# Question 1

## Question 1

0.0/1.0 point (graded)

A manufacturer receives a shipment of 100 parts from a vendor. The shipment will be unacceptable if more than five of the parts are defective. The manufacturer is going to randomly select $K$ parts from the shipment for inspection, and the shipment will be accepted if no defective parts are found in the sample.

How large does $K$ have to be to ensure that the probability that the manufacturer accepts an unacceptable shipment is less than 0.1?

Hint: We recommend using R to plug in different values of $K$.

- ○ 42
- ○ 22
- ○ 32
- ○ 12

Submit   You have used 0 of 2 attempts

Save

# Question 2

## Question 2

0.0/1.0 point (graded)

Now suppose that the manufacturer decides to accept the shipment if there is at most one defective part in the sample. How large does $K$ have to be to ensure that the probability that the manufacturer accepts an unacceptable shipment is less than 0.1? As above, a shipment is unacceptable if there are more than 5 defective parts.

Submit   You have used 0 of 2 attempts

Save

# Question 3

## Question 3

0.0/1.0 point (graded)

A man with $n$ keys wants to open his door and tries the keys at random. Exactly one key will open the door.

What is the expected value of the number of trials needed to open the door if unsuccessful keys are not eliminated for further selections?

- ⃝ $n$
- ⃝ $n-2$
- ⃝ $\frac{n-1}{n+1}$
- ⃝ $n-1$

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# Question 4

## Question 4

0.0/1.0 point (graded)

Let the number of chocolate chips in a certain type of cookie have a Poisson distribution. We want the probability that a randomly chosen cookie has at least two chocolate chips to be greater than 0.99. For which of the following values of the **mean** of the distribution is this condition assured? (Please select all that apply!)

*Hint: You may wish to try different values in R when solving this problem if you have trouble solving the relevant equations.*

- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9

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# Question 5

You decide to move out of your college's dorms and get an apartment, and you want to discuss the budget with your roommate. You know that your monthly grocery bill $G$ will depend on a number of factors, such as whether you are too busy to cook, whether you invite guests for meals frequently, how many special holiday meals you will cook, etc. In particular, G will have an approximate normal distribution with a variance of 2500 and a mean:

$$\mu = 300 + 10M - 100B + 50H$$

Where $M$ is the number of meals to which you invite guests, and $E[M] = 8$. $B$ is a measure for how busy you are with 14.310X problem sets and assume it is $U[0, 1]$. $H$ is a variable that takes on the value 1 for holiday months of November, December, and January and 0 otherwise.

## Question 5

0.0/1.0 point (graded)

What is the mean of $G$ in a November, where $M = 10$ and $B = 0.5$?

Submit    You have used 0 of 2 attempts

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# Question 6

## Question 6

0.0/1.0 point (graded)

For a month chosen at random what is $E[G]$? (Select all that apply)

☐ $E[300 + 10M - 100B + 50]$

☐ $E[300 + 10M - 100B]$

☐ $300 + 10E[M] - 100E[B] + 50 * E[H]$

☐ $312.5 + 10E[M] - 100E[B]$

☐ $E\left[300 + 10M - 100B + 50 * \frac{3}{4}\right]$

☐ $E\left[300 + 10M - 100B + 50 * \frac{1}{4}\right]$

Submit    You have used 0 of 2 attempts

Save

# Question 7

## Question 7

0.0/1.0 point (graded)

What is $E(G)$?

[ ]

[ ]

Submit    You have used 0 of 2 attempts

## Question 8

Now we are going to perform some simulations in $R$. We are going to follow Sara's example in the lecture where we imagine a case where the $x_i$ follow a uniform distribution between $0$ and $\theta$ ($U[0, \theta]$), and two researchers are trying to figure out the value of $\theta$. (We will set $\theta = 5$). We are going to simulate different random samples from this distribution with a sample size of 100 observations each. These samples will be available to the two researchers, and we are going to plot how $\hat{\theta}$ is distributed for different estimators.

There are two types of researchers in this world. Researcher $A$ uses as an estimator for $\theta$, $\hat{\theta}_A = 2 * \bar{x}$, where $\bar{x}$ corresponds to the sample mean of the sample he receives from us. Researcher $B$ uses as an estimator $\hat{\theta}_B = 2*\text{median}(x)$, where $\text{median}(x)$ corresponds to the median of the sample he receives from us.

We have provided you with this R code that has some information missing in case you need help for this exercise.

## Question 8

0.0/1.0 point (graded)

What would be the mean of this distribution of $\bar{x}$?

[ ]

[ ]

Submit    You have used 0 of 2 attempts

## Question 9

## Question 9

0.0/1.0 point (graded)

What would be the variance of the distribution of $\hat{\theta}_A$? Please enter the numerical value of the variance.

*Note: Please review our guidelines on precision regarding rounding answers here.*

[    ]

[  ]

Submit    You have used 0 of 2 attempts

## Question 10

If you haven't already, please fill in the R code provided earlier.

We have run our simulations, simulating 100,000 different samples of size 100. We have provided 200,000 researchers (A and B), each with one of these samples. They have sent us their estimators for $\hat{\theta}$. The following plot shows a histogram of their estimators (Figure 1).
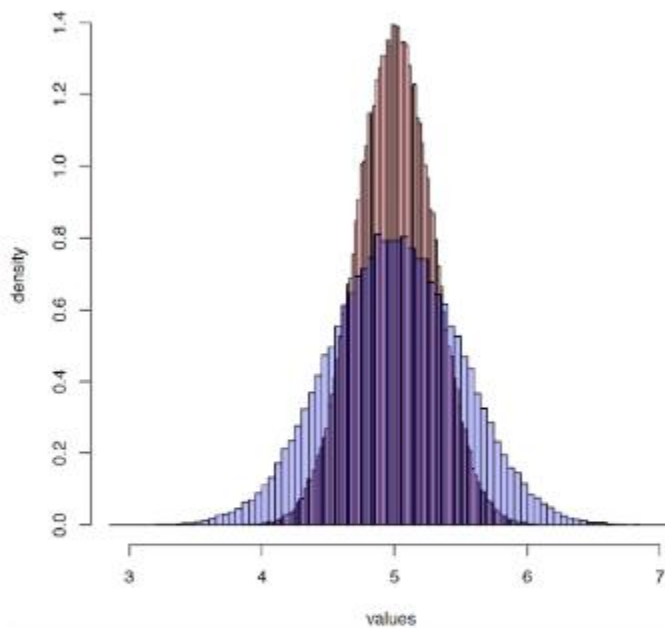


## Question 10

0.0/1.0 point (graded)

Does the blue histogram correspond to the estimator of researcher A or researcher B?

○ Researcher A

○ Researcher B

## Question 11

## Question 11

0.0/1.0 point (graded)

Since both of the estimators are centered around the real value of the parameter $\theta$, you should use the estimator with the lowest variance. Which estimator should you use?

○ $\hat{\theta}_A$

○ $\hat{\theta}_B$

Submit    You have used 0 of 1 attempt

Save

Question 12

## Question 12

0.0/1.0 point (graded)

Now, let's increase the sample size to 1000. As an exercise try to use the provided code to code this yourself in R. What would be the new variance of the estimator $\hat{\theta}_A$?
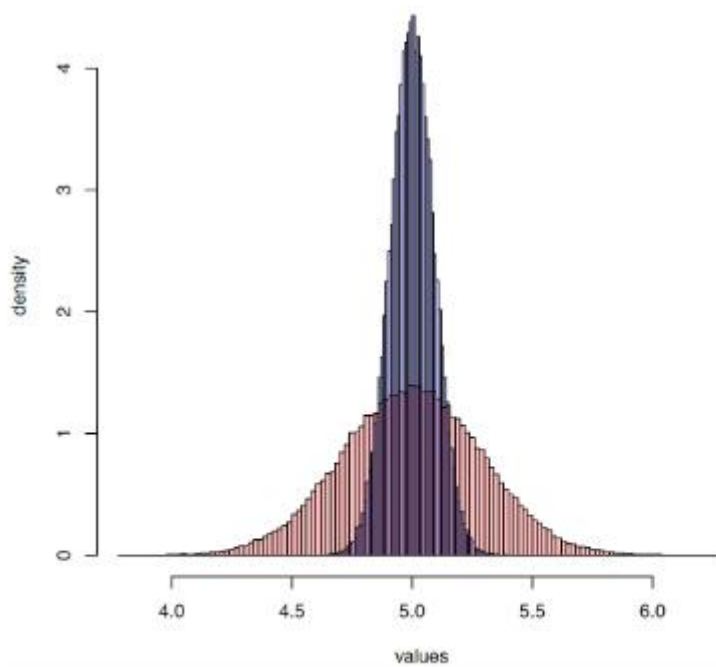
*Note: Please review our guidelines on precision regarding rounding answers here.*

[_____]

[____]

The following figure shows the distribution for $\hat{\theta}_A$ for $n = 100$, and $n = 1000$



## Question 13

## Question 13

0.0/1.0 point (graded)

Does the blue histogram correspond to a sample size of 100 or of 1000?

- ○ 100

- ○ 1000

Submit    You have used 0 of 1 attempt

Save