1. (10 points) In a large aspirin study, there were 19,934 women in the aspirin group and 19,942 in the placebo group. There were 477 major cardiovascular events in the aspirin group and 522 in the placebo group. Assuming the women were assigned to the aspirin and placebo groups appropriately, perform a statistical significance test to determine whether or not aspirin prevents major cardiovascular events for women like these. You should clearly state the null and the alternative hypotheses, find a test statistic and an approximate P-value, and state your conclusions in everyday language.

null: there is no difference between aspirin & placebo with respect to major cardiovascular events for women like these

alt: aspirin prevents major cardiovascular events for women like these

aspirin

sample % $= \frac{477}{19934} \times 100\% = 2.4\%$

placebo

sample % $= \frac{522}{19942} \times 100\% = 2.6\%$

box is approx

19457 [0] 477 [1], $SD_{box} \approx .15$

$SE_{sum} = \sqrt{19934}(.15) = 21.2$

$SE_{\%} = \frac{21.2}{19934} \times 100\% = .10\%$

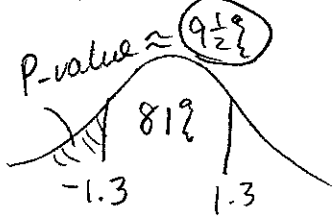
19420 [0] 522 [1], $SD_{box} \approx .16$

$SE_{sum} = \sqrt{19942}(.16) = 22.6$

$SE_{\%} = \frac{22.6}{19942} \times 100\% = .11\%$

$SE_{diff\ \%} = \sqrt{.10^2 + .11^2} = .15$

$z = \frac{2.4 - 2.6}{.15} = -1.3$



The P-value is large (9½%) so we fail to reject the null & conclude there is no evidence aspirin is better than placebo in preventing major cardiovascular events.

2. (10 points) Researchers think that eating margarine lowers the particle size of LDL molecules (so-called "bad cholesterol") compared to eating butter. In a randomized, controlled, double-blind experiment, 105 people in the treatment group (margarine diet) had an average LDL particle size of 252.6 Angstroms, with an SD of 4.5 Angstroms, while 110 people in the control group (butter diet) had an average LDL particle size of 254.8 Angstroms, with an SD of 4.0 Angstroms. Perform a test to determine whether the researchers' claim is correct. You must state a null and alternative hypotheses, compute a test statistic and a P-value, and clearly state your conclusions about the size of LDL molecules for people on margarine and butter diets such as those in this study.

null: there is no difference between treatment and control

alt: LDL for treatment has smaller particle size than LDL for control

Treatment

$\xrightarrow{105}$ SD ≈ 4.5

$SE_{sum} = \sqrt{105}(4.5)$

$= 46$

$SE_{ave} = 46/105$

$= .44$

Control

$\xrightarrow{110}$ SD ≈ 4.0

$SE_{sum} = \sqrt{110}(4.0)$

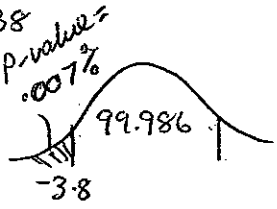
$= 42$

$SE_{ave} = 42/110$

$= .38$

$SE_{diff} = \sqrt{.44^2 + .38^2} = .58$

$z = \dfrac{252.6 - 254.8}{.58} = -3.8$



The P-value is .007% so we reject the null and conclude that eating margarine results in smaller average particle size of LDL than eating butter.

3. (10 points) The spermicide nonoxynol-9 kills HIV in the test tube, so researchers hypothesized that it might be useful in protecting high-risk women from HIV. Other researchers argued that nonoxynol-9 might increase the risk because it is an irritant. In a study of 990 prostitutes, participants were randomly divided into two groups. The treatment group were given a nonoxynol-9 gel. The control group were given a similar-looking but inactive gel. When the study ended in May 2000, 67 of the 495 women in the treatment group were HIV-positive, and 44 of the 495 women in the control group were HIV-positive. Perform a 2-tailed test to decide whether the treatment and control groups were significantly different with respect to HIV. Clearly state your conclusions.

null: treatment makes no difference to HIV

alt: " does make a difference

Treatment: $SD \approx \sqrt{\frac{67}{495} \times \frac{428}{495}} = .342$

% is $\frac{67}{495} \times 100\% = 13.5\%$

$SE_{sum} = \sqrt{495} \times .342 = 7.6$

$SE_{\%} = \frac{7.6}{495} \times 100\% = 1.5\%$

Control: $SD = \sqrt{\frac{44}{495} \times \frac{451}{495}} = .285$

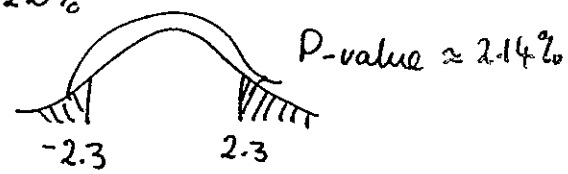
% is $\frac{44}{495} \times 100\% = 8.9\%$

$SE_{sum} = \sqrt{495} \times .285 = 6.3$

$SE_{\%} = \frac{6.3}{495} \times 100\% = 1.3\%$

$SE_{diff} = \sqrt{1.5^2 + 1.3^2} = 2.0\%$

$Z = \frac{13.5\% - 8.9\%}{2.0\%} = 2.3$



The P-value is smaller than 5% so we reject the null & conclude that the nonoxynol-9 has increased the HIV-positive rate.