Statistical Evaluation of Three Computer Models to Determine the Minimum Size of a Large Population Which Remains in Hardy-Weinberg Equilibrium

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The Hardy-Weinberg Principle states that allele frequencies will not significantly change in 5 generations if there is an extremely large population size along with other factors. I compared three computer models with a By-Hand model, performing 100 trials for each of the four simulations, to determine which model is the most accurate to the Hardy-Weinberg Principle. I used Spreadsheet #1 from the AP Biology lab book to determine a minimum population size of 302 would stay in equilibrium at 95% confidence level. I found this value after testing 10 population sizes with a total of 860 trials. Spreadsheet #2 was designed to mimic natural conditions to represent true random mating. The third model differed from #1 and #2 by not allowing any two individuals or their descendants to mate more than once. Five volunteers assisted in completing 100 trials of the By-Hand Model where they randomly selected two cards of the 302 to “mate” and produce two offspring. Dice rolling determined which allele a parent would give the offspring. This took 500 hours of combined labor. Two human trials with 132 and 128 volunteers were performed. Both stayed in Equilibrium. I used t-tests to compare the Chi square values between models. Spreadsheets #1 and #2 had no significant difference with the By-Hand Model, while Spreadsheet #3 had a significantly lower average Chi square value, meaning there was greater variation in the By-Hand trials conducted by humans, and more accuracy in Spreadsheets #2 and #3. Using probability of the z-test yielded more trials rejecting the null. Using t-test to compare z-test between models showed that only Spreadsheet #1 was not significantly different than the By-Hand Model. Spreadsheets #2 and #3 were statistically similar and the most accurate.

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