D \quad = \quad \text{1 if the distribution is skewed-left, 2 if it is skewed-right, or 3 if it is symmetric}$$

Find $\dfrac{A}{B} + C + D$.

QUESTION 2

Dr. Fraser's lamp just died, so he needs to replace the light bulb. He finds a random light bulb with a tag that claims the amount of hours the light bulb will last follows a Normal distribution with a mean and standard deviation of 20 and 3, respectively. Let:

$$
\begin{aligned}
A &= \text{the probability the light bulb lasts exactly 1200 minutes} \\
B &= \text{the probability the light bulb lasts less than half a day} \\
C &= \text{the probability the light bulb lasts more than a day} \\
D &= \text{the probability the light bulb lasts between 17 and 22 hours}
\end{aligned}
$$

Round each part to three decimal places, and find $A + B + C + D$.

QUESTION 3

Meit wants to see if there is a linear relationship between the amount of chicken you eat, and how much you weigh. He carried out a study, and collected the following data.

Amount of Chicken (x)	1	1.2	1.5	2.4	3	4.2	6.9	7	7.2	7.4
Weight (y)	80	74	90	97	95	140	125	143	156	183

Using Meit's data, let:

$$
\begin{aligned}
A &= \text{the sum of the mean of the } x\text{-values and the mean of the } y\text{-values} \\
B &= \text{the slope of the least-squares regression line} \\
C &= \text{the coefficient of determination} \\
D &= \text{the residual for } x = 3
\end{aligned}
$$

Round each answer to 3 decimal places, and find $A + B + C + D$.

QUESTION 4

The Mu Alpha Theta Club at Rickards is divided over which food is the best. The following table displays how many members in each grade level like each food.

	Pizza	Sushi	Tacos
9th Grade	7	10	3
10th Grade	15	2	8
11th Grade	4	2	0
12th Grade	6	9	9

If a Mu Alpha Theta member is randomly selected, let:

$$
\begin{aligned}
A &= P(\text{Likes Pizza}) \\
B &= P(\text{10th Grader}) \\
C &= P(\text{Likes Sushi}|\text{12th Grader }) \\
D &= P(\text{10th Grader}|\text{Likes Tacos})
\end{aligned}
$$

Keep each part as an exact answer, and find $B \cdot C + \dfrac{A}{D}$. Give your final answer as a simplified fraction.

QUESTION 5

Jasmine is conducting an experiment to see if eating certain foods can reduce pain. 12 volunteers agreed to participate in her study. She asks each subject to rate their pain on a scale of 1 to 10 at the beginning of the experiment. Next, she uses a random table of digits to randomly assign 6 subjects to a group that will eat broccoli, and then puts the remaining 6 subjects in a group that will eat cauliflower. In each group, 2 of the subjects will eat 1 pound of their respective food, 2 will eat 2 pounds of their respective food, and 2 will eat 3 pounds of their respective food. At the end of the experiment, Jasmine will ask each subject to rate their pain on a scale from 1 to 10, and compare it to their original rating. Let:

$$
\begin{aligned}
A &= \text{the total amount of food eaten during the experiment, in pounds} \\
B &= \text{the number of factors} \\
C &= \text{the number of levels} \\
D &= \text{the number of treatments}
\end{aligned}
$$

Find $\dfrac{A}{B} + C \cdot D$.

QUESTION 6

The following statements have point values indicated by the numbers within the parentheses by each statement. Starting with 0, add the points of every true statement, and subtract the points of every false statement.

(9)   The area under the Normal Distribution is approximately 1.

(5)   An r value of 0.99 means that changes in x strongly cause changes in y.

(-4)   Asking the first 40 people you meet at the mall is an example of convenience sampling.

(7)   Flipping 3 heads in a row on a fair coin is more likely than rolling two fair dice and getting a sum of 3.

(3)   The Central Limit Theorem states that as the number of observations in a sample increases, the sample mean gets closer to the population mean.

(-6)   The standard deviation of any sample must always be positive.

What is the final number of points?

QUESTION 7

Suppose there are two random variables, X and Y. X has a mean and variance of 100 and 900, respectively, and Y has a mean and standard deviation of 20 and 16, respectively. Assuming the two variables are independent, let:

$$
\begin{aligned}
A &= \text{the mean of } 3X + 6 \\
B &= \text{the standard deviation of } X + Y \\
C &= \text{the standard deviation of } X - Y \\
D &= \text{the standard deviation of } Y + 10
\end{aligned}
$$

Find $\dfrac{A}{B} + C - D$.

QUESTION 8

Kyle and Aditya are trying to get girlfriends, so they plan to ask out some random girls. Kyle will ask out 10 random girls. Assume that the probability that a girl says yes to Kyle is 0.6. Aditya is more desperate, so he will keep asking out random girls until one says yes. Assume that the probability that a girl says yes to Aditya is 0.2. Given that each girl's answer is independent of the others, and that a girl will only say yes or no, let:

$$
\begin{aligned}
A &= \text{the probability that 4 girls say yes to Kyle} \\
B &= \text{the probability that at least 2 girls say no to Kyle} \\
C &= \text{the probability that Aditya gets a girlfriend on his 5th try} \\
D &= \text{the probability that it takes 3 or less tries for Aditya to get a girlfriend}
\end{aligned}
$$

Round each part to three decimal places and find $A + B - C + D$.

QUESTION 9

Roehl is teaching Shardul how to play poker. Roehl deals Shardul 5 cards without replacement from a standard 52 card deck. Assume the cards are randomly dealt and that the deck is adequately shuffled. Let:

$$
\begin{aligned}
A &= \text{the probability Shardul gets a two pair} \\
B &= \text{the probability Shardul gets a full house} \\
C &= \text{the probability Shardul gets a flush} \\
D &= \text{the probability Shardul has at least 1 ace}
\end{aligned}
$$

Note: A two pair is one pair of matching cards, another pair of matching cards that are different from the first pair, and then a side card, that's not equal to either pair; for example, two 4s, two 7s, and a 5. A full house consists of a three of a kind and a pair; for example, three Kings and two 5s. A flush is 5 cards of the same suit (this includes straight flushes and royal flushes); for example, 5 hearts.

Round each part to three decimal places and find $A + B + C + D$.

QUESTION 10

Wenxin wants to see if she's sleeping less than the average student at Rickards. She collects a simple random sample of 16 students and calculates the average number of hours that the students sleep. Her result was 6.3 hours. Suppose that the number of hours of sleep an average Rickards student gets follows a Normal distribution with mean 7.2, and variance 4. Let:

$$A \quad = \quad \text{the standard deviation of the sampling distribution}$$
$$B \quad = \quad \text{the probability of Wenxin observing her sample mean or a value less}$$

Rida is trying to figure out the proportion of students at Rickards that like basketball. She conducts a simple random sample of 100 students, and finds that 54 of them like basketball. Suppose the true proportion of students at Rickards that like basketball is actually 0.5. Let:

$$C \quad = \quad \text{the standard deviation of the sampling distribution}$$
$$D \quad = \quad \text{the probability of Rida observing her sample proportion or a value greater}$$

Round each part to three decimals places, and find $\dfrac{A}{C} - B + D$.

QUESTION 11

Let:

A =   the smallest number of people that yields a margin of error no greater than 0.5 for a confidence interval with a sample mean of 70, a population standard deviation of 5, and a 90 percent confidence level

B =   the number of degrees of freedom for a one-sample t confidence interval with a sample mean of 49, sample standard deviation of 16, 15 observations, and a 99 percent confidence level

C =   the smallest number of people that yields a margin of error no greater than 0.05 for a confidence interval for a population proportion with a 95 percent confidence level (Use 0.4 as your guessed value of the sample proportion.)

D =   the margin of error for the confidence interval $(430.346, 442.346)$

Find $A - B - C - D$

QUESTION 12

Prior knowledge has shown that the time it takes to complete a MAO test follows a Normal distribution with a mean of 60, and a standard deviation of 10. Ms. Pickett plans to carry out a significance test to determine if there's statistically significant evidence that the average time it takes to complete a MAO test is more than 60 minutes. She sets a 5 percent significance level, randomly samples 50 MAO members, and then records how long it takes for them to finish a test. The sample mean ended up being 75 minutes. Suppose that the true time it takes to finish a MAO test follows a Normal distribution with mean 65 and standard deviation 10. Let:

$$
\begin{aligned}
A &= \text{the probability of Type 1 error} \\
B &= \text{the probability of Type 2 error} \\
C &= \text{the p-value of Ms. Pickett's test statistic} \\
D &= \text{1 if Ms. Pickett rejects the null hypothesis, 2 if Ms. Pickett fails to reject the null hypothesis}
\end{aligned}
$$

Round each part to three decimals places, and find $A + B + C + D$.

QUESTION 13

Mr. Cook has a bag full of identical, indiscernible marbles. 5 of them are blue, 4 of them are gold, and 7 of them are white. Assuming he draws marbles randomly, and without replacement, let:

$$
\begin{aligned}
A &= \text{the probability his first draw is a gold marble} \\
B &= \text{the probability his second draw is a white marble} \\
C &= \text{the probability his third draw is a blue marble if the first two marbles he drew were the same color} \\
D &= \text{the probability his second draw is a blue marble if the first draw was not a white marble}
\end{aligned}
$$

Keep your parts as exact answers, and find $\dfrac{B}{A} + C \cdot D$. Give your answer as a simplified fraction.

QUESTION 14

A probability distribution is a right trapezoid. The right side of the right trapezoid is a right isosceles triangle, and the left side is a rectangle. If the longer base of the right trapezoid is 1.5 units long, find:

$$
\begin{aligned}
A &= \text{the height of the probability density function at } 0.75 \\
B &= \text{the probability of getting a value between } 0.5 \text{ and } 1.25 \\
C &= \text{the probability of getting a value between } 1.3 \text{ and } 1.5 \\
D &= \text{the probability of getting a value between } 0 \text{ and } 1
\end{aligned}
$$

Keep the parts as exact answers and find $A + B + C + D$.