

1. (12 pts) As Virginia Governor Timothy Kaine attempts to balance Virginia's budget, a recent survey of 700 people, conducted by Christopher Newport University's Center for Public Policy, showed that 58% of Virginians favor holding the line on taxes and reducing spending<sup>1</sup>. Use these statistics to test the claim at the 1% level of significance that a *majority* of Virginians (i.e., more than 50%) favor holding the line on taxes and reducing spending.
2. (12 pts) In September 2007 an Associated Press-Ipsos poll surveyed 3007 people concerning their political views<sup>2</sup>. The poll reported, among other things, that 37% of Democrats consider themselves to be moderate while 28% of Republicans consider themselves to be moderate. Unfortunately, the survey did not report how many Democrats and Republicans were polled, so we will assume that there were 1000 of each. (There were lots of independents in the poll.) At the 5% level of significance test the hypothesis that a greater proportion of Democrats than Republican consider themselves to be moderate.
3. (8 pts) Using the data of the previous problem, find a 90% confidence interval for the difference between the proportions of Republicans and Democrats who consider themselves to be moderate.
4. (6 pts) Answer true or false.
  - (a) If  $\alpha = 0.05$  and the  $p$ -value is 0.034, then we should reject  $H_0$ .
  - (b) The larger the sample size is, the more likely it is that we will reject  $H_0$ .
  - (c) A 95% confidence interval for  $\mu$  based on a sample of size  $n = 1000$  is more likely to contain the correct value of  $\mu$  than is a 95% interval based on a sample of size  $n = 500$ .
5. (8 pts) For the  $t$  distribution, find the following probabilities.
  - (a)  $P(t > 2.5)$  with 3 degrees of freedom.
  - (b)  $P(-1.0 < t < 1.0)$  with 25 degrees of freedom.
6. (16 pts) October 2007 was pretty warm here in Farmvegas. The average high temperature was nearly  $79^\circ$ . Some say that was due to the weather. The following figures represent the high temperatures for 12 randomly selected October days over the past 30 years.

73 67 89 61 60 75 82 72 84 55 64 81

A QQ plot of these data indicate that they come from a normal population.

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<sup>1</sup><http://www.inrich.com/cva/ric/search.apx.-content-articles-RTD-2007-10-12-0248.html>

<sup>2</sup>[http://www.boston.com/news/nation/articles/2007/09/23/independent\\_voters\\_tilt\\_toward\\_democrats/](http://www.boston.com/news/nation/articles/2007/09/23/independent_voters_tilt_toward_democrats/)

- (a) (3 pts) To find a confidence interval based on these data, should you use the normal distribution or the  $t$  distribution? Explain.
  - (b) (8 pts) Use this sample to find a 95% confidence interval for the average daily high temperature in October over the past 30 years.
  - (c) (3 pts) What is the margin of error in your confidence interval of part (b)?
  - (d) (2 pts) If we used the same sample, but increased the confidence level to 99%, would the interval be wider or narrower?
7. (12 pts) The average high temperature during October 2007 was, in fact,  $78.6^\circ$ . Use the sample data from the previous problem to test the hypothesis that the average high temperature for October over the past 30 years was less than  $78.6^\circ$ . Use a 5% level of significance.
8. (12 pts) A random sample of 40 students from HSC has an average combined SAT score of 1130 with a standard deviation of 110 while a random sample of 60 students from RMC has an average combined SAT score of 1086 with a standard deviation of 105. Test at the 5% level of significance the hypothesis that the average SAT score of HSC students is higher than the average SAT score of RMC students.
9. (14 pts) Math SAT scores are modeled by a normal distribution with mean of 500 and a standard deviation of 100.
- (a) (3 pts) Describe the sampling distribution of the sample mean for random samples of  $n = 100$  math SAT scores.
  - (b) (3 pts) What happens to the mean of the sampling distribution of  $\bar{x}$  as the sample size increases?
  - (c) (3 pts) What happens to the standard deviation of the sampling distribution of  $\bar{x}$  as the sample size increases?
  - (d) (5 pts) According to this model, what is the probability that the average of 100 randomly selected math SAT scores will be between 475 and 525?