Inference for Distributions: 11.1 Matched Pairs (1 sample, 2 treatments)

Use a separate sheet of paper. You must show all work and all steps must be clearly labeled. Submitting just answers will result in a grade of 0! All unexplained numbers will be ignored and final answers must be written in complete sentences.

1. Social psychologists at the University of California at Berkeley wanted to study the effect that staring at drivers would have on driver behavior (Ellsworth, Carlsmith, and Henson, 1972). In a randomized experiment, the researchers either stared or did not stare at the drivers of automobiles stopped at a campus stop sign. The researchers timed how long it took each driver to proceed from the stop sign to a mark on the other side of the intersection. Suppose that the crossing times, in seconds, gave the following output:

Group	N	Mean	StDev
NoStare	14	6.63	1.360
Stare	13	5.59	0.822

   a. Compute and interpret a 99.5% confidence interval for the difference between the mean crossing times.
   b. What assumptions would we need to make to feel our calculations are accurate?

2. An educational psychologist has developed an instructional program for children designed to promote creative thinking. To test the effectiveness of this program, 7 fifth - grade children were selected at random from all the fifth-graders attending Lake Elementary School. The students were randomly assigned to take the regular program or the new program and then after a period of time they were instructed in the other program. The measure of creativity in this test is based on the number of ways a child can think to use common, everyday objects. A higher score implies more creativity.

Student	1	2	3	4	5	6	7
Regular Program	15	8	19	4	16	9	11
New Program	21	11	16	5	20	7	16

   Run a test of significance to test if the new program improves creativity. Use an alpha level of .01.

3. A growing number of employers are trying to hold down the costs that they pay for medical insurance for their employees. As part of this effort, many medical insurance companies are now requiring clients to use generic brand medicines when filling prescriptions. An independent consumer advocacy group wanted to determine if there was a difference, in milligrams, in the amount of active ingredient between a certain "name" brand drug and its generic counterpart. Pharmacies may store drugs under different conditions. Therefore, the consumer group randomly selected ten different pharmacies in a large city and filled two prescriptions at each of these pharmacies, one for the "name" brand and the other for the generic brand of the drug. The consumer group's laboratory then tested a randomly selected pill from each prescription to determine the amount of active ingredient in the pill. The results are given in the following table.

ACTIVE INGREDIENT
(in milligrams)

Pharmacy	1	2	3	4	5	6	7	8	9	10
Name brand	245	244	240	250	243	246	246	246	247	250
Generic brand	246	240	235	237	243	239	241	238	238	234

   Based on these results, what should the consumer group's laboratory report about the difference in the active ingredient in the two brands of pills? Give appropriate statistical evidence to support your response.

4. The design of controls and instruments affects how easily people can use them. A student project investigated this effect by asking 25 right-handed students to turn a knob (with their right hands) that moved an indicator. There were two identical instruments, one with a right-hand thread and the other with a left-hand thread. The following table gives the times in seconds each subject took to move the indicator a fixed distance:

Subject	Right thread	Left thread	Subject	Right thread	Left thread
1	113	137	14	107	87
2	105	105	15	118	166
3	130	133	16	103	146
4	101	108	17	111	123
5	138	115	18	104	135
6	118	170	19	111	112
7	87	103	20	89	93
8	116	145	21	78	76
9	75	78	22	100	116
10	96	107	23	89	78
11	122	84	24	85	101
12	103	148	25	88	123
13	116	147			

For right-handed people, are right-hand threads easier to use? Use $\alpha = .01$

5. A random sample of students from a high school were chosen to determine if their sitting pulse rate was lower than their standing pulse rate. Each student's pulse rate was measured in both positions.

Sitting	62	74	82	88	82	66	64	84	72	82	80	72	64	62
Standing	68	78	80	92	58	96	72	100	82	76	92	74	60	58

Can we conclude the sitting pulse rate is lower?

6. Suppose it is possible to measure a slow learners' "reading IQs" before they are subjected to a teaching method. Eight pairs of slow learners with similar reading IQs are found, and one member of each pair is randomly assigned to the standard teaching method while the other is assigned to the new method. The data are given below. Do the data support the hypothesis that the population mean reading test score for slow learners taught by the new method is greater than the mean reading test score for those taught by the standard method?

Pair	New Method	Standard Method
1	77	72
2	74	68
3	82	76
4	73	68
5	87	84
6	69	68
7	66	61
8	80	76

7. A study is conducted to see how effective aspirin is in reducing temperature in children. A sample of 7 children suffering from influenza had their temperatures taken immediately before and 1 hour after administration of aspirin. The results are given below. We would like to conduct a paired differences t-test for this situation. The data follow.

Patient	Temperature Before	Temperature After
1	99.7	99
2	101.7	100.9
3	101.7	100.8
4	100.7	99
5	101.7	98.4
6	103.7	103.5
7	99.7	97

Note: *Children under 17 should not be given aspirin unless advised by a physician, due to the possibility of Reyes Syndrome, a disease affecting the liver and brain.*

   a. What are the appropriate hypotheses for testing whether aspirin reduces fever?
   b. Calculate the sample mean difference for these data. (When calculating differences, subtract the before temperature from the after temperature (after-before).)
   c. Calculate the sample standard deviation of the differences.
   d. Calculate the appropriate test statistic for a matched pairs t-test for these data.
   e. Does our data support the claim that taking the aspirin reduces children's temperatures?

7. Male high school students taking AP Statistics have been know to exaggerate their height. To test the claim 12 male students were asked how tall they were and were then measured with a precise measuring device and method. The table below shows the reported and measured heights for the 12 males.

Male Statistics Students

Student	A	B	C	D	E	F	G	H	I	J	K	L
Reported Height	68	74	82.25	66.5	69	68	71	70	70	67	68	70
Measured Height	66.8	73.9	74.3	66.1	67.2	67.9	69.4	69.9	68.6	67.9	67.6	68.8
Difference	1.2	0.1	7.95	0.4	1.8	0.1	1.6	0.1	1.4	-0.9	0.4	1.2

outlier

   a. Using the sample data (with the outlier excluded), construct a 95% confidence interval on the differences and interpret the results.
   b. Does the evidence support the claim that male stat students deliberately exaggerate their height? Explain.