Midterm 3 - STAT 301
Fall 2017

Name:

UIN:

Signature:

Version A:

1. Do not open this test until told to do so.
2. This is a closed book examination, However you may use the cheat sheet provided and the tables you have brought with you. You should have no other printed or written material with you on the exam. But scrap paper is allowed.
3. You have 60 minutes to work on this exam. There are **16** multiple choice questions.
4. On the scantron please state the version of exam that you have.
5. You may use a calculator in the exam.
6. If there is no correct answer or if multiple answers are correct, select the **best** answer.
7. If you are unsure of what a question is asking for, do not hesitate to ask the instructor or course assistant for clarification.
8. Do all tests at the **5%** level unless specified otherwise.
9. Some questions are very easy (don't make them more complicated than they are), make sure you get these correct.
10. Please only give one answer per question (the one that is closest to the solution).
11. Good Luck!!!

(1-3) 174 people rated a product on Amazon. The rating they could give was an integer from 1-5 (5 being the top score). The summary statistics based on 174 people who rated a product is given below.

Summary statistics:

Column	n	Mean	Variance	Std. dev.	Std. err.
Lintelek	174	4.2528736	1.8778819	1.3703583	0.10388659

(1) Construct a 95% confidence interval for the mean rating of the product (use the t-distribution).

probability	0.3	0.15	0.10	0.05	0.025	0.01	0.005
t^*	0.53	1.03	1.28	1.65	1.97	2.34	2.60

Table 1: Critical values for t-distribution with 173 df

(A) [1.55,6.9] (B) [0,0.22] (C) [4.05,4.45] (D) [4.23,4.27]

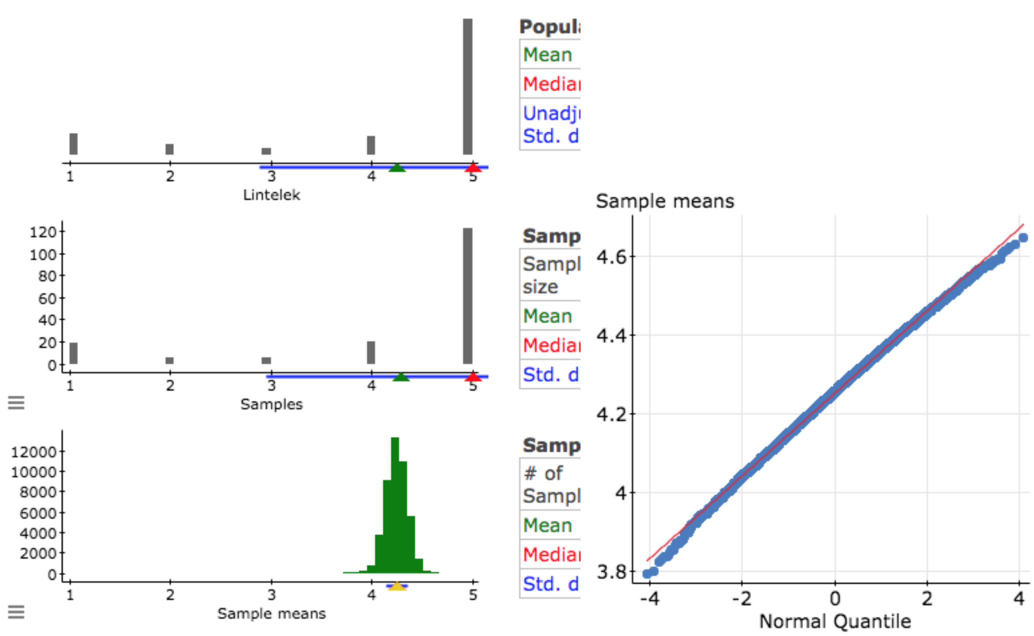
(2) Based on the above we test the hypothesis $H_0 : \mu = 4.3$ vs $H_A : \mu \neq 4.3$ (the test is done at the 5% level). Which statement(s) are correct?

(A) The p-value is less than 5% (B) The p-value is more than 5%

(C) There is evidence in the data to suggest the mean is **not** 4.3 (and reject null).

(D) [A] and [C] (E) [B] and [C].

(3) Based on the statcrunch app below (where both the histogram and QQplot of the sample mean is given). How reliable is the confidence interval constructed in (Q1)?



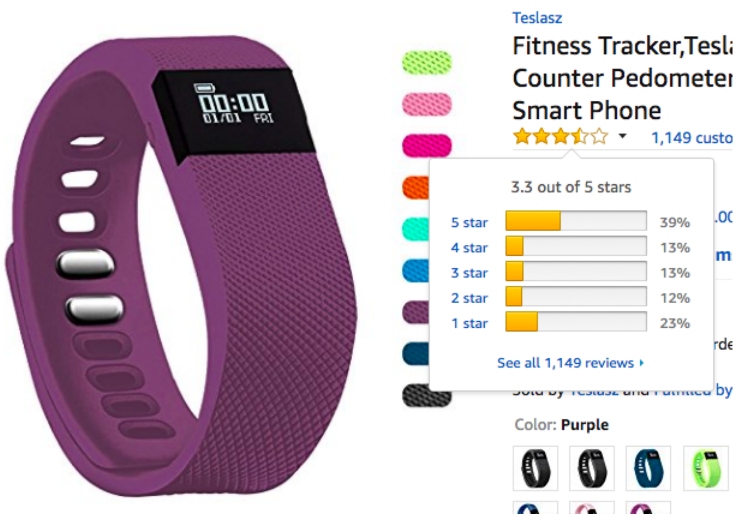
(A) The distribution of the sample mean is close to normally distributed.

(B) From the app, we see that we have close to 95% confidence in the interval.

(C) From the app, we see that we **do not** have close to 95% confidence in the interval.

(D) [A] and [C] (E) [A] and [B].

(4) You see the following watch and ratings on Amazon and test the hypothesis $H_0 : \mu \leq 4$ vs $H_A : \mu > 4.0$. What is the result of the test?



(A) The p-value is less than 50%

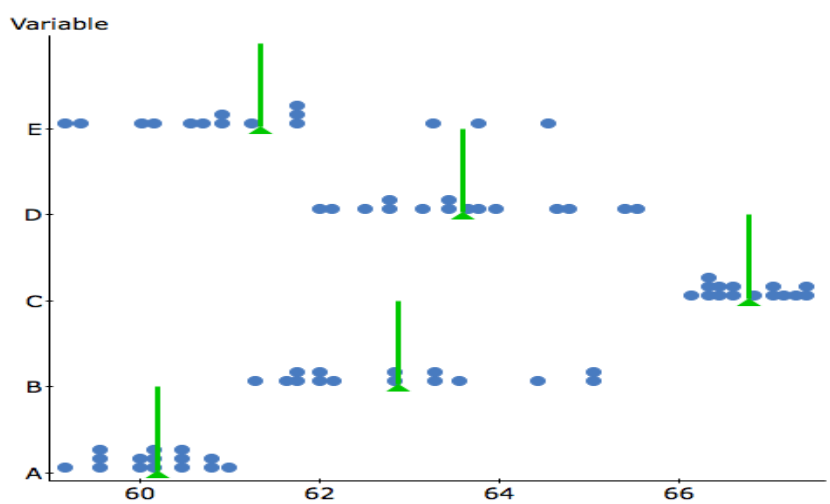
(B) Reject the null; buy the product.

(C) No evidence to reject the null; don't buy the product.

(D) [A] and [B]

(E) [A] and [C].

(5-6) Below a dotplot of 5 data sets (labelled A-E) is given (15 observations in each data set). The vertical line is the sample mean.



(5) We test the hyothesis $H_0 : \mu \leq 64$ vs $H_A : \mu > 64$. Which data set has the smallest p-value.

(6) We test the hyothesis $H_0 : \mu \leq 64$ vs $H_A : \mu > 64$. Which data set has the largest p-value.

(7) In a two party election people could either vote for Dr. Strange or Dr. Love. Let p denote the proportion of the electorate who would vote for Dr. Strange. 500 people are questioned, in that sample 55% said they would vote for Dr. Strange.

Dr. Strange's team want to test the hypothesis that Dr. Strange will get the **majority** of votes, what is the hypothesis of interest?

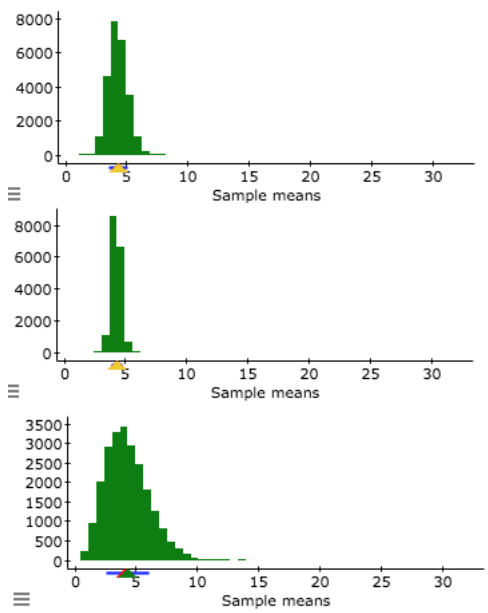
(A) $H_0 : p \leq 0.5$ vs $H_A : p > 0.5$ (B) $H_0 : p = 0.5$ vs $H_A : p \neq 0.5$

(C) $H_0 : p \geq 0.5$ vs $H_A : p < 0.5$ (D) $H_0 : p \leq 0.55$ vs $H_A : p > 0.55$

(E) $H_0 : p \geq 0.55$ vs $H_A : p > 0.55$

(8) The distribution of the sample means for various sample sizes are plotted below.

The top plot we call Plot 1. The middle plot we call Plot 2. The botton plot we call Plot 3.



Match the sample sizes, $n = 5, 20$ and 40, to the plots.

	Plot 1	Plot 2	Plot 3
A	20	5	40
B	40	5	20
C	20	40	5
D	5	40	20
E	40	5	20

(9) Every hour quality control at a tomato packing plant samples 20 boxes from a tomato packing machine and tests the hypothesis $H_0 : \mu = 227g$ vs $H_A : \mu \neq 227g$. Each test is done at the 5% level (if the p-value is less than **5%** the machine is checked).

The power of the test when the mean is $\mu = 240g$ is 99%.

Suppose the machine is **working correctly** and **1000** statistical tests are conducted. On average how many times will the machine be checked?

(A) 10 (B) 50 (C) 990 (D) 950 (E) 500.

(10-12) 5 thousand years ago it was known that the mean time between eruptions of Old Faithful Geyser was 68 minutes. The time between recent eruptions (in minutes) of Old Faithful Geyser is recorded and given below.

One sample T hypothesis test:
μ : Mean of variable
$H_0 : \mu = 68$
$H_A : \mu \neq 68$

Hypothesis test results:

Variable	Sample Mean	Std. Err.	DF	T-Stat	P-value
waiting	70.897059	0.82431637	271	3.5144987	0.0005

(10) Using the output above determine whether there is evidence to suggest that the mean time between eruptions of Old Faithful is **not equal** to 68 minutes. State the hypothesis of interest and the results of the test at the 5% level.

(A) $H_0 : \mu \leq 68$ vs. $H_A : \mu > 68$, the p-value is 0.05%, there is **no** evidence to suggest that the mean is greater than 68 minutes.

(B) $H_0 : \mu \leq 68$ vs. $H_A : \mu > 68$, the p-value is 0.05%, there **is** evidence to suggest the mean is less than 68 minutes.

(C) $H_0 : \mu = 68$ vs. $H_A : \mu \neq 68$, the p-value is 0.05%, there **is no** evidence to reject the null.

(D) $H_0 : \mu = 68$ vs. $H_A : \mu \neq 68$, the p-value is 0.05%, there **is** evidence to suggest that the mean is not 68 minutes.

(E) $H_0 : \mu \neq 68$ vs. $H_A : \mu = 68$, the p-value is 0.05%, there is evidence to suggest the mean is 68 minutes.

(11) Using the output above determine whether there is evidence to suggest that the mean time between eruptions of Old Faithful is **greater** than 68 minutes. State the hypothesis of interest and the results of the test at the 5% level.

(A) $H_0 : \mu \leq 68$ vs. $H_A : \mu > 68$, the p-value is 0.025%, there **is** evidence to suggest that the mean is greater than 68 minutes.

(B) $H_0 : \mu \leq 68$ vs. $H_A : \mu > 68$, the p-value is 99.975%, there **is no** evidence to suggest the mean is greater than 68 minutes.

(C) $H_0 : \mu < 68$ vs. $H_A : \mu \geq 68$, the p-value is 99.975%, there **is no** evidence to suggest the mean is greater than 68 minutes.

(D) $H_0 : \mu \geq 68$ vs. $H_A : \mu < 68$, the p-value is 0.05%, there **is no** evidence to suggest the mean is greater than 68.

(12) Using the output above determine whether there is evidence to suggest that the mean time between eruptions of Old Faithful is **less than** 68 minutes. State the hypothesis of interest and the results of the test at the 5% level.

(A) $H_0 : \mu \geq 68$ vs. $H_A : \mu < 68$, the p-value is 0.025%, there **is** evidence to suggest that the mean is less than 68 minutes.

(B) $H_0 : \mu \geq 68$ vs. $H_A : \mu < 68$, the p-value is 99.975%, there **is no** evidence to suggest the mean is less than 68 minutes.

(C) $H_0 : \mu < 68$ vs. $H_A : \mu \geq 68$, the p-value is 99.975%, there **is no** evidence to suggest the mean is greater than 68 minutes.

(D) $H_0 : \mu \leq 68$ vs. $H_A : \mu > 68$, the p-value is 99.975%, there **is no** evidence the mean is greater than 68.

(13) Entomologists conjecture that the mean number of chirps a cricket makes in a minute is **more than** 15.5. A random sample of $n =$**15** crickets is sampled. The average number of chirps (sample mean) for this sample is 16.66 and the **sample standard deviation** (based on this sample) is $s = 1.7$. They test the hypothesis $H_0 : \mu \leq 15.5$ vs $H_A : \mu > 15.5$.

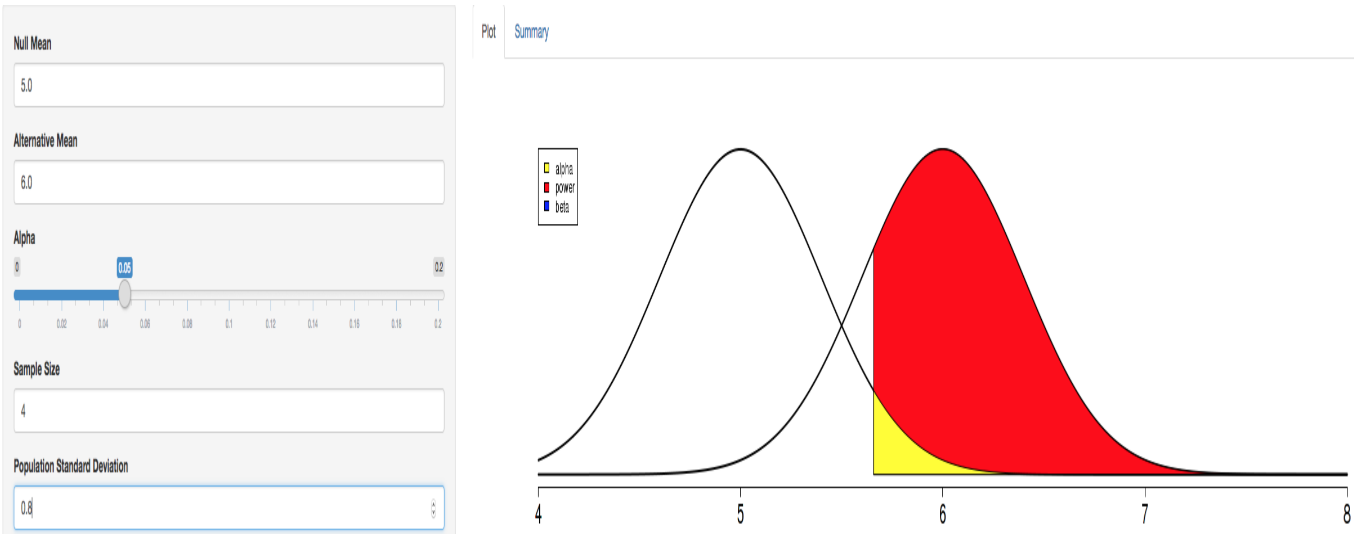
What is the p-value and result of test (use a t-distribution with 14df)?

(A) The p-value greater than 25%. There **is no** evidence to suggest the mean is greater than 15.5.

(B) The p-value between 0.5 to 1%. There **is** evidence to suggest the mean is greater than 15.5.

(C) The p-value between 99 to 99.5%. There is **no** evidence to suggest the mean is greater than 15.5.

(14) If the mean amount of potassium in the blood is higher than 5.0mm hyperkalemia (high potassium) is diagnosed. The statistical test $H_0 : \mu \leq 5.0$ vs $H_A : \mu > 5.0$ is conducted at the 5% level. 4 blood samples are taken and used to test the hypothesis. Using the applet below what is the chance the **statistical test can detect** a person with dangerously high potassium (when $\mu = 6.0$).

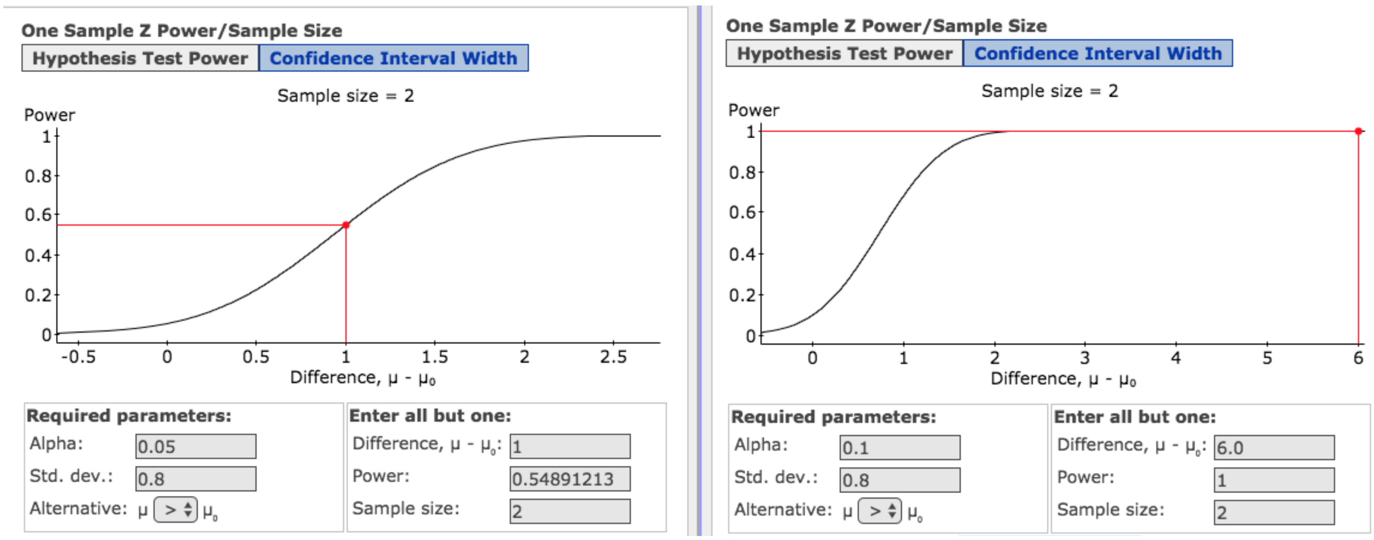


(A) 5% (B) less than 50% (C) 50% (D) Between 60-90% (E) More than 95%.

(15) High potassium is diagnosed if the mean amount of potassium in blood is **greater than** 5.0mg/ml.

To determine whether someone has high potassium **two** blood samples are taken. The standard deviation for each blood sample is known to be $\sigma = 0.8mg/ml$. We test the hypothesis $H_0 : \mu \leq 5.0$ vs $H_A : \mu > 5.0$, using the average the average of the two blood samples. The test is done at the **5**% level.

A person has **critically high potassium** if their mean level is 6.0. A power analysis is given below. Which statement is correct?



(A) The p-value is 100% and there is evidence the person has critically high potassium.

(B) The p-value is 55% and there is no evidence the person has critically high potassium.

(C) We see that there is a **100%** chance of the statistical test rejecting the null and diagnosing person with critically high potassium.

(D) We see that there is a **45%** chance of the statistical test rejecting the null and diagnosing a person with critically high potassium.

(E) We see that there is a **55%** chance of the statistical test rejecting the null and diagnosing a person with critically high potassium.

(16) In a statistical test the significance level is **increased** from 5 to 10%. Which statement(s) are true?

(A) The number of false positives (type I error) will **decrease**.

(B) The number of false positives (type I error) will **increase**

(C) The testing procedure will be less able to detect the alternative (power decreases).

(D) [A] and [C] (E) [B] and [C].