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In [ ]: # Session 17 - Statistics 3 Assignment
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# Problem 1 :Diet rich in corn starch effect
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# Problem Statement 1: Blood glucose levels for obese patients have a mean of 100 with a standard deviation
# of 15. A researcher thinks that a diet high in raw cornstarch will have a positive effect on
# blood glucose levels. A sample of 36 patients who have tried the raw cornstarch diet
# have a mean glucose level of 108. Test the hypothesis that the raw cornstarch had an
# effect or not.

# importing the Packages
import math

# population mean and std deviation
mu,sigma = 100 , 15

# sample mean and number of samples
n,xbar = 36,108

# Null hypothesis ( No change in mean value it is same) and alternate Hypothesis (Theres effect on mean value ) for corns
'''
Ho : mu = muo
Ha : mu != muo
'''

# Since n>30 , Population distribution shape doesnt have effect on the sample Distributon , Using Ztest to solve
# to get the Z value,  $Z = (xbar - \mu) / (\sigma / \sqrt{n})$ 

# std Error of Sample is S.E =  $\sigma / \sqrt{n}$ 
sigmax = sigma/math.sqrt(36)
print("The Standard Error is :")
print(sigmax)
print('-'*80)

# Z calculated value is
Z = round(((xbar-mu)/sigmax),3)

print("The Z calculated score value is :")
print(Z)
print('-'*80)

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# At 95 % confidence Level(5% significance )
alpha , alphaby2 = 0.05,(0.05)/2

# The Z table value for alphaby 2 is
Zalphaby2 = 1.965
print("The 95% confidence Value at 5% significance from table is :")
print(Zalphaby2)
print('-'*80)

# Since Z value is greater than Zalphaby2, we reject the null Hypothesis
print(''Since the Zcalculated Value is beyond the Z a/2 value , \n we reject the Null Hypothesis and accept the Alternat

print("\n Therefore Alternate Hypothesis,Ha i.e raw corn starch has effect on Blood Glucose Levels is true")

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In [ ]: #*****
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#           Problem 2 : Probability of greater Percentage of Republic Voters in second state
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#*****
# In one state, 52% of the voters are Republicans, and 48% are Democrats. In a second
# state, 47% of the voters are Republicans, and 53% are Democrats. Suppose a simple
# random sample of 100 voters are surveyed from each state.

# What is the probability that the survey will show a greater percentage of Republican
# voters in the second state than in the first state?

import math

# Let Proportion of voters in one state be
P1 =mu1 = 0.52
Pdem1 = 0.48

# Let number of voters in another state be
P2 = mu2 = 0.47
Pdem2 = 0.53

# Sample size taken from each state is
n1 = 100
n2 = 100

# Let the null hypothesis be republican percentage is same between two states in sample
# Ho : mu1-mu2 = 0

# And the alternate hypothesis is republican is greater in second state as compared to first
# H1 : mu1-mu2 < 0

# as n1 and n2 >30 , sample size is big enough and hence the sample differnece distribution is
# independent of population distribution and can be assumed as normal and hence use Z statistics

# Expected Value of populations means xbar1-xbar2

diff_ofxbar1xbar2 = mu1-mu2
print("The Expected Value of mean differences E(P1-P2) is :")
print(round(diff_ofxbar1xbar2,2))
print('-'*80)

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# Std Deviation of the difference is
sd = round(math.sqrt(P1*(1-P1)/n1 + P2*(1-P2)/n2),2)
print("The Standard Deviation of differences is :")
print(sd)
print('-'*80)

# To find probability we need to transform to the random variable to Z score by ((xbar1-x2bar)-(mu1-mu2)/sd)
Zval = round((0 - diff_ofxbar1xbar2 )/ sd,2)

print("The Z calculated vAlue of differences is :")
print(Zval)
print('-'*80)

# on referring the Percentage for the Zscore in Z table
Zscore = 0.7611
#P(Z<0.71) = 1-Zscore
Probz = round((1-Zscore),2)
print("The Probability that republicans in state2 will be greater than state 1 is :\n",'-'*80)
print(Probz)
print('-'*80)
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In [ ]: #*****
#
#           Problem 3 :
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#*****
# You take the SAT and score 1100. The mean score for the SAT is 1026 and the standard
# deviation is 209. How well did you score on the test compared to the average test taker?

# The mean for all those who appeared for SAT , i.e Population mean and deviation is
xbar = 1026
sigma = 209

# my SAT score is 1100
xsat = 1100

# Null hypothesis is my score and population mean is same
# Alternative Hypothesis is my score is more than xbar
#Ho : xsat = xbar
#Ha : xsat > xbar

# To find the my score compared to avg test taker , i need to tranform to Z

Z = round((xsat - xbar)/sigma,2)

print(" The Zscore for the test taken is :")
print(Z)
print('-'*80)

# referring the Z table the Percentage obtained by me
print(" The Percentage acheived is : 0.6368 which is greater than xbar value of 0.5 \n")
print(" Therefore we reject the null hypothesis , in favour of alternate hypothesis which is my score is more than avg ")
print('-'*80)

# To know how well my score as compared to avg test taker is my ztable score-0.5
Zcom = round((0.6368-0.5)*100,2)
print(" My score is better than avg test taker by ", Zcom,'%')

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