

# A S S I G N M E N T 5

*Due date: 12:00noon, 9 May, 2018*

1. Suppose that the thickness of a part used in a semiconductor is its critical dimension and that measurements of the thickness of a random sample of 18 such parts have the variance 0.68, where the measurements are in thousandths of an inch. The process is considered to be under control if the variation of the thickness is given by a variance not greater than 0.36. Assume that the measurements constitute a random sample from a normal population. Is the variance significantly greater than 0.36 at the 0.05 level?
  
2. A petroleum company will soon have to switch a large proportion of its production from a formulation containing tetra-ethyl lead to a lead-free formulation. An important quality characteristic of gasoline is the road octane number. If the gasoline with a road octane number that is too low for the engine compression is used, excessive knocking will result. The company has formulated the lead-free product so that its road octane number should be identical to that of the older, lead-containing product. An experiment is performed in which 10 observations on road octane number are obtained for each product formulation. These data are

Contains lead	89.5	90.0	91.0	91.5	92.5	91.0	89.0	89.5	91.0	92.0
Contains no lead	89.5	91.5	91.0	89.0	91.5	92.0	92.0	90.5	90.0	91.0

- (a) Test at the 0.02 significance level whether the two formulations have the same variance.
  - (b) Assuming that the two variances are the same, test at the 0.05 significance level whether the difference in mean is significant.
  
3. An experiment is performed to determine whether the average nicotine content of one kind of cigarette exceeds that of another kind by 0.2 mg. If 50 cigarettes of the first kind had an average nicotine content of 2.61 mg with a standard deviation of 0.12 mg, whereas 40 cigarettes of the other kind had an average nicotine content of 2.38 mg with a standard deviation of 0.14 mg, is the mean of the first kind exactly 0.20 mg more than the mean of the second kind? Assuming that the sample sizes are large enough to use normal to approximate  $t$ -distribution, what can you conclude at the 0.05 significance level without assuming equality between the two variances?
  
4. To test the effectiveness of a new seasickness remedy, a random sample of 60 passengers on cruise ship were given a pill containing the medication and a random sample of 60 other passengers were given a placebo containing only sugar on the evening before anticipated rough seas. If 21 of the passengers in the first group and 30 of the passengers in the second group got seasick during the night, what can we conclude at the 0.01 significance level about the effectiveness of the new remedy?

5. An experiment was conducted to determine the degree of relief provided by three cough remedies and yielded the following data:

		Cough Remedy		
		NyQuil	Robitussin	Triaminic
Effectiveness	No relief	82	70	62
	Some relief	93	62	67
	Total relief	25	18	21

Do the three cough remedies have the same effectiveness? (Test at the 0.05 significance level.)

6. Mendelian theory indicates that the shape and colour of a certain variety of pea ought to be grouped into four groups, “round and yellow”, “round and green”, “angular and yellow” and “angular and green”, according to the ratios 9:3:3:1. In his experiments he observed 315 were round and yellow, 108 were round and green, 101 were angular and yellow, and 32 were angular and green. Is there any evidence to doubt his theory at the 0.05 significance level?
7. A lecturer wished to compare three methods for teaching Statistics to first year students and obtained the following measurements of the effectiveness of the teaching methods:

	Teaching Method		
	A	B	C
	70	90	100
	80	90	100
	90	90	120
	100	90	120
	110	120	140

Assume that the measurements are normally distributed with equal variance. Construct the ANOVA table for the data and determine whether or not the teaching methods are significantly different at the 0.05 significance level?