AP Statistics Review Using Technology

IMPORTANT POINTS FOR THE EXAM

1. Explanations and conclusions **in context** are always required for a complete answer. For example, the results of a hypothesis test should always be followed by a conclusion in context.

2. Know the vocabulary of statistics, and use that vocabulary correctly in all written responses.

3. Remember to define all symbols. Specifically, remember to distinguish between population parameters and sample statistics.

4. Remember **to state and check all necessary assumptions** when performing hypothesis tests and constructing interval estimates.

2018 Question 6

Systolic blood pressure is the amount of pressure that blood exerts on blood vessels while the heart is beating.
The mean systolic blood pressure for people in the United States is reported to be 122 millimeters of mercury (mmHg) with a standard deviation of 15 mmHg.

The wellness department of a large corporation is investigating whether the mean systolic blood pressure of its employees is greater than the reported national mean. A random sample of 100 employees will be selected, the systolic blood pressure of each employee in the sample will be measured, and the sample mean will be calculated.

Let μ represent the mean systolic blood pressure of all employees at the corporation.

Consider the following hypotheses:

$$H_0 : \mu = 122$$
$$H_a : \mu > 122$$

2018 Question 6 Part a

Describe a Type II error in the context of the hypothesis test.

A Type II error occurs when the alternative hypothesis is true, but the null hypothesis is not rejected.

In this situation a Type II error would happen if the mean systolic blood pressure of the population of employees is greater than 122 mmHg, but the null hypothesis that it is 122 mmHg is not rejected.

In other words a Type II error would happen if the mean blood pressure for the population of employees is higher than the national average, but the test does not conclude that it is higher.

2018 Question 6 Part b

Assume that σ, the standard deviation of the systolic blood pressure of all employees at the corporation, is 15mmHg.
If $\mu = 122$, the sampling distribution of $\mu_{\bar{x}}$ for samples of size 100 is approximately normal with a mean of 122 mmHg and a standard deviation of 1.5 mmHg.

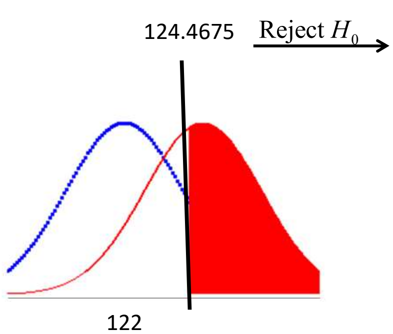
What values of the sample mean $\bar{x}$ would represent sufficient evidence to reject the null hypothesis at the significance level of $\alpha = 0.05$?

Sampling Distribution is N(122,1.5)

2018 Question 6 Part c

The actual mean systolic blood pressure of all employees at the corporation is 125 mmHg, not the hypothesized value of 122 mmHg, and the standard deviation is 15 mmHg.

Using the actual mean of 125 mmHg and the results from part (b), determine the probability that the null hypothesis will be rejected.



2018 Question 6 Part c

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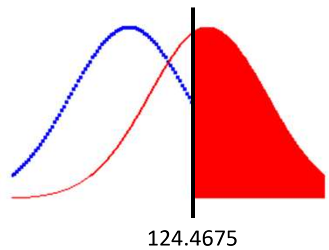

2018 Question 6 Part d

What statistical term is used for the probability found in part (c) ?

power of the test.

2018 Question 4 Part b

The anterior cruciate ligament (ACL) is one of the ligaments that help stabilize the knee. Surgery is often recommended if the ACL is completely torn, and recovery time from the surgery can be lengthy. A medical center developed a new surgical procedure designed to reduce the average recovery time from the surgery. To test the effectiveness of the new procedure, a study was conducted in which 210 patients needing surgery to repair a tom ACL were randomly assigned to receive either the standard procedure or the new procedure.

Summary statistics on the recovery times from the surgery are shown in the table.

Type of Procedure	Sample Size	Mean Recovery Time (days)	Standard Deviation Recovery Time (days)
Standard	110	217	34
New	100	186	29

Do the data provide convincing statistical evidence that those who receive the new procedure will have less recovery time from the surgery, on average, than those who receive the standard procedure, for patients similar to those in the study?

2018 Question 4 Part b

Type of Procedure	Sample Size	Mean Recovery Time (days)	Standard Deviation Recovery Time (days)
Standard	110	217	34
New	100	186	29

μ_S : mean recovery time of patients recieving standard treatment

μ_N : mean recovery time of patients recieving new treatment

$$H_0 : \mu_S = \mu_N$$
$$H_a : \mu_S > \mu_N$$

Two-sample t-test for a difference between means

2018 Question 4 Part b

Type of Procedure	Sample Size	Mean Recovery Time (days)	Standard Deviation Recovery Time (days)
Standard	110	217	34
New	100	186	29

$t-$ statistic = 7.127 with 207.179 df

p-value = 8.357 x 10^{-12}

The *p*-value is very small (essentially 0).

Therefore, we have sufficient evidence to conclude that for patients similar to the ones in the study, those receiving the new procedure would have less recovery time, on average, than those receiving the standard procedure.

2017 Question 2 Part a

The manager of a local fast-food restaurant is concerned about customers who ask for a water cup when placing an order but fill the cup with a soft drink from the beverage fountain instead of filling the cup with water.

The manager selected a random sample of 80 customers who asked for a water cup when placing an order and found that 23 of those customers filled the cup with a soft drink from the beverage fountain.

Construct and interpret a 95 percent confidence interval for the proportion of all customers who, having asked for a water cup when placing an order, will fill the cup with a soft drink from the beverage fountain.

2017 Question 2 Part a

Construct and interpret a 95 percent confidence interval for the proportion of all customers who, having asked for a water cup when placing an order, will fill the cup with a soft drink from the beverage fountain. (23 out of 80)

Random sample

Large sample ($n\hat{p} \geq 10$ and $n(1-\hat{p}) \geq 10$)

One sample z-interval for a population proportion p

We can be 95 percent confident that in the population of all customers of the restaurant who ask for a water cup, the proportion who will fill it with a soft drink is between 0.18832 and 0.38668.

2017 Question 2 Part b

The manager estimates that each customer who asks for a water cup but fills it with a soft drink costs the restaurant $0.25. Suppose that in the month of June 3,000 customers ask for a water cup when placing an order. Use the confidence interval constructed in part (a) to give an interval estimate for the cost to the restaurant for the month of June from the customers who ask for a water cup but fill the cup with a soft drink.

From part a, the proportion who will fill it with a soft drink is between 0.18832 and 0.38668.

2017 Question 5

The table and the bar chart below summarize the age at diagnosis, in years. for a random sample of 200 men and women currently being treated for schizophrenia.

Do the data provide convincing statistical evidence of an association between age group and gender in the diagnosis of schizophrenia?

	Age-Group (years)				
	20 to 29	30 to 39	40 to 49	50 to 59	Total
Women	46	40	21	12	119
Men	53	23	9	3	88
Total	99	63	30	15	207

H_0: Age group at diagnosis and gender are independent
for the population of people currently being treated for schizophrenia.
H_a: Age group at diagnosis and gender are not independent
for the population of people currently being treated for schizophrenia

2017 Question 5

	Age-Group (years)				
	20 to 29	30 to 39	40 to 49	50 to 59	Total
Women	46	40	21	12	119
Men	53	23	9	3	88
Total	99	63	30	15	207

χ^2 test of independence

Problem states random selection of sample

Expected counts all at least 5

(counts must be reported)

2017 Question 3 Part a

A grocery store purchases melons from two distributors, J and K. Distributor J provides melons from organic farms. The distribution of the diameters of the melons from Distributor J is approximately normal with mean 133 millimeters (mm) and standard deviation 5 mm.

(a) For a melon selected at random from Distributor J, what is the probability that the melon will have a diameter greater than 137 mm?

$$P(X > 137) \text{ in a } N(133, 5)$$