

1. An experiment was performed to compare the fracture toughness of high-purity 18 Ni maraging steel with commercial-purity steel of the same type. The sample average toughness was $\bar{x}_n = 65.6$ for $n = 32$ specimens of high-purity steel and $\bar{y}_m = 59.8$ for $m = 38$ specimens of commercial-purity steel. Because the high-purity steel is more expensive, its use can only be justified if its fracture toughness is more than the commercial steel by at least 5. Suppose that the toughness distributions are normal.
 - a. Assuming that $\sigma_x = 1.2$ and $\sigma_y = 1.1$, test the relevant hypotheses using $\alpha = 0.01$.
 - b. Compute the power of the test in a. when $\mu_x - \mu_y = 6$.

2. The article “Measuring and Understanding the Aging of Kraft Insulating Paper in Power Transformers” (IEEE, 1996) contains observations on the degree of polymerization for two types of paper specimens:

Type 1: 418 421 421 422 425 427 431 434 437 439 446 447 448 453 454
463 465

Type 2: 429 430 430 431 436 437 440 441 445 446 447

Calculate a 95% confidence interval for the difference between the true average polymerization for the two paper types. Does the interval suggest that the true averages may be different?

3. It has been estimated that between 1945 and 1971 as many as 2 million children were born to mothers treated with diethylstilbestrol (DES), a nonsteroidal estrogen recommended at the time for pregnancy maintenance (I don't know what that means...). The FDA banned this drug in 1971 because research indicated a link between its use and incidence of cervical cancer. The article "The effects of prenatal exposure to DES on hemispheric laterality and spatial ability in human males" (Hormones Behavior 1992) discussed a study in which 10 males exposed to DES and their unexposed brothers underwent various tests. The results of a spatial ability test showed $\bar{x} = 12.6$ for exposed males and $\bar{y} = 13.7$ for unexposed males with standard error (s_D/\sqrt{n}) 0.50. Test at the 0.05 level whether exposure is associated with reduced spatial ability.