MSCR 500 Homework Assignment 5

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11/05/19

Q1.

Random sample of 10 diabetic women.
x-bar = 84 mmHg
s = 9.1 mmHg
Test if true DBP for female is > µ (µ = true mean DBP 74.4 mmHg)
alpha = 0.05
N(0,1)

Hypothesis:

H0 -> µ = xbar
H1 -> µ < xbar (left tailed hypothesis)

Parameters:

population mean, sample mean

alpha = 0.05

Name of hypothesis test:

one-sample, left-tailed t-test

Justification:

The population follows a normal distribution but population SD is unknown (thus t is correct), and this is talking about a single sample population, with knowledge of the population mean given, but not the population SD. Also, n = 10, which is n < 15, but can use normal distribution since that is given.

Test Statistic Computation:

T = (xbar - µ) / (s / sqrt(n))
= 84 - 74.4 / (9.1 / sqrt(10))
= 3.336

Distribution of test statistic under H0:

T ~ t(9)

P-value computation:

t = 3.336, which with df = 9, gets us to a t(0.005) = 3.250. This suggests that P < 0.005 when T >= 3.3

Decision to *REJECT* H0 at alpha = 0.05

Conclusion:

alpha = 0.05, and P < 0.005. Since alpha > P, we can reject the H0. This means that the sample mean of DBP for diabetics is likely greater than 74.4.

Q2.

xbar = 747.3 mg of calcium intake
s = 262.2 mg
alpha = 0.05
µ = 800 mg
n = 40

Hypothesis:

H0 –> µ = xbar
H1 –> µ > xbar (right-tailed)

Parameters:

alpha = 0.05

Name of hypothesis test:

one-sided, right-tailed t-test

Justification:

We have a n=40 population, allowing us to use normal distribution pattern, but population SD is unknown, thus must use t-distribution. Only single sample for comparison to population mean.

Test Statistic Computation:

T = (xbar - u) / (s / sqrt(n))
= (747.3 - 800) / (262.2 / sqrt(40))
= -1.2712

Distribution of test statistic under H0:

T ~ t(39)

P-value computation:

t = -1.2712 with df = 39.
t(0.10) = -1.304
p(t = -1.271) <= 0.10

Decision to *FAIL TO REJECT* H0 at alpha = 0.05

Conclusion:

We fail to reject the null, H0, at an alpha of 0.05. The mean calcium of the poor is not significantly less than the population mean of 800 mg calcium.

Q3.

Random sample of 10 diabetic women.
x-bar = 84 mmHg
sigma = 9.1 mmHg
Test if true DBP for female is > µ (µ = true mean DBP 74.4 mmHg)
alpha = 0.05
N(0,1)

Hypothesis:

H0 -> µ = xbar
H1 -> µ < xbar (left tailed hypothesis)

Parameters:

population mean, sample mean

alpha = 0.05

Name of hypothesis test:

one-sample, left-tailed z-test

Justification:

The population follows a normal distribution and population SD is known (thus z is correct), and this is talking about a single sample population, with knowledge of the population mean given. We also know its a normal distribution, can use z-distribution.

Test Statistic Computation:

Z = (xbar - µ) / (sigma / sqrt(n))
= 84 - 74.4 / (9.1 / sqrt(10))
= 3.336 –> area under curve = 0.9996

Distribution of test statistic under H0:

X ~ N(u, (sigma/sqrt(n))^2)
X ~ N(74.4, 8.281)

P-value computation:

P(Z >= 3.336) for left sided test = 1 - 0.9996 = 0.0004

Decision to *REJECT* H0 at alpha = 0.05

Conclusion:

alpha = 0.05, and P = 0.0004. Since p < alpha, we can reject the H0. This means that the sample mean of DBP for diabetics is likely greater than 74.4.

Q4.

xbar = 747.3 mg of calcium intake
sigma = 262.2 mg
alpha = 0.05
µ = 800 mg
n = 40

Hypothesis:

H0 –> µ = xbar
H1 –> µ > xbar (right-tailed)

Parameters:

alpha = 0.05

Name of hypothesis test:

one-sided, right-tailed z-test

Justification:

We have a n=40 population, allowing us to use normal distribution pattern, and population SD is known, thus can use z-test.

Test Statistic Computation:

Z = (xbar - u) / (s / sqrt(n))
= (747.3 - 800) / (262.2 / sqrt(40))
= -1.2712

Distribution of test statistic under H0:

X ~ N(800, 1718.721)

P-value computation:

P(Z = -1.2712) = 0.1020

Decision to *FAIL TO REJECT* H0 at alpha = 0.05

Conclusion:

The P value associated with the Z score is 0.1020. alpha is $<$ p, thus we cannot reject the null hypothesis, H0. We cannot exclude that the sample mean of calcium in the poor is less than the population mean of calcium.