

INSTRUCTIONS The answers are to be written in the spaces provided. Be brief. All 3 questions are worth equal points. For tests of significance, indicate the null hypothesis and the direction(s) of the alternative hypothesis, and what Table in Colton or Armitage would be appropriate.

Question 1

Allergic reactions in healthy plateletpheresis donors caused by sensitization to ethylene oxide gas (Leitman)

Results: Reactions during Plateletpheresis.

- a Assuming that the first 600 are representative of "donors elsewhere", what percentage\* of "donors elsewhere" can be expected to have reactions with the use of the CS-3000 cell separator? \*Provide an interval rather than a point estimate.
- b How would you formally compare the number of reactions among the 300 contemporaneous users of the V-50 device with the number among the 600?
- c From the previous 10 years of data, what is an upper confidence limit on the frequency of such reactions with manual plateletpheresis using the Fenwal 4R3945 sets?

Results: Skin Testing.

- a Put the data analyzed in the first sentence of this paragraph ("Four of the six donors..") into the most appropriate 2x2 table for analysis.
- b What statistical test does one use to formally compare the six with the two groups of twenty (last sentence)?

Results: Ethylene Oxide-Albumin RAST.

- a What null hypothesis is implied in the comparison in the second sentence ("Serum samples from four...")?  $H_0$ :
- b What statistical test would you recommend to formally test it?

Results: Basophil histamine Release.

- a What null hypothesis is implied in the comparison in the second and third sentences ("Basophils from all six..." & "This was significantly ...")?  $H_0$ :
- b What test would you recommend?

Discussion: Second last paragraph.

- a What numbers from the study were used to say that "the predictive value of a negative (ETO-HSA) skin test was 100 percent"?
- b What data do the authors provide about the value of a positive (ETO-HSA) skin test?
- c Why do they say that their "data do not permit conclusions" about it?

Blood Alcohol and Eye Movements

- a What test do you think the authors used to show that the decrease of  $58.5 - 43.0 = 15.5$  degrees per second is statistically significant?
- Do you have enough data to verify their calculations?
- b Verify that the p value is indeed less than 0.05 for the "direct linear relation"
- c In fitting a regression line of the % decrease (y) on the blood alcohol (x), which would be a more suitable candidate (i) a straight line through (0,0) (ii) a straight line with nonzero intercept? Why? [Answer as if you had been asked the question before seeing the data.]
- d The authors claim that the direct linear relation ( $r=0.67$ ,  $p<0.05$ ) "provides reliable evidence that at a blood ethanol of 80 mg/dl the capacity of the eyes to track objects moving slowly across the visual fields is impaired by about 25%?"
- Why might you disagree with this claim? For example, if a judge quoted you this statement, how would you defend yourself? [Your defense must be statistical but intelligible to the judge, who has never taken a course in statistics; also, do not go beyond the data at hand... ie don't get into a discussion of whether eye movements are the most relevant parameter of impairment]
- e List 3 suggestions (1 sentence each) for improving on this study:

Acetazolamide in prevention of acute mountain sickness: a double blind controlled crossover study

Parts a-c refer only to the Kilimanjaro portion of the expedition.

- a "Those taking acetazolamide reached a higher altitude (11 versus 4 reached the summit)" (abstract).
- What is the most appropriate statistical test to compare the "success in reaching the summit" of the two groups?
- b "Fig. 2 compares the altitudes reached by subjects taking the drug and those taking the placebo... the drug group showed a striking advantage (Wilcoxon signed rank sum test  $p < 0.01$ )" (last paragraph, 2nd page)
- Presumably, they carried out a "Wilcoxon signed rank test" and their description of it as a "signed rank sum test" is just a slight confusion of terms.
- Can you verify this p-value from the diagram? If not, why not?
- Check whether the p-value could have been calculated using the Wilcoxon signed rank test.
- c "In every pair the partner on acetazolamide had the lower symptom score." (first sentence of third page)
- To what value of the Wilcoxon signed rank statistic does this statement correspond?

What other non-parametric test is suggested by this statement?

d We could make two contrasts:

i using the data from the "self paired" crossover:

use the data from the two expeditions; compare each person's data from the expedition on which (s)he was taking active treatment with the same person's data from the expedition on which (s)he was taking placebo... a one-sample test (within-person comparisons, a paired t-test with 23 df if we were using parametric tests)

ii using the data from the "matched pairs":

use only the data from the Mt. Kilimangaro expedition; compare each treated person's data with his/her partner's data... again a paired t-test but with only 11 df, and between-person comparisons)

Although contrast i looks more powerful statistically (and is the one implied in the title of the paper), why is it the scientifically weaker one in this study?