MS Module 19 Correlation Fisher transformation practice exam questions

(The attached PDF file has better formatting.)

X and Y are a bivariate normal distribution from which a sample of 20 observations is taken. The sample correlation between X and Y is 0.82.

We test the null hypothesis H_0: $\rho = 0.71$. The alternative hypothesis is H_a: $\rho_o > 0.71$.

Question 19.1: Fisher transform of observed correlation ρ

What is the Fisher transform of the observed correlation ρ?

Answer 19.1: $0.5 \times \ln((1 + 0.82) / (1 - 0.82)) = 1.1568$

(Fisher transform = $\frac{1}{2} \times ln((1+\rho)/(1-\rho)))$

Question 19.2: Fisher transform of correlation ρ_0 assumed in null hypothesis

What is the Fisher transform of the correlation ρ_0 assumed in the null hypothesis?

Answer 19.2: $0.5 \times \ln((1 + 0.71) / (1 - 0.71)) = 0.8872$

(Fisher transform = $\frac{1}{2} \times ln((1+\rho)/(1-\rho)))$

Question 19.3: Variance of Fisher transform

What is the variance of the Fisher transform?

Answer 19.3: $1 / (20 - 3) = 0.058824$

(variance of the Fisher transform = 1/(number of observations – 3))

Question 19.4: Standard deviation of Fisher transform

What is the standard deviation of the Fisher transform?

Answer 19.4: $0.058824^{0.5} = 0.2425$

(standard deviation = square root of variance)

Question 19.5: *z* value

What is the *z* value to test the null hypothesis?

Answer 19.5: $(1.1568 - 0.8872) / 0.2425 = 1.1118$

(*z* value = (Fisher transform of sample ρ – Fisher transform of ρ_o) / standard deviation of Fisher transform)

Question 19.6: Confidence interval of the Fisher transform

What is the 90% confidence interval for the true value of the Fisher transform of the correlation?

Answer 19.6: confidence interval = Fisher transform ± critical *z* value × standard deviation of Fisher transform

- lower bound: 1.1568 – 1.645 × 0.2425 = 0.758
- upper bound: 1.1568 + 1.645 × 0.2425 = 1.556

Question 19.7: Confidence interval of the correlation

What is the 95% confidence interval for the true value of the correlation?

Answer 19.7: The inverse of the Fisher transform is $(e^{2x} – 1) / (e^{2x} + 1)$.

- lower bound: (exp(2 × 0.758) – 1) / (exp(2 × 0.758) + 1) = 0.640
- upper bound: (exp(2 × 1.556) – 1) / (exp(2 × 1.556) + 1) = 0.915