A model for continuous Y:

Y = a1X1 + a2X2 + … + aiXi+ e

Var(Y) = a1^2\* Var(X1) + a2^2 \* Var(X2) + … +ai^2\*Var(Xi) + e,

At locus Xi, the three possible values are 0, 1, 2, with probabilities pi^2, 2\*pi\*(1-pi), and (1-pi)^2

Therefore, Var(Xi) = pi(1-pi)

The so-called heritability at locus i, hi, = ai^2\*Var(Xi) / Var(Y) = ai^2\*Var(Xi) / [sum(ai^2\*Var(xi)) + Var(e)]

which is also R2 in linear regression.

At each locus, we can do power calculation using pwr package (<https://www.statmethods.net/stats/power.html>).

pwr.f2.test(u =, v = , f2 = , sig.level = , power = )

here f2 = R2/ (1-R2), u=1, v=n-2

Suppose we are going to simulate 10 loci with predetermined N, MAFs, sig.level, and power, we can get 10 Ri2. We can predetermine the coefficient ai’s, (note there will be some constraints depending on MAFs, sig.level, and power). By R2 = hi = ai^2\*Var(Xi) / [sum(ai^2\*Var(xi)) + Var(e)], we can get Var(e).

To sum, we simulate Xi’s, then simulate Y by E(Y) + Var(e) = sum(ai\*Xi) + rnorm(n, 0, sd(e))