

Sample Final Exam for Stat. 224. Prof. Callan

1. a) Suppose A,B,C are independent events with probabilities
 $P(A) = .6$, $P(B) = .4$, $P(C) = .3$.

- Find (i) $P(A \cap B)$
(ii) $P(A \cup B)$
(iii) $P(A|B)$
(iv) $P(\text{exactly one of } A, B, C \text{ occurs})$

- b) True(T) or False(F)? [Circle one]

- (i) The sample standard deviation of a set of data points is always larger than its standard deviation. T F
- (ii) The value of z_α is greater than the value of t_α with n degrees of freedom for all significance levels α and all positive integers n . T F
- (iii) For every distribution, the sample mean of a random sample is an unbiased estimator of the population mean. T F
- (iv) For every normal distribution, the sample variance of a random sample is an unbiased estimator of the population variance. T F
- (v) Looking on a criminal trial as a hypothesis test, the American legal system is set up to consider a Type II error as more serious than a Type I error. T F

2. a) In a casino game, two dice are rolled simultaneously. You win \$12 if the two dice show different numbers.

What is a fair price to play this game? _____

- b) If there are 11 cars in a race, in how many different ways can they place first, second, and third? _____

- c) A high school class committee is composed of 4 women and 2 men. If the class consists of 20 men and 20 women, in how many ways can the committee be formed? _____

Is this number larger than or less than a million?
[Circle one]

3. A blood test for a certain rare disease comes up positive in 98% of people who have the disease, but also has a 1% false positive rate. Suppose that 1 in 10,000 persons has the disease.

a) If your test comes up positive, what is the probability you actually have the disease? _____

b) If your test comes up negative, what is the probability you have the disease anyway? _____

4. a) A sample of 45 import cars yielded an average selling price of \$18,500 with a sample standard deviation of \$1,700.

Based on this data, find a 95% confidence interval for the true mean selling price of import cars. _____

- b) A sample of 200 urban voters yielded 145 in favor of Proposition X, and a sample of 360 rural voters yielded 200 in favor.

Find a 95% confidence interval for the difference between the proportions of urban and rural voters in favor of the

Proposition. _____

5. a) For a polling organization to assert with 95% confidence that its estimated proportion is correct within ± 4 percentage points, how large a sample will be needed? _____

b) Let μ denote the average gas mileage (miles per gallon) of a certain line of cars. Suppose the null hypothesis that $\mu = 30$ is to be tested against the alternative that $\mu < 30$ using a sample of 20 cars. Suppose also that it is known the standard deviation of the gas mileage is $\sigma = 2.7$.

If the significance level is to be 5%, use Table 8 to estimate the Type II error probability when $\mu = 28$.

6. One hundred observations of a random variable X yielded the following results

X	0	1	2	3	4
frequency	23	35	26	11	5

Test at the 5% level if these results are consistent with a binomial distribution of $n = 4$ trials.

Hint. First use the formula $\mu = np$ for the mean of a binomial distribution to estimate p from the data.

7. In a linear regression problem with $n = 80$ pairs (x_i, y_i) , the following quantities were calculated.

S_{xx}	S_{yy}	S_{xy}
26.4	20.5	22.1

Find a 98% confidence interval for the slope of the regression line. _____

- 8 a) A sample of 81 from a normal population yielded a sample standard deviation of $s = .318$.

Find a 95% confidence interval for the population standard deviation. _____

- b) In a one-way analysis of variance problem, a different treatment was applied to $k = 5$ samples each of size $n = 13$. The following sums of squares were computed:

$$SST = 79.9$$

$$SS(\text{Tr}) = 13.2$$

Test at the 5% level the hypothesis that the treatments are equally effective.