

## Homework Day 12 - ECON 186

**Problem 1.** Suppose that you are interested in testing what effect the level of air pollution has on the number of asthma hospitalizations over a one year span. You find that the size of the effect is  $\hat{\beta} = 5.67$  with a standard deviation of 29. You want to test whether the effect is different from 0 in either direction. The data set has 100 observations. Let the true effect size be known as  $\beta$ .

- a. Set up the null and alternative hypothesis.
- b. Calculate the t-statistic and perform a t-test at the 5% significance level.
- c. Calculate the p-value (approximate using the table, but also feel free to use an online calculator to check your answer, you can also report this if you wish).
- d. Interpret the p-value.

**Problem 2.** Suppose that you perform a trial where you flip a fair coin 100 times and record the number of heads, which we will call the random variable  $X_i$  where the subscript  $i$  represents the  $i$ th trial. Then, you perform this trial 1000 times. Let  $X$  be the number of heads from the distribution formed by the  $X_i$ 's.

- a. What does the Law of Large Numbers tell you about the sample mean of  $X$ ? Write the formula for the sample mean of  $X$ .
- b. What does the Central Limit Theorem tell you about what kind of distribution  $X$  looks like?

**Problem 3.** You are in a debate where you are claiming that for the last 50 years or so, interest rates have been lower when (choose your favorite political party) held the Presidency. The person you are debating with claims that they have been lower for the other party. As the objective economist that you are, you decide to look at the data.

Year	Interest Rate	Democrat or Republican	President
1963	4.00	Democrat	Lydon B. Johnson
1964	4.19		
1965	4.28		
1966	4.93		
1967	5.07		
1968	5.64		
1969	6.67		
1970	7.35	Republican	Richard Nixon
1971	6.16		
1972	6.21		
1973	6.85		
1974	7.56		
1975	7.99	Republican	Gerald Ford
1976	7.61		
1977	7.42		
1978	8.41	Democrat	Jimmy Carter
1979	9.43		
1980	11.43		
1981	13.92		
1982	13.01	Republican	Ronald Reagan
1983	11.10		
1984	12.46		
1985	10.62		
1986	7.67		
1987	8.39		
1988	8.85		
1989	8.49		
1990	8.55	Republican	George H.W. Bush
1991	7.86		
1992	7.01		
1993	5.87		

1994	7.09	Democrat	Bill Clinton
1995	6.57		
1996	6.44		
1997	6.35		
1998	5.26		
1999	5.65		
2000	6.03		
2001	5.02	Republican	George W. Bush
2002	4.61		
2003	4.01		
2004	4.27		
2005	4.29		
2006	4.80		
2007	4.63		
2008	3.66	Democrat	Barack Obama
2009	3.26		
2010	3.22		
2011	2.78		
2012	1.80		
2013	2.35		

- a. Find the sample mean and standard deviation of 10 year treasury rates for the Democrats.
- b. Find the sample mean and standard deviation of 10 year treasury rates for the Republicans.
- c. Who “won?” Do you think the results tell us anything “causal” about the relationship between political parties and interest rates?
- d. Despite your empirical evidence, your “friend” still does not believe you and wants you to show that they are actually statistically different at the 95% confidence level.