Forensic Genetics

Module 19 – Section 3 & 4 Exercises

Topic 3 Group Work

Allelic Independence

Bayesian Exercise

A rapid test for covid-19 is set up outside a supermarket and is available to anyone who wishes. The test has a false-positive rate of 5% and a false-negative rate of 30%.

If the disease has a prevalence in that population of 20%. What is the probability a person who tests positive does actually have the disease? i.e. calculate $\Pr(B|A)$ if A is the event that a test is positive, and B is the event that a person has the disease. Use Bayes' Theorem.

NIST Data

Go to https://strbase.nist.gov/NISTpop.htm

and look at "Excel file of revised allele frequencies."

How many loci appear not to be in Hardy-Weinberg Equilibrium?

Topic 4 Group Work

LR Calculations

Exercise 1a: LR – Binary Model

Consider a simple two-person mixture profile (e.g. contributors are unrelated, ignoring population structure, no drop-outs/drop-ins), where $G_C = ABCD$. Let K denote a known contributor with observed profile $G_K = CD$, and S the POI with profile $G_S = AB$.

- $G_S = AB$ and $G_K = CD$, with

  H_p : K + POI (S) and H_d : K + Unknown (U)

What are the LRs for $p_A = p_B = p_C = p_D = 0.1$?

Exercise 1b: LR – Binary Model

Consider a simple two-person mixture profile (e.g. contributors are unrelated, ignoring population structure, no drop-outs/drop-ins), where $G_C = ABCD$. Let K denote a known contributor with observed profile $G_K = CD$, and S the POI with profile $G_S = AB$.

- $G_S = AB$ and $G_K = CD$, with

  H_p : K + POI (S) and H_d : K + Unknown (U)

- $G_S = AB$ and $G_K = CD$, with

  H_p : K + S and H_d : 2U

What are the LRs for $p_A = p_B = p_C = p_D = 0.1$?

Exercise 1c: LR – Binary Model

Consider a simple two-person mixture profile (e.g. contributors are unrelated, ignoring population structure, no drop-outs/drop-ins), where $G_C = ABCD$. Let K denote a known contributor with observed profile $G_K = CD$, and S the POI with profile $G_S = AB$.

- $G_S = AB$ and $G_K = CD$, with

  H_p : K + POI (S) and H_d : K + Unknown (U)

- $G_S = AB$ and $G_K = CD$, with

  H_p : K + S and H_d : 2U

- $G_S = AB$ and the second contributor is unknown

  H_p : S + U and H_d : 2U

What are the LRs for $p_A = p_B = p_C = p_D = 0.1$?

Exercise 2: LR – Binary Model

a) Considering the previous exercise, what do you expect to happen to the LRs if we use match probabilities instead of profile probabilities? *Increase, decrease or stay the same?*

b) Verify your answer by using the appropriate Balding-Nichols formula with $\theta = 0.03$ in Exercise 1a.

c) Ignoring a known contributor under H_d (but not under H_p) is *favorable/unfavorable/irrelevant* to the defendant? (Hint: compare your answers from 1a and 1b).