PROBABILITY AND STATISTICS - HOMEWORK 9

DO NOT SUBMIT

1. In the file http://math.iisc.ernet.in/~manju/UGstatprob/simulatednormaldata.txt you will see data *simulated* on a computer from a normal distribution with unknown mean and variance. The problem is to test the hypotheses $H_0 : \mu = 2$ versus $H_1 : \mu \neq 0$.

(1) Use only the first n data points for $n = 20, 50, 100, 200, 400, 500, 800, 1000$, and carry out the test for each n at significance level 0.05. Report the p-values.

(2) Repeat the same tests but now assume that the variance is given to be 9.

2. Are real coins fair? Formulate this as a hypothesis testing problem and perform the test at 0.01 level of significance using the following data. Report the p-value.

(1) In an experiment reported in http://www.stat.berkeley.edu/~aldous/Real-World/coin_tosses.html, a real coin was tossed 20000 times. The number of heads observed was 10231.

(2) In another experiment reported on the same page, 10014 heads appeared in 20000 tosses. Repeat the test with this data.

3. In the file http://math.iisc.ernet.in/~manju/UGstatprob/twomidtermgrades.txt you see the scores obtained in two exams by a class of students in their first and second midterms in the UM201 course, respectively. Test the hypothesis that the overall performance is worse in the second mid-term than in the first.

The following problem may be omitted. It is a two sample test for Bernoulli (which we did not cover in class). But if interested, it is a problem where we have $X_1, \ldots, X_n$ i.i..d Ber(p_1) and $Y_1, \ldots, Y_m$ i.i.d. Ber(p_2) and we test $H_0 : \ p_1 = p_2$ versus $H_1 : \ p_1 < p_2$.

4. This gallup poll conducted in the USA has data on support for capital punishment for a person convicted of murder. In 2013, 60% of the 1028 people sampled favoured capital punishment. In a similar survey conducted in 2007, 1010 people were sample of which 69% favoured capital punishment. Based on just these two surveys, would you agree that support for capital punishment in that country has gone down?

Set up the question as an appropriate hypothesis testing problem, carry out the test at $\alpha = 0.01$ level of significance, and report the p-value.

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