**Simulation for a pair of biallelic Loci in LD**

The purpose of this note is to give an introduction that how to simulate a pair of loci, which is in gametic disequilibrium. s the commonly used gametic disequilibrium parameter, D, has its upper bound and lower bound upon to the allele frequencies, it seems to be easier to simulate a pair of loci given D’, the relative gematic disequilibrium as defined by Lewontin, the value of which is between -1 to 1.

Let the allele frequency of locus A is of for allele A and of for a, and of locus B is of for B and of for b. The frequencies of the four haplotypes of these two loci are (haplotype AB), (haplotype Ab), (haplotype aB), and (haplotype ab). The Lewontin’s measure (Lewontin 1964; Devlin and Risch 1995) of linkage disequilibrium, which is a quantity between -1 and 1, can be specified first for a pair of loci of question

in which [Devlin and Risch 1995]. Regardless of the sign of , the denominator in the expression of is denoted as , and .

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Locus A | |  |
|  |  | A (1) | a (0) |  |
| Locus B | B (1) | AB | aB |  |
| b (0) | Ab | ab |  |
|  |  |  |  |  |

In simulation, under random mating, the conditional probability of generating the second locus could be expressed as ( is generation)

and indicates the allele. , if the allele is A, and 0 for a. Similar for .

Devlin B., Risch N., 1995 A comparison of linkage disequilibrium measures for fine-scale mapping. Genomics **29**: 311–22.

Lewontin R. C., 1964 The Interaction of Selection and Linkage. I. General Considerations; Heterotic Models. Genetics **49**: 49–67.