

EEB 596z, Problem Set Two

Due Thursday 24 Jan 2002

1 : Suppose you are studying the number of visitations of a pollinator to a flower. Your hypothesis is that yellow flowers are better than red flowers (in terms of pollinator attraction). Previous studies have found that the number of visitors to red flowers follows a normal distribution with a mean of 200 visits per flower and a variance of 50. Suppose in a sample of 20 yellow flowers that the mean number of visits is 202 with a known variance (of visits per flower) of 50. Again, assume the number of visitors is normally distributed.

- (a) What is the probability of this data under the null hypothesis (yellow and red flowers are equivalent)?
- (b) What is the critical value for a (two-sided) test of the null hypothesis at the $\alpha = 0.05$ level?
- (c) What are the values for (a) and (b) when the variance for yellow flowers (50) is instead a SAMPLE variance (i.e., an estimate of the true variance)? Hint: Would you now use a normal or a t distribution?
- (d) Suppose that yellow flowers are indeed better. Given the sample size (20) and assuming the variance (50) is the true value, how small an effect can we detect using a (two-sided) test of significance of $\alpha = 0.05$ with 80% power?
- (e) Repeat the calculation in (d) assuming that the variance (50) is now an estimated value, not necessarily the true value.
- (f) Suppose the true mean and variance for yellow flowers are 201 and 10. How large a sample size is required to have a power of 80 percent of detecting a difference between red and yellow using a test of significance with level $\alpha = 0.05$? Compute this for both the normal (variance assumed know) and t (variance estimated) settings.
- (g) If the true variance for yellow is 35, what is the probability that we observe a sample variance of 50 (or larger) given our sample size of 20.