

**A.P. Statistics**  
**Assignment 8.6**

**Remember to show your thinking through your work.**

- 1) Below is the formula we used to find the test statistic  $t$  for a single sample. Copy and paste the formula into the answer box and adjust it to find the test statistic  $t$  for the 2-sample interval.

$$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$$

- 2) A bank compares two proposals to increase the amount that its credit card customers charge on their cards. (The bank earns a percentage of the amount charged, paid by the stores that accept the card.) Proposal A offers to eliminate the annual fee for customers who charge \$2400 or more during the year. Proposal B offers a small percent of the total amount charged as a cash rebate at the end of the year. The bank offers each proposal to an SRS of 150 of its existing credit card customers. At the end of the year, the total amount charged by each customer is recorded. Here are the summary statistics:

Group	n	x	s
A	150	\$1987	\$392
B	150	\$2056	\$413

- (a) Do the data show a significant difference between the mean amounts charged by customers offered the two plans? Carry out a complete test.

- (b) The distributions of amounts charged are skewed to the right, but outliers are prevented by the limits that the bank imposes on credit balances. Do you think that skewness threatens the validity of the test? Explain your answer.

- 3) In a study of cereal leaf beetle damage on oats, researchers measured the number of beetle larvae per stem in small plots of oats after randomly applying one of two treatments: no pesticide or Malathion at the rate of 0.25 pound per acre.

<b>Control:</b>	2	4	3	4	2	3	3	5	3	2	6	3
<b>Treatment:</b>	0	1	1	2	1	2	1	1	2	1	1	1

Is there significant evidence at the 1% level that the mean number of larvae per stem is reduced by Malathion? Carry out a complete test.

- 4) In a study of heart surgery, one issue was the effect of drugs called beta-blockers on the pulse rate of patients during surgery. The available subjects were divided at random into two groups of 30 patients each. One group received a beta-blocker; the other, a placebo. The pulse rate of each patient at a critical point during the operation was recorded. The treatment group had mean 65.2 and standard deviation 7.8. For the control group, the mean was 70.3 and the standard deviation was 8.3.

- (a) Do beta-blockers reduce the pulse rate at the 5% level? At the 1% level? Carry out a complete test.

- (b) Give a 99% confidence interval for the difference in mean pulse rates.

- 5) College financial aid offices expect students to use summer earnings to help pay for college. But how large are these earnings? One college studied this question by asking a sample of students how much they earned. Omitting students who were not employed, 1296 responses were received. Here are the data in summary form:

<b>Group</b>	<b>n</b>	<b>x</b>	<b>s</b>
<b>Males</b>	675	\$3297.91	\$2394.65
<b>Females</b>	621	\$2380.68	\$1815.55

- (a) Use the two-sample t procedures to give a 90% confidence interval for the difference between the mean summer earnings of male and female students.

- (b) The distribution of earnings is strongly skewed to the right. Nevertheless, use of t procedures is justified. Why?

- (c) Once the sample size was decided, the sample was chosen by taking every  $k^{\text{th}}$  name from an alphabetical list of undergraduates. Is it reasonable to consider the sample as two SRSs chosen from the male and female undergraduate populations?

- 6) The pesticide DDT causes tremors and convulsions if it is ingested by humans or other mammals. Researchers seek to understand how the convulsions are caused. In a randomized comparative experiment, 6 white rats poisoned with DDT were compared with a control group of 6 un-poisoned rats. Electrical measurements of nerve activity are the main clue to the nature of DDT poisoning. When a nerve is stimulated, its electrical response shows a sharp spike followed by a much smaller second spike. Researchers found that the second spike is larger in rats fed DDT than in normal rats. This observation helps biologists understand how DDT causes tremors. The researchers measured the amplitude of the second spike as a percentage of the first spike when a nerve in the rat's leg was stimulated.

<b>Poisoned rats</b>	12.207	16.869	25.050	22.429	8.456	20.589
<b>Un-poisoned rats</b>	11.074	9.686	12.064	9.351	8.182	6.642

Normal probability plots show no evidence of outliers or strong skewness. Both populations are reasonably normal, as far as can be judged from 6 observations. The difference in means is quite large, but in such small samples the sample mean is highly variable. A significance test can help confirm that we are seeing a real effect. Because the researchers did not conjecture in advance that the size of the second spike would increase in rats fed DDT, we test

$$H_0: \mu_1 = \mu_2$$

$$H_a: \mu_1 < \mu_2$$

Carry out the complete significance test.

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