1. An advertisement claims that wearing a magnetized bracelet will reduce arthritis pain in those who suffer from arthritis. A medical researcher tests this claim with 233 arthritis sufferers randomly assigned to wear either a magnetized bracelet or a placebo bracelet. The researcher records the proportion of each group who report relief from arthritis after 6 weeks. After analyzing the data, he fails to reject the null hypothesis of no difference between the groups. Which of the following are valid interpretations of his findings?
   1. The magnetized bracelets are not effective at reducing arthritis pain.
   2. There is insufficient evidence that the magnetized bracelets are effective at reducing arthritis pain.
   3. The magnetized bracelets had exactly the same effect as the placebo at reducing arthritis pain.
   4. There were no statistical significant differences between the magnetized bracelets and the placebos in reducing arthritis pain.
2. Spam filters try to sort your e-mails, deciding which ones are real and which are unwanted. We can think of the filter’s decision as a hypothesis test. The null hypothesis would be that the e-mail is real and should go to your Inbox.  
   1. In this context, what is a Type I error?
   2. In this context, what is a Type II error?
   3. Which type of error would you consider to be more serious?
3. For each of the following, identify which type of error (Type I or Type II) could have been made.
   1. In the “Astrology” hypothesis testing example, we found a p-value of 0.4 and concluded that there was “no evidence that more than 5% of people consider astrology to be very scientific.”
   2. In the “Colonoscopy” hypothesis testing example, we found a p-value of 0.003 and concluded that there was “very strong evidence that having polyps removed during colonoscopies lower the rate of death from colon cancer.”
4. Public health officials believe that 90% of children have been vaccinated against measles. A random survey of medical records at many schools across the country found that, among more than 13,000 children, only 89.4% had been vaccinated. A researcher would reject the 90% (null) hypothesis with a p-value of 0.011.  
   1. The result is statistically significant, but is it important? Discuss.