Name _____   **Elementary Statistics**

When finished submit your answers by following the appropriate link on my Assignments page.
If you feel the answer is none of the choices given, submit no answer to the question.

1. The statement "If there is sufficient evidence to reject a null hypothesis at the 5% significance level, then there is sufficient evidence to reject it at the 10% significance level" is

   (A) Always True
   (B) Never True
   (C) Sometimes True; the *p*-value for the statistical test needs to be provided for a
         conclusion
   (D) Not Enough Information; this would depend on the type of statistical test used

2. When testing a new drug, scientists measure the amount of the active ingredient that is absorbed by the body.   In a study done at the Colorado School of Mines, a new antifungal medication that was designed to be applied to the skin was tested. The medication was applied to the skin of eight adult subjects. One hour later, the amount of active ingredient that had been absorbed into the skin was measured for each subject. The results, in micrograms, were

1.28	1.36	2.01	3.20	1.00	2.50	3.36	3.50

   Is the mean amount absorbed greater than 2 micrograms. Use the $\alpha = 0.05$ level of significance.   *p*-value = 0.231, Fail to reject Ho

   (A) Yes   **(B) No**

3. One of the measurements used to determine the health of a person's lungs is the amount of air a person can exhale under force in one second.   This is called forced expiratory volume in one second, and is abbreviated FEV_1.   Assume the mean FEV_1 for 10-year-old boys is 2.1 liters that the population standard deviation is $\sigma = 0.2$.   A random sample of 53 10-year-old boys live in a community with high levels of ozone pollution are found to have a sample mean FEV_1 of 2.09 liters.   Can you conclude that the mean FEV_1 in the high-pollution community differs from 2.1 liters?   *p*-value = 0.715, Fail to reject Ho

   (A) Yes   **(B) No**

4. Vertical banded gastroplasty is a surgical procedure that reduces the volume of the stomach in order to produce weight loss. In a recent study, 52 patients with Type 2 diabetes underwent this procedure, and 32 of them experienced a recovery from diabetes. At the 0.01 significance level, can we conclude that a majority of those with Type 2 diabetes who undergo this surgery will recover from diabetes?   *p*-value = 0.048, Fail to reject Ho

   A) Yes   **(B) No**

5. The anterior cruciate ligament (ACL) runs diagonally in the middle of the knee. An article reported results for 80 young athletes who suffered anterior cruciate ligament (ACL) injuries. Of the 80 injuries, 45 were to the left knee and 35 were to the right knee. In testing if more than half of ACL injuries are to the left knee, the p-value for testing the null hypothesis $p = 0.50$ versus the alternative hypothesis $p > 0.50$ is

(A) 0.263   **(C) 0.131**

(B) 0.035   **(D) 0.868**

6. Mercury is a toxic metal that is used in many industrial applications. Seven measurements, in milligrams per cubic meter, were taken of the mercury concentration in a lake. Assume that the population of measurements is approximately normally distributed. If the sample standard deviation is 0.197, can you conclude that the mean concentration is greater than 1 milligram per cubic meter? Use the 0.02 level of significance.
blank no sample mean given   or (B) No
(A) Yes   **(B)** No

7. When the light turns yellow, should you stop or go through it? A 2011 article defines the "indecision zone" as the period when a vehicle is between 2.5 and 5.5 seconds away from an intersection. At the intersection of Route 7 and North Shrewsbury in Clarendon, Vermont, 150 vehicles were observed to encounter a yellow light in the indecision zone, and 21 of them ran the red light. At the intersection of Route 62 and Paine Turnpike in Berlin, Vermont, 175 vehicles entered the intersection in the indecision zone, and 20 ran the red light. Can you conclude that the proportion of red-light runners differs between the two intersections? p-value = 0.486, Fail to reject Ho

(A) Yes   **(B) No**

8. Measurements of the sodium content in samples of two brands of chocolate yielded the following results: Brand A - $n = 9$, $s = 2.642$, Brand B - $n = 13$, $s = 6.409$. Can you conclude, at the 1% significance level, that the sodium content is more variable in Brand B ? (Assume that sodium content is normally distributed.) p-value = 0.008, Reject Ho

(A) Yes   **(B)** No

9. A group of five individuals with high blood pressure were given a new drug that was designed to lower blood pressure. Systolic blood pressure was measured before and after treatment for each individual. the table at the right. Can we conclude that the drug does reduce systolic pressure?
        p-value = 0.000, Reject Ho
(A) Yes   **(B)** No

Patient	Before	After
1	170	145
2	164	132
3	168	129
4	166	140
5	183	145

10. N95 masks are made of a polypropylene material that goes through a process where it's melted and extruded through small-diameter holes into hundreds of tiny fibers that are tangled together. The meltblown fibers are randomly oriented with diameters ranging from 1-10 micrometers. A quality control engineers measures the diameters of the fibers and tests $H_o: \mu = 5$ *versus* $H_a: \mu \neq 5$. If a Type I error is made, what conclusion will be drawn regarding the average diameter of the fibers?

(A) The mean fiber diameter is equal to 5 micrometers.   OR

(B) The mean fiber diameter is not equal to 5 micrometers.

11. If a Type II error is made in the preceding problem, , what conclusion will be drawn regarding the average diameter of the fibers?

(A) The mean fiber diameter is equal to 5 micrometers. .   OR

(B) The mean fiber diameter is not equal to 5 micrometers

- Four different types of solar energy collectors were tested. Each was tested at four randomly chosen times, and the power (in watts) was measured, The results are listed in the table below. We have sampled to conclude whether there is a difference in the average energy output from each the four solar energy collectors.

Collector A	Collector B	Collector C	Collector D
1.9	1.6	1.2	1.4
1.6	1.5	0.9	1.0
2.0	1.6	1.2	1.4
1.8	1.9	0.9	1.3

12. We could test the averages from the solar collectors against each other in unique pairs. How many separate tests would that demand?

(A) 4   **(B)** 16   **(C) 6**   **(D)** 8

13. What hypotheses testing method should be used?

(A) ANOVA   (C) McNemar's Test
(B) Matched Pairs Test   (D) Shapiro-Wilk Test

14. In order to use the test specified in problem 18, what three (3) conditions must be satisfied with samples above?
       normal populations, independent samples, approx. equal sample variances

15. From the sample data, there does seem to be significant evidence that there is a difference in the average energy output from each the four solar energy collectors. Why? (Be specific)
       p-value = 0.000,   TS = 15.84, CV$_F$ = 3.490 Reject Ho