

INSTRUCTIONS: Each question is worth 10 points. Your 10 best answers will be counted.

1. The number of admissions to the emergency ward of a hospital between 6 and 8 p.m. for a sample period of 50 days had the following distribution:

number (x) of admissions	number of days (f) with this many admissions
0	5
1	8
2	16
3	10
4	6
5	4
6	1

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$$f = 50 \quad fx = 120 \quad fx^2 = 394$$

$$120^2 / 50 = 288$$

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$$\text{difference} \quad 106$$

- a What is the modal x range of x (Approximate) standard deviation of x      mean x (Approximate) variance of x      median x (Approximate) standard deviation of x
- b If we added the number of admissions for a 51st day, which of the statistics of central tendency would change?
- c If observations for 100 days rather than 50 days were contained in the dataset, would you expect the range to be larger than calculated here? the standard deviation?

Explain.

- d Calculate (approximately) the coefficient of variation of the 50 x's. In what units is it expressed?
- e To compare the variability in the number of admissions to this ward with that in another hospital that handles more emergencies, would the standard deviation or the coefficient of variation be the more meaningful measure?

Why?

2. In a study of weather effects on air travel, it was noted that for any particular day in January, (1) the probability that New York City has fog is 0.10, (2) the probability that Baltimore has fog if New York City has fog is 0.30, and (3) the probability that Washington has fog if both Baltimore and New York City have fog is 0.70.

What is the probability that all three cities have fog on the same day in January?

3. Consider the standard normal random variable Z. Consult the tables of the normal distribution to find:

a  $\text{Prob}(Z > .44)$     b  $\text{Prob}(-.44 < Z < 0.44)$     c The value such that  $\text{Prob}(Z > \text{value}) = 0.25$

4. A student, on studying sampling, was puzzled about how there can be a sampling distribution of  $\bar{x}$  when in practice only a single sample is selected.

Explain to this student the concept of a sampling distribution and its importance.

5. Why is the Central Limit Theorem so "Central" and important in inferential statistics?

6. With simple random sampling, what distribution does each of the following statistics follow if:

$$\bar{x}$$

$$\frac{\bar{x} - \mu}{s/\sqrt{n}}$$

$$\frac{\bar{x} - \mu}{s/\sqrt{n}}$$

X is normally distributed  
and n is small?

X is normally distributed  
and n is large?

X is not normally distributed  
and n is small?

X is not normally distributed  
and n is large?

7. A research report (based on a random sample of hospitals) stated that the mean percentage reduction in the number of hospital beds over the past year was between 6.1% and 10.8% with a confidence coefficient of 95%. One person interpreted this as meaning that 95% of hospitals had reductions in the number of beds between 6.1% and 10.8%. Another interpreted this in the sense that if many random samples were taken, 95% of the samples would have mean reductions between 6.1% and 10.8%.

Why are these interpretations incorrect?

8. Is it true that to halve the standard error of the mean, one must double n. Why?

9. A survey to estimate the proportion of 16 year old schoolgirls in Quebec that are protected against rubella examined 40 randomly selected girls from each of 25 randomly selected schools. The authors used the Binomial distribution with  $n=1,000$  to calculate the uncertainty of their estimated proportion.

What is wrong with this method of calculating the uncertainty?

Is the real uncertainty bigger or smaller than the authors calculated? Why?

10. What is wrong with a study protocol which states

$$H_0: \bar{x} = 10.0$$

$$H_{alt}: \bar{x} > 10.0$$

11. Many journal editors and referees are suggesting that a confidence interval (CI) is often a useful adjunct (or even a replacement for) a statistical test of significance.

Suppose that we use a t-test to decide whether two sample means are significantly different.

If the means ARE significantly different from each other, what more can the CI tell us?

If the means ARE NOT significantly different from each other, what more can the CI tell us?