The Daily Cal: Math 10B Special Edition

insert your name

Breaking News: Biology undergraduate student …….. at the University of California, Berkeley, has developed a groundbreaking new Cancer Screening Method.

"It was easy, I just applied all the cool math I've been learning this semester in my Math 10B class"

We find out the details of the new treatment in the exclusive report below.

The revolutionary method is based on counting the number of AAA repeats in a certain string of DNA of length 5.

A DNA sequence is a string of letters that involves the four bases A, C, G and T. There are _____different DNA strings of length 5. But, there are only _____ strings that contain three consecutive A's, "AAA". This means there's a probability of just _____ that a random string contains "AAA".

The study involved 5 cancer patients, and 5 controls. Among the 5 cancer patients, four of them had AAA in this part of their DNA sequence. In contrast, none of the controls had the AAA string in their DNA sequence.

The young scientist conducted a hypothesis test for this observation on the 5 patients to see whether the probability of observing AAA significantly deviated from what was to be expected for a random string (at the 5% significance level). The hypotheses were:
H_0: p equals _____.
H_1: p is greater than _____.
The p-value of this hypothesis test was _____, hence the outcome was _____.

Among the five patients in the study, two of them had just one AAA string in their DNA sequence, one of them has two (overlapping) AAA strings, and the remaining two had three (overlapping) AAA strings – i.e. all five letters in the DNA sequence were A.

They also noticed that patients with a higher number of AAA strings seemed to respond better to treatment. Treatment effectiveness was measured on a five-point scale (with 5 being the "best response"). They got the following data: (1,3), (1,2), (2,4), (3,4), (3,5). Where the x-coordinate is the number of AAA repeats, and the y-coordinate is the treatment response. They modeled this data as having a linear relationship. The least squares regression line of the data was _____.

The scientist wanted to predict how well a new patient would respond to treatment. This new patient actually had zero AAA repeats. According to the linear model, the best estimate for the treatment response in this case would be _____. However, since there were no patients in the original study with no AAA repeats, they had some doubts about these results.

The young scientist also studied how rehabilitation, after treatment, was affected by exercise, sleep, and diet. Three patients in the study were ranked according to these factors, and their recovery rate.

Patient 1 got a recovery score of 4. Their exercise was rated 5, sleep 3, and diet 2. Patient 2 got a recovery score of 2, an exercise rating of 3 and sleep and diet ratings 1. Patient 3 got a recovery score of 3, an exercise rating 1, sleep rating 4 and diet rating 2. They solved a linear system of equations to find that the importance of exercise was _____, the importance of sleep was _____ and the importance of diet was _____.

In the future, the student plans to expand this study to a larger scale.

Report by Anna Seigal, April 2017