Problems

Problem 1

Researchers are developing a new covid test and would like to see how effective their new test is. Let the number of inviduals who have covid be 110 and of these 90 tested positive with the new test. There were 190 individuals who did not have covid, 170 of them tested negative.

Part(A)

Arrange the data in a contingency table.

Test Diagnosis	Covid Status (+)	Covid Status (-)
Test Positive = (+)		
Test Positive = (-)		
Total	110	190

Part (B)

What is the sensitivity of the new test?

$$P(\text{Disease} = +|\text{Test} = +) =$$

Provide an interpretation.

Part (C)

What is the specificty of the new test?

$$P(\text{Disease} = -|\text{Test} = -) =$$

Provide an interpretation.

Part (D)

What is the relationship between specificity and sensitivity in general?

Problem 2

A researcher is studying the association between a new drug and disease remission across two different hospitals. The data collected is summarized in the following stratified contingency tables:

	Remission (+)	Remission (-)	Total
Drug	40	20	60
Placebo	30	30	60

	Remission (+)	Remission (-)	Total
Drug	50	30	80
Placebo	20	40	60

Using the Mantel-Haenszel method, calculate the common odds ratio across both hospitals. Interpret the result in the context of the study.

Problem 3

A researcher is conducting a cohort study to investigate the effect of smoking on lung cancer incidence. The study follows two groups of individuals: Smokers and Non-Smokers. However, since age is a confounding variable, the researcher stratifies the participants into two age groups: Young (≤ 50 years) and Old (> 50 years).

Age Group	Smokers (Cases / Total)	Non-Smokers (Cases / Total)
Young (≤ 50)	50 / 5,000	20 / 6,000
Old (> 50)	200 / 3,000	100 / 4,000

Additionally, the researcher uses a standard population with the following age distribution:

- **Young (≤ 50 years):** 7,000 individuals
- **Old (> 50 years):** 5,000 individuals

Part (A)

Compute the age-stratified risk of lung cancer in both smokers and non-smokers.

Part (B)

Perform direct standardization to calculate the adjusted risk for both smokers and non-smokers using the standard population.

Part (C)

Compute the adjusted risk difference (RD) and the adjusted risk ratio (RR) between smokers and non-smokers.

Part (D)

Does smoking increase the risk of lung cancer after adjusting for age?