1. A stats teacher wants to determine the effectiveness of her statistics lesson. She gives a simple skills test to nine students before the start of class (a pre-test) and another test to the same students at the end of class (a post-test). Conduct the appropriate test to determine her effectiveness.

Student	Pre-test	Post-test
1	78	80
2	67	69
3	56	70
4	78	79
5	96	96
6	82	84
7	84	88
8	90	92
9	87	92

 H_0 : $\mu_d = 0$ H_1 : $\mu_d \neq 0$

d values: {2,2,14,1,0,2,4,2,5}

$$t = \frac{\bar{d}}{s/\sqrt{n}}$$

d = Post-test - Pre-test d-bar = 3.5556; s_d = 4.1866; t = 2.5478, p-value = 0.0343 $t_{critical}$ = \pm 2.306 at 8df

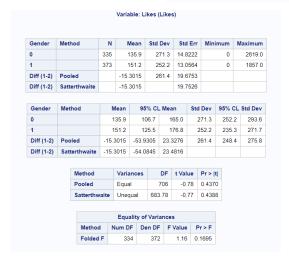
Reject NULL. There is enough evidence to conclude at .05 level that her stats class was effective. We can also conclude that, t-value being positive, it was effective in a positive way. (I didn't presume positive effect by doing right tailed t test and tested if the class was effective or not.)

2. Using the Facebook dataset, conduct the appropriate test to determine if males and females (0 = female, 1 = male in sas dataset) differ in terms of

a. number of friends $H_0: \mu_{male} = \mu_{female}$ $H_1: \mu_{male} \neq \mu_{female}$ b. posts $H_0: \mu_{male} = \mu_{female}$ $H_1: \mu_{male} \neq \mu_{female}$ c. number of likes $H_0: \mu_{male} = \mu_{female}$ $H_1: \mu_{male} \neq \mu_{female}$ $H_1: \mu_{male} \neq \mu_{female}$







- **a)** Since the p-value at Equality of Variances is less than alpha (.05), we can conclude that the two variances are unequal. Therefore, we need to check the Satterthwaite test. The P-value is calculated as 0.0018 < a (0.05), concluding reject NULL. There is a significant difference in the number of friends between males and females.
- **b)** Since the p-value at Equality of Variances is less than alpha (.05), we can conclude that the two variances are unequal. Therefore, we need to check the Satterthwaite test. The P-value is calculated as 0.7072 > a (0.05), concluding fail to reject NULL. There is not a significant difference in posts between males and females.
- **c)** Since the p-value at Equality of Variances is greater than alpha (.05), we can conclude that the two variances are equal. Therefore, we can check the Pooled test. The P-value is calculated as 0.4370 > a (0.05), concluding fail to reject NULL. There is not a significant difference in the number of likes between males and females.

3. Records of 40 used passenger cars and 40 used pickup trucks (none used commercially) were randomly selected to investigate whether there was any difference in the meantime in years that they were kept by the original owner before being sold. For cars, the mean was 5.3 years with standard deviation 2.2 years. For pickup trucks, the mean was 7.1 years with standard deviation 3.0 years. Test the hypothesis that there is a difference in the means against the null hypothesis that there is no difference. Use the 1% level of significance.

H₀:
$$\mu_{\text{truck}} = \mu_{\text{car}}$$

H₁: $\mu_{\text{truck}} \neq \mu_{\text{car}}$

$$t = \frac{(\overline{x_1} - \overline{x_2})}{\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}}$$

$$t = (\frac{(7.1 - 5.3)}{\sqrt{\frac{3.0^2}{40} + \frac{2.2^2}{40}}}$$

$$= 3.0601$$

 $df = minimum of (n_1-1) or (n_2-1)$ So df = 39

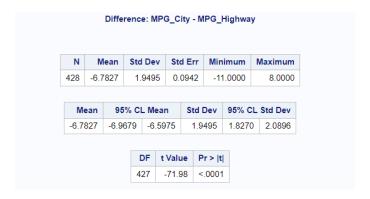
t-critical = ± 2.7079 p-value (0.004) < a (0.01)

t-calculated = 3.0601

Reject H_0 – we can conclude at .1 level that there is a significant difference in the meantime that truck owners and car owners keep their vehicles before they sell them.

4. Using the cars dataset, conduct the appropriate test to determine if there is a significant difference between the miles per gallon that we can expect between city driving and highway driving conditions (MPG_city and MPG_highway)

 $H_0: \mu_d = 0$ $H_1: \mu_d \neq 0$



With a t Value of -71.98 and a very small p-value of less than .0001, which is less than our nominal alpha of .05, we reject the NULL and conclude that there is a significant difference between the miles per gallon used between city and highway driving.