Stevens Institute of Technology

SYS-601 Homework #7

# Due Apr. 2 2018

7.1 Revisiting Super Bowl Coin Flips [10 points]

(a) 3 pts If the coin were fair (50/50 chance of winning a flip), what is the theoretical:

(i) Probability mass function p(x) (Hint: don't over-think this)

(ii) Population mean

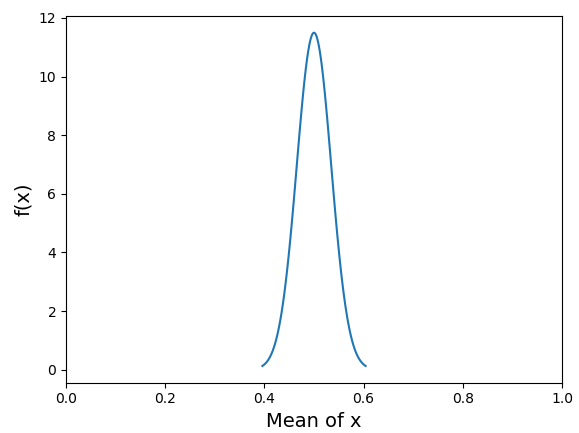
(iii) Population standard deviation or variance

(b) 2 pts Compute the following for N = 52 observed values of X in superbowl.csv:

(i) Sample mean \_x

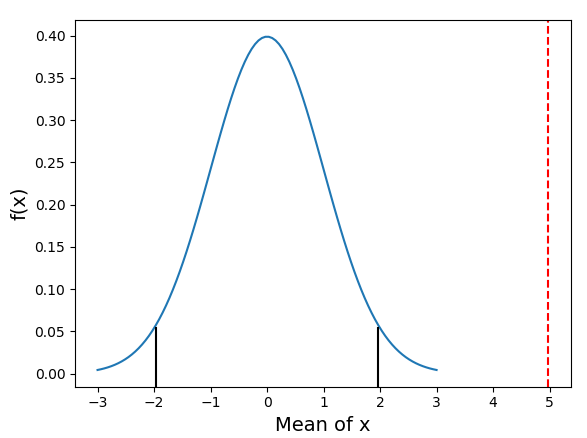
(ii) Sample standard deviation or variance

(c) 2 pts Create a plot of the PDF f(\_x) for values 0 ≤ \_x ≤ 1 using the Central Limit Theorem to model the distribution of sample means for N = 52 trials.



(d) 2 pts Perform a hypothesis test for the following: Report the p-value and determine whether H0 can be rejected at α = 0:05.

All the 52 samples are independent, and N is big enough. Therefore, it can be tested by z Test for population mean.



**Reject H0!**

It’s two-tailed test

It means there is 0.000064% chance of more extreme samples under H0

(e) 1 pt What can you conclude about the validity of the Superbowl coin flip?

Someone cheated on the coin.

7.2 GRE Tutoring Service [10 points]

A $1799 tutoring service advertises a significant increase in verbal reasoning GRE score. The attached file gre.csv contains a set of N = 100 samples of pre- and post-test scores for participating students.

(a) 3 pts Assuming the pre- and post-test data are not related (i.e. randomly ordered), perform a hypothesis test for the following:

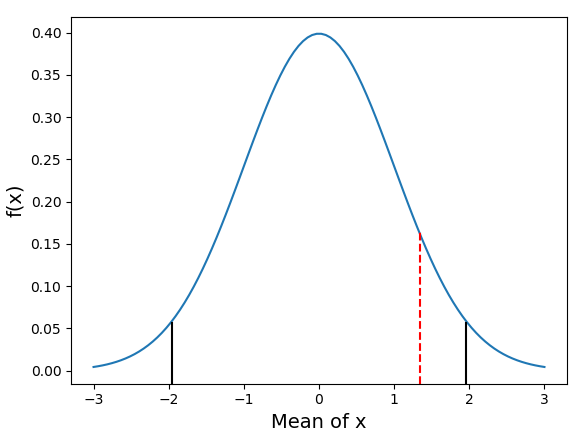
H0: µpre = µpost

Ha: µpre < µpost

Report the p-value and determine whether H0 can be rejected at α = 0:05.

|  |  |  |  |
| --- | --- | --- | --- |
| Pre |  | Post |  |
| N | 100 | N | 100 |
| Mean µpre | 149.08 | Mean µpost | 150.90 |
| Standard deviation σpre | 8.83 | Standard deviation σpost | 10.31 |

They are independent samples and the number of them is large enough, so it’s can be tested by z Test.

Assume:

Then:

It’s one-tail test:

It means only 9% chance difference between post- and pre- test average grade is larger than 1.82 points. The result is statistically significant. Assumption could not be rejected.

(b) 1 pt Do the results in (a) support the tutoring service's advertising claim?

I don’t think it support the claim. In this case,

(c) 3 pts Assuming the pre- and post-test data are related (i.e. paired from the same student), perform a hypothesis test for the following:

H0: µpre = µpost

Ha: µpre < µpost

Report the p-value and determine whether H0 can be rejected at α = 0:05.

Use t Test

, degree freedom: 99

It’s one-tail test:

It means 99.64% chance difference between post- and pre- test average grade is larger than 1.82 points. The result is practically significant. Assumption should be rejected.

(d) 1 pt Do the results in (c) support the tutoring service's advertising claim?

I think it supports the claim, since there is great probability that students could get higher points after the tutoring service.

(e) 2 pts Are the results in (c) practically significant? Would you buy the service? Why?