



[Course](#) > [Final E...](#) > [Final E...](#) > Final E...

Final Exam

1

4.0/5.0 points (graded)

For any two sets A and B , add \subseteq or \supseteq to make the following statements true.

Hint: Venn Diagrams may help.

• $A \cap B$ ____ A

\subseteq ▼

✓ Answer: \subseteq

• $A \cup B$ ____ A

\supseteq ▼

✓ Answer: \supseteq

- $A - B$ ____ A

✓ Answer: \subseteq

- $A \cap B$ ____ $A \cup B$

✗ Answer: \subseteq

- $A - B$ ____ $A \Delta B$

✓ Answer: \subseteq

Submit

You have used 1 of 1 attempt

i Answers are displayed within the problem

2

0/6 points (graded)

Recall that the power set $\mathcal{P}(S)$ of a set S is the collection of all subsets of S .

For $A = \{1, 2, 3\}$ and $B = \{x, y\}$, calculate the following cardinalities.

- $|\mathcal{P}(A)|$

✗ Answer: 8

- $|\mathcal{P}(B)|$

✗ Answer: 4

- $|A \times B^2|$

✗ Answer: 12

- $|\mathcal{P}(A \times B)|$

✗ Answer: 64

- $|\mathcal{P}(A) \times B|$

✖ Answer: 16

- $|\mathcal{P}(\mathcal{P}(A))|$

✖ Answer: 256

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You have used 4 of 4 attempts

i Answers are displayed within the problem

3

0/2 points (graded)

An instructor gives a class a set of 10 problems and says that the final exam will consist of a random selection of 5 of the problems. If a student has figured out how to solve 7 of the problems, what is the probability that he or she will answer correctly

- all 5 problems,

✖ Answer: 0.083333

- at least 4 problems?

✖ Answer: 0.50

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You have used 4 of 4 attempts

i Answers are displayed within the problem

4

0/4 points (graded)

Let X be distribution over \mathbb{N} with mass

$$P(X = i) = \frac{\alpha}{2^i}$$

for some fixed $\alpha \in \mathbb{R}$. Find

- α

0

✖ Answer: 1/2

0

- $E[X]$

✖ Answer: 1

For $Y = X \bmod 3$, find

- $P(Y = 1)$

✖ Answer: 2/7

- $E[Y]$

✖ Answer: 4/7

Submit

You have used 4 of 4 attempts

i Answers are displayed within the problem

5

0/1 point (graded)

A production line has a 5% defective rate, and its product are inspected one-by-one until the first defect is found. Given that the first 10 inspections do not find any defect, what is the probability that the number of inspections is no more than 20?

✗ Answer: $0.05 \cdot (0.95^{10-1}) / (0.95-1)$

You have used 3 of 3 attempts

i Answers are displayed within the problem

6

0/3 points (graded)

- What is the coefficient of x^4 in the expansion of $(2x - 1)^7$?

✗ Answer: -560

Explanation

$$\binom{7}{4} (2x)^4 (-1)^3 = -560x^4$$

- What is the constant term in the expansion of $(x - \frac{2}{x})^6$?

✗ Answer: -160

Explanation

$$\binom{6}{3} x^3 \left(-\frac{2}{x}\right)^3 = -160$$

- What is the coefficient of $x^3 y^2$ in expansion of $(x + 2y + 1)^{10}$?

✗ Answer: 10080

Explanation

$$\binom{10}{3,2,5} x^3 (2y)^2 = 10080x^3 y^2$$

Submit

You have used 4 of 4 attempts

i Answers are displayed within the problem

7

0.0/3.0 points (graded)

Suppose a binary message is transmitted through a noisy channel. The transmitted signal S has uniform probability to be either 1 or -1 , the noise N follows normal distribution $\mathcal{N}(0, 4)$ and the received signal is $R = S + N$. Assume the receiver conclude the signal to be 1 when $R \geq 0$ and -1 when $R < 0$.

- What is error probability when one signal is transmitted?

✗ Answer: 0.308538

- What is error probability when one signal is transmitted if we triple the amplitude of the transmitted signal? It means $S = 3$ or -3 with equal probability.

✗ Answer: 0.0668072

- What is the error probability if we send the same signal three times (with amplitude 1), and take majority for conclusion? For example, if three received signal was concluded 1, -1 , 1 by receiver, we determine the transmitted signal to be 1.

✗ Answer: 0.226844

Submit

You have used 4 of 4 attempts

i Answers are displayed within the problem

8

0/2 points (graded)

According to the U.S. Department of Agriculture, ten to twenty earthworms per cubic foot is a sign of healthy soil. The soil of a garden is checked by digging 8 holes, each of one-cubic-foot, and counting the earthworms, and the following counts are found: 5, 25, 15, 10, 7, 12, 16, 20. Use the

unbiased estimators discussed in the video to estimate

- the true mean,

✗ Answer: 13.75

- the true variance.

✗ Answer: 44.5

You have used 4 of 4 attempts

i Answers are displayed within the problem

9

0.0/2.0 points (graded)

In the following problem we discuss the test comparing two distribution means with the same variance. Assume $X \sim \mathcal{N}(\mu_1, \sigma^2)$ and $Y \sim \mathcal{N}(\mu_2, \sigma^2)$.

- What is the variance of $X - Y$?

☐ σ^2
☒ $2\sigma^2$ ✓

☐ $\sigma^2/2$ ✗

- If \bar{X} is the sample mean of n independent random observations of X and \bar{Y} is the sample mean of n independent random observations of Y , what distribution does $\bar{X} - \bar{Y}$ follow?

☐ $\mathcal{N}(\mu_1 - \mu_2, \frac{\sigma^2}{n})$
☐ $\mathcal{N}(\mu_1 - \mu_2, \frac{\sigma^2}{2n})$ ✗

☐ $\mathcal{N}(\mu_1 - \mu_2, \frac{2\sigma^2}{n})$ ✓

- We now want to test the null hypothesis H_0

H_0 : In college, the average GPA of men is equal to the average GPA of women.

H_1 : In college, the average GPA of men is different from the average GPA of women.

A sample of 10 men's GPA in college has sample mean 2.9, and a sample of 10 women's GPA has sample mean 3.1. We also know the GPAs of men and women have the same standard deviation 0.2. Calculate the p value.

Hint: It's a two-sided test.

0

✗ Answer: 0.025347318677468145

0

Submit

You have used 4 of 4 attempts

📘 Answers are displayed within the problem

10

0/2 points (graded)

- In a town of 30 families, the average annual family income is \$80,000. What is the largest number of families that can have income at least \$100,000 according to Markov's Inequality?

Note: The annual family income can be any **non-negative** number.

0

✗ Answer: 24

0

- In the same town of 30 families, the average household size is 2.5. What is the largest number of families that can have at least 4 members according to Markov's Inequality?

Note the household size can be any **positive** integer.

✗ Answer: 15

Submit

You have used 4 of 4 attempts

i Answers are displayed within the problem

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