# ALLELIC INDEPENDENCE GROUP WORK

AllelicIndependence

#### **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.

#### **Bayesian Exercise**

A: positive test;  $\overline{A}$ : negative test; Pr(B) = 0.20: infected; Pr( $\overline{B}$ ) = 0.80: unaffected.

$$\Pr(A|\bar{B}) = 0.05$$
:  $\Pr(\bar{A}|B) = 0.30 => \Pr(A|B) = 0.70$   
 $\Pr(A) = \Pr(A|B) \Pr(B) + \Pr(A|\bar{B}) \Pr(\bar{B}) = 0.18.$ 

$$\Pr(B|A) = \frac{\Pr(A|B)\Pr(B)}{\Pr(A)} = \frac{0.14}{0.18} = 0.78$$

AllelicIndependence

## **Permutation Test**

Put four folds across the width, of a sheet of paper to mark five genotypess, and then one fold the middle of the page, top to bottom. This gives 10 alleles, six of type A and four of type a.

	Allele	Allele
Genotype 1:	A	A
Genotype 2:	A	A
Genotype 3:	A	A
Genotype 4:	а	а
Genotype 5:	а	а

Tear along the folds give a deck of 10 alleles. Shuffle the deck and deal into 5 pairs, to give five new genptypes. How many heterozygotes are there?

AllelicIndependence

Slide 4

### **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?

Group	No. $p < 0.05$
Total	8
African American	0
Caucasian	3
Hispanic	1
Asian	2

## **Why is** p < 0.05

- Population structure for 'Total' group.
- Multiple testing: each of 29 STRs should be tested with significance level of 0.05/29.
- Possible genotyping error.
- HWE issue in whole database avoided with use of Balding-Nichols match probability.