NORTHWESTERN UNIVERSITY | SCHOOL OF CONTINUING STUDIES

Handout: Problem Set #6 Solutions

PREDICT 401: Introduction to Statistical Analysis

These problem sets are meant to allow you to practice and check the accuracy of your work. Please do not review the solutions until you have finalized your work. Although these problem sets are not submitted and graded, treat them as if they were. It is to your great benefit to work on and even struggle with the problem sets. Looking at the solutions before finalizing your work will, quite simply, make for a less meaningful learning experience.

1. This problem comes from Sirkin (2005, p. 273). A tolerance index has been developed that is designed to measure one's tolerance of "unpopular" beliefs such as those of a racist or sexist nature. On the scale, 0 means the lowest level of tolerance and 15 the highest level. A random sample of 10 university students (Group 1) is scored along the index. A second sample (Group 2) of students from the same university is a sample of students who had recently attended a workshop on multicultural diversity. Making no directionality assumption in H1, test a null hypothesis that there is no difference in tolerance between the two populations.

Group 1 (control) x1=	Group 2 (workshop) x2=
2	4
3	4
3	4
4	5
4	5
5	6
5	6
5	7
6	7
6	7

Answer:

This is a case of testing independent samples.

1. **H_o: $\mu_1 = \mu_2$**
   H_a: $\mu_1 \neq \mu_2$

2. **xbar1 = 43/10 = 4.3**
   xbar2 = 55/10 = 5.5
   $s_1^2 = [201-(43)^2/10] / 10 = 1.61$
   $s_2^2 = [317-(55)^2/10] / 10 = 1.45$

3. **Perform F-test**
   F = 1.61/1.45 = 1.11
   Degrees of freedom of numerator = 9
   Degrees of freedom of denominator = 9

   F-table tells us that the critical value of F at 0.05 is approximately 3.20

4. **Since 1.11 < 3.2, we cannot reject the null that the variances are equal. This tells us that we can assume equal population variances for the t test.**

5. $$t = \frac{xbar1 - xbar2}{\frac{(n1s1\text{^}2^2 + n2s2\text{^}2^2)}{n1+n2-2} * (\frac{1}{n1} + \frac{1}{n2})} = \quad -1.2 \,/\, \overline{\frac{10*1.61\ +(10*1.45)}{10+10-2} * (\ \frac{1}{10}\ \ + (\frac{1}{10}))}$$

   ***t* = -2.058**

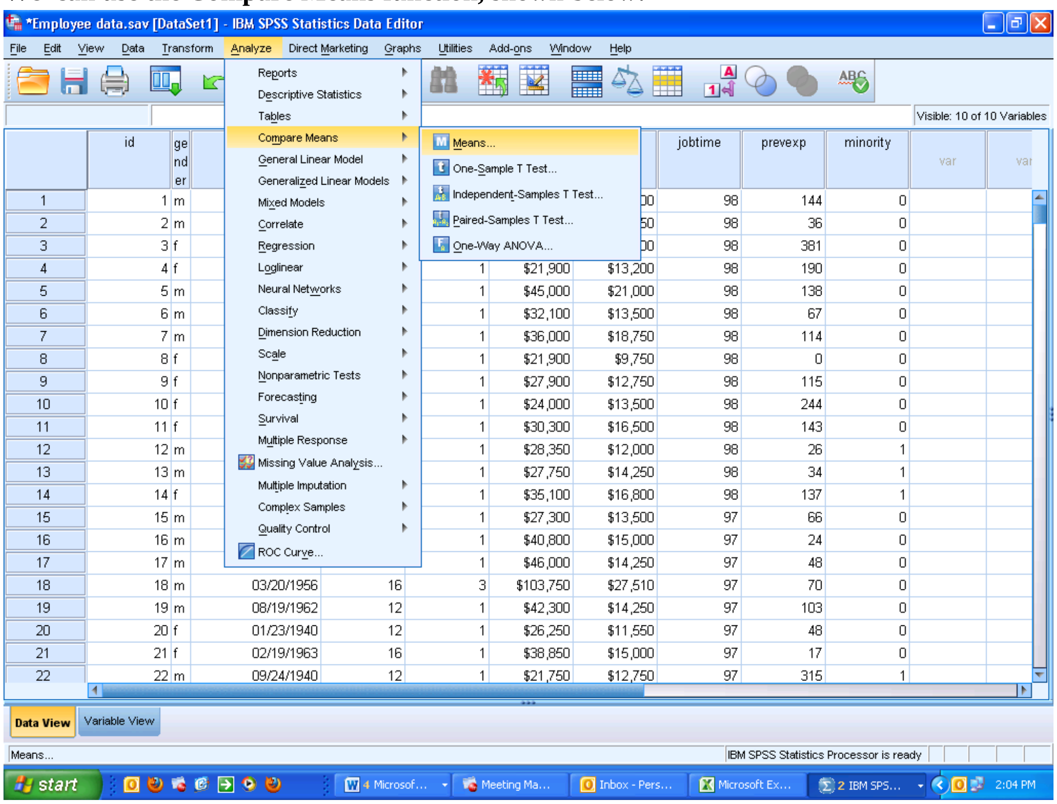
Degrees of freedom = 10 + 10 – 2 = 18.

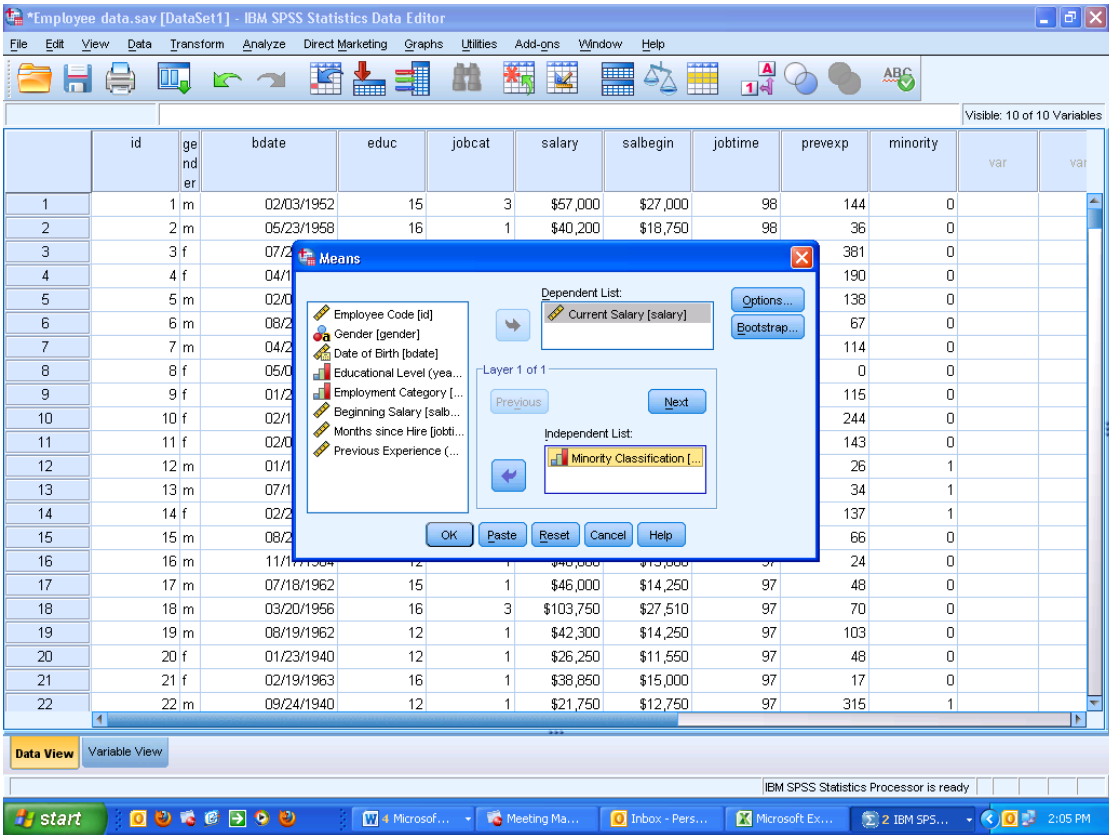
6. **Using the t-table for a two-tailed (non-directional) test, we see that the critical value of t at 0.05 with d.f. 18 = 2.101. Since 2.058 is less than 2.101, we cannot reject the null hypothesis that the two means are the same. In other words, the means are not statistically significantly different from one another. If we were to generalize this to a broader population, we would not be convinced that the two populations would have different levels of tolerance.**

2. Use SPSS and the “Employee data” dataset.

   a. What is the mean salary for minorities and non-minorities?

   We can use the Compare Means function, shown below:





Report

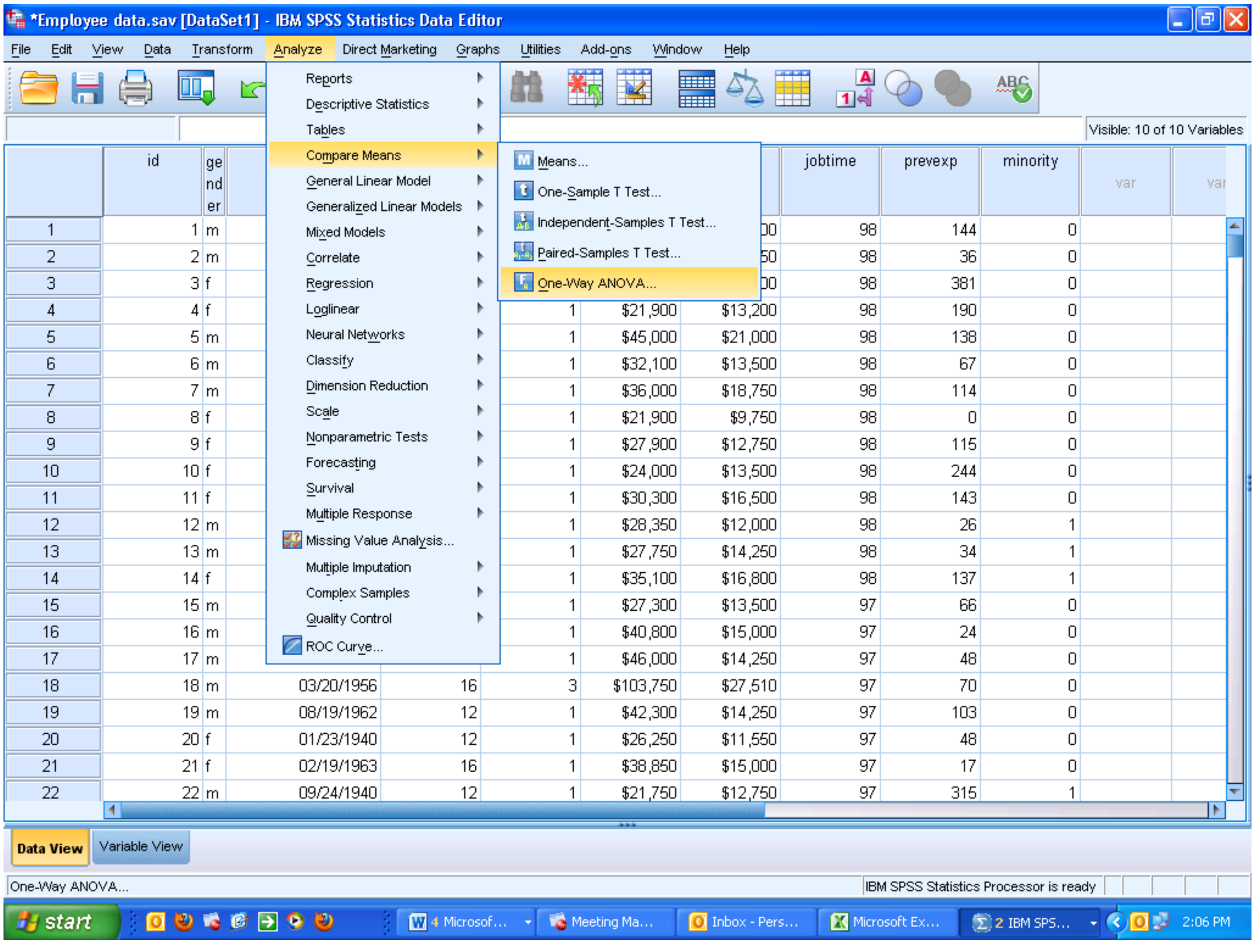
Current Salary

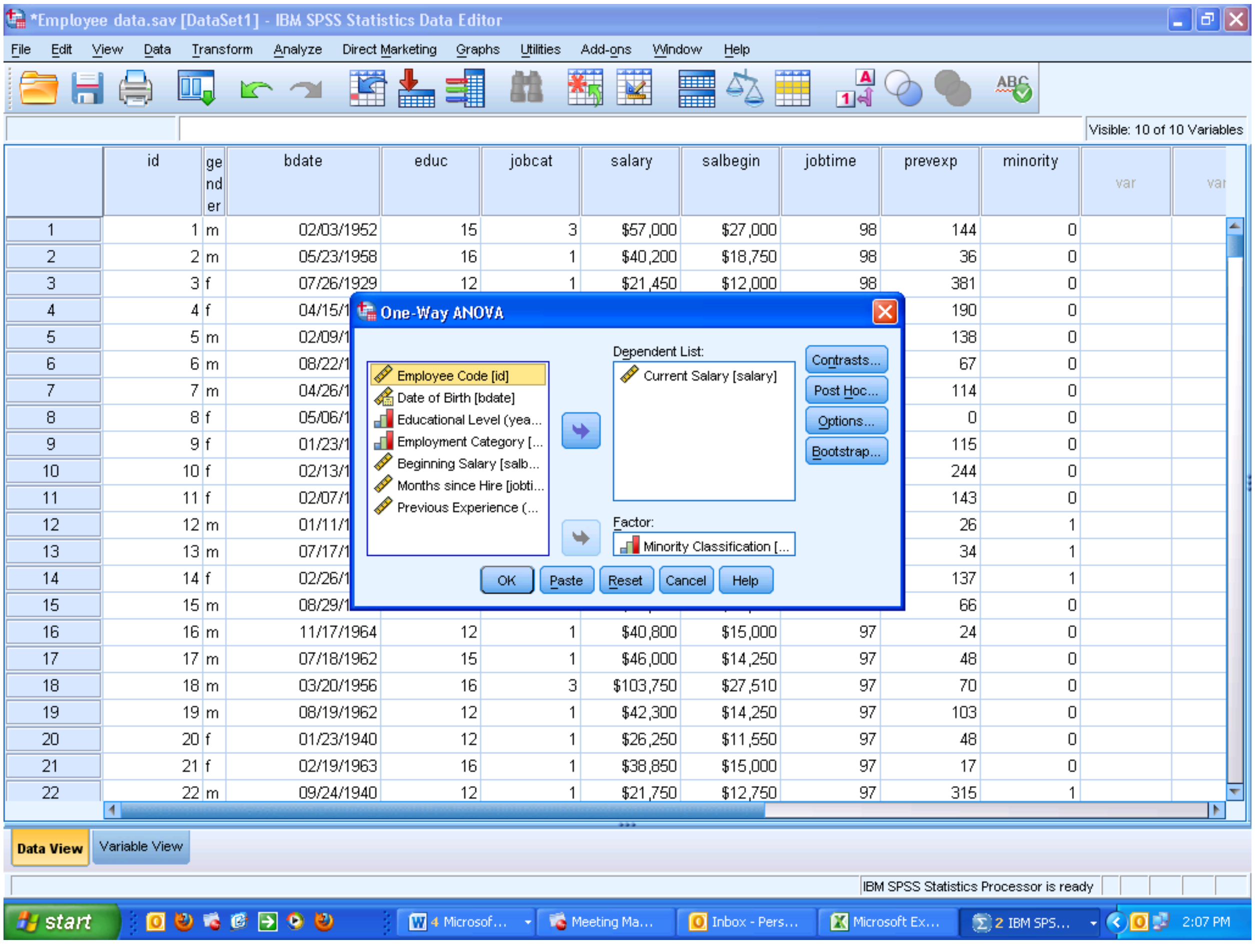
Minority Classification	Mean	N	Std. Deviation
No	$36,023.31	370	$18,044.096
Yes	$28,713.94	104	$11,421.638
Total	$34,419.57	474	$17,075.661

This output shows that minorities make an average of $28,713.94 and non-minorities make an average of $36,023.31.

b. What does the ANOVA function here tell us about the relationship between salary and minority status?

First, we use the ANOVA function as shown below:





The ANOVA output looks like the following:

ANOVA

Current Salary

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.337E9	1	4.337E9	15.326	.000
Within Groups	1.336E11	472	2.830E8		
Total	1.379E11	473			

This ANOVA output tells us that the variation between groups is significantly higher than the variation within groups. The ration of the between group to within group variation is 4.34 x 10^9 / 2.83 x 10^8, or 15.326. Using an F-table at a 0.05 significant level, we can see that the critical value of F is somewhere in the low 1s (Perhaps around 1.1?). Here, F = 15.326, which is greater than the critical value of F, which means that we reject the null hypothesis that the mean salary of the two populations are the same. That is, if we were to generalize this out to a broader population, we would strongly believe that non-minorities earn more than minorities.

