Homework 7

# 7.1 Revisiting Super Bowl Coin Flips

## Recall the Super Bowl coin flip problem. Assume the random variable X is defined as:

## X =

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

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

Solution

PMF for all the values p(x) = 1/2

## Population mean μ0 =

Solution

Mean = 0.5

## Population standard deviation σ0 or variance

Solution

= 0.5 x (1 – 0.5)2 + 0.5 x (0 – 0.5)2

= 0.25

σ0 = 0.5

## Compute the following for N = 52 observed values of X in superbowl.csv:

## Sample mean x̅

Solution

x̅ = 0.3269

## Sample standard deviation sx or variance

Solution

Sx = 0.473

= 0.2243

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

Solution

## Perform a hypothesis test for the following:

Report the p-value and determine whether H0 can be rejected at α = 0.05.

Solution

∴ z = -2.49

We cannot accept H0

## What can you conclude about the validity of the Superbowl coin flip?

Solution:

The value of z and p are not normal. Therefore we can assume that the coin flip is one-sided.

# 7.2 GRE Tutoring Service

## 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.

Sample Space

|  |  |  |
| --- | --- | --- |
|  | pre | post |
| N | 100 | 100 |
| mean | 149.08 | 150.9 |
| std div (Sample) | 8.829107 | 10.30593 |

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

Report the p-value and determine whether H0 can be rejected at α = 0.05

Solution:

P = Fnorm (|z|)

=0.089

When α = 0.05 the z bounds are between [-1.96, 1.96] so we can assume the hypothesis to be correct.

## Do the results in (a) support the tutoring service's advertising claim?

Solution:

Yes, the advertisement claim and the dataset support each other.

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

Report the p-value and determine whether H0 can be rejected at α = 0.05

Solution

p-value = 0.0034 {using t test}

The p-value is too small to be considered for the hypothesis to be true.

## Do the results in (c) support the tutoring service's advertising claim?

Solution:

The claim seems to be false. There is no significant difference in the dataset.

## Are the results in (c) practically significant? Would you buy the service? Why?

Solution:

There is very less significant increase in marks & are therefore not practically significant. I wouldn’t buy these services because there are very few people who benefit from these services.