Extra Problems - t tests

1. A manufacturer of running shoes knows that the averagelifetime for a particular model of shoes is 15 months. Someone in the research and development division of the shoe company claims to have developed a longer lasting product. This new product was worn by 30 individuals and lasted on average for 17 months. The variability of the original shoe is estimated based on the standard deviation of the new group which is 5.5 months. Is the designer's claim of a better shoe supported by the trial results? Please base your decision on a two tailed testing using a level of significance of $p < .05$.

2. Average heart rate for Americans is 72 beats/minute. A group of 25 individuals participated in an aerobics fitness program to lower their heart rate. After six months the group was evaluated to identify is the program had significantly slowed their heart. The mean heart rate for the group was 69 beats/minute with a standard deviation of 6.5. Was the aerobics program effective in lowering heart rate?

3. A research team wants to investigate the usefulness of relaxation training for reducing levels of anxiety in individuals experiencing stress. They identify 30 people at random from a group of 100 who have "high stress" jobs. The 30 people are divided into two groups. One group acts as the control group - they receive no training. The second group of 15 receive the relaxation training. The subjects in each group are then given an anxiety inventory. The summarized results appear below where higher scores indicate greater anxiety.

Control	Relaxation
$\overline{X} = 30$	$\overline{X} = 26$
S = 6.63	S = 6.20
n = 15	n = 15

4. A colleague of the investigators is problem 3 repeats the experiment but matches the samples on the dimensions of sex and job type. the raw data appear below. Evaluate her experiment using the criteria of $p < .05$. Assume it is a two tailed test.

Pairs:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Contr:	38	40	35	36	35	32	31	30	28	26	24	21	18	34	22
Relax:	35	32	30	34	30	32	28	27	22	22	18	17	17	25	21

Answer Key – t test extra problems

1. This is a problem that requires a t test for single samples. You have been given the fact that the population mean is 15. The sample mean is 17 with a standard dev. of 5.5.
Step One: Generally you should start by computing the st. dev. but that has been done so you can move on to computing the st. error. In this case st. error = 1.00
Step Two: Compute t using the sample mean, pop mean and st. error. In this case, t = 2.00
Step Three: Evaluate. The crit. value of t for a two tailed test is 2.045, for a one tailed test is 1.699. So, if you wrote a two tailed test you must accept the null. If you wrote a one tailed test you must reject the null and accept the alternative.
2. The pop. mean is given as 72 beats per minutes. The sample of 25 has an average of 69 with a standard dev. of 6.5.
Step One: Again you need to solve for st. error. St. error = 1.30
Step Two: Solve for t test for single samples t = -2.31
Step Three: Evaluate. The critical value is 2.064. The computed value exceeds this value so there is a significant effect of the ind. var. of fitness.

3. You have no info about the population and there are two samples so this calls for a t test for independent samples. You can use the shortened version of the t formula if you want since the size of each sample is the same. Remember that the value that is given is the st. dev. of each sample and that the formula (either one) requires the variance so that the first thing to do is to square each of the st. dev.s. The numerator of the t formula is 4. The denominator is 2.34. The overall t value is 1.71. The critical value at df = 28 is 2.048 so that this outcome is not statistically significant.

4. This last problem is a t test for matched samples. In order to solve this you must first find D - the difference between the control subject and the relaxation subject in each matched pair. The sum of D= 60, the mean value of D = 4 and the sum of D squared is 332. The st. dev. of D = 2.56 and the st. error equals .66. This makes t = 6.06. When you evaluate this the critical value at df = 15-1 or 14 is 2.145. The computed t value exceeds this and so it is a significant outcome. The relaxation group is significantly different than the control group.