T1E simulation

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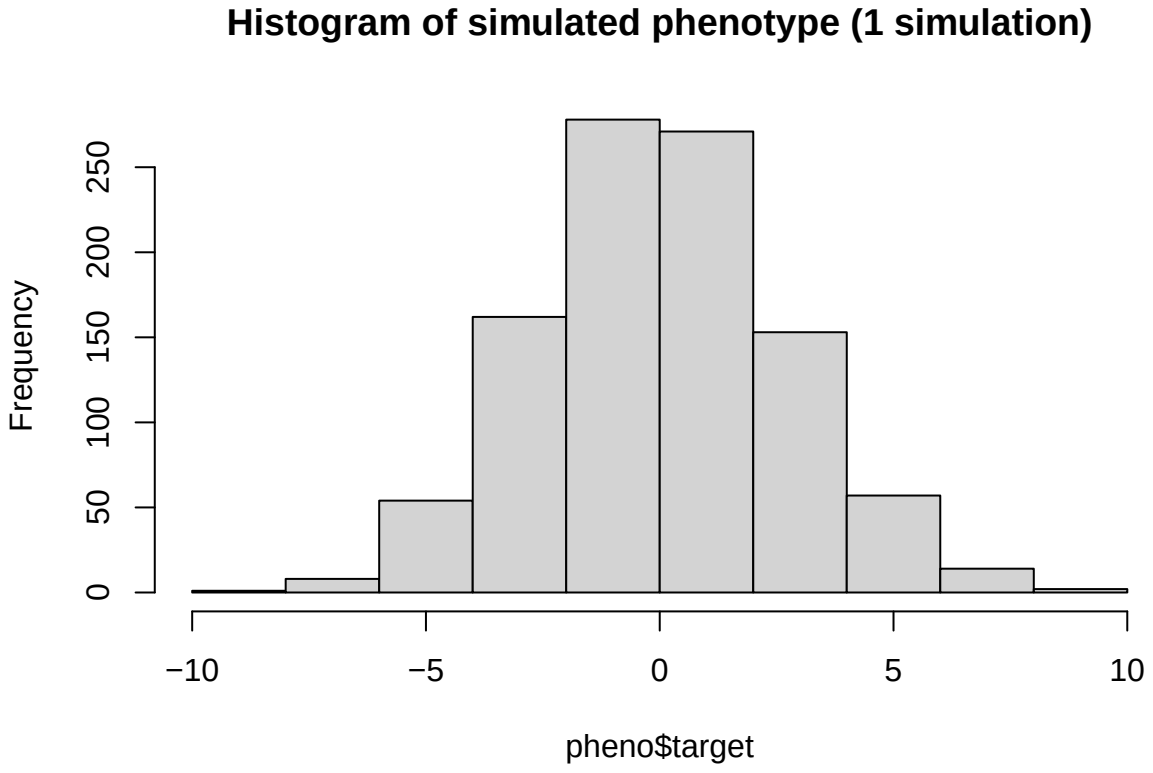
This document is a bit informal, but I hope it's informative!

Parameter set-up

- sample size $N = 10^3$
- Number of replicates: 10^5
- Genotypes are generated $G \sim Bin(2, \text{maf}), \text{maf} \sim Unif[0.05, 0.5]$
- Target phenotypes $Y_i \sim N(X_i^T\beta, 1)$, where $X_i = (1, x_{1,i}, x_{2_i})$ and $x_{1,i}, x_{2,i} \sim N(0, 1)$.
- Surrogate $S_i \sim N(X_i^T\beta + \rho(Y_i - X_i^T\beta), 1 - \rho^2)$.
- Code is borrowed from zack's github.
- $\rho \in \{0, 0.25, 0.5, 0.75\}$
- missing rate of target phenotype $m \in \{0, 0.25, 0.5, 0.75\}$
- $\beta = (1, 1, 2)$



Result

With 10^5 replicates, i did not see inflated t1e for surrogate?

Table 1: Proportion of test making type I error

mssing	rho	oracle	target	surrogate	bivariate
0.00	0.00	0.05020	0.05020	0.05040	0.05042
0.00	0.25	0.05096	0.05096	0.05076	0.05110
0.00	0.50	0.05065	0.05065	0.05000	0.05085
0.00	0.75	0.05030	0.05030	0.05033	0.05049
0.25	0.00	0.04936	0.04995	0.04945	0.05047
0.25	0.25	0.04980	0.04894	0.05052	0.04922
0.25	0.50	0.04918	0.04854	0.04967	0.04911
0.25	0.75	0.04994	0.04988	0.05039	0.04981
0.50	0.00	0.04926	0.04917	0.04991	0.04983
0.50	0.25	0.05049	0.05088	0.05064	0.04986
0.50	0.50	0.04997	0.05006	0.04911	0.05066
0.50	0.75	0.04999	0.05007	0.04932	0.05075
0.75	0.00	0.05184	0.05198	0.05151	0.05353
0.75	0.25	0.04885	0.04919	0.05051	0.05010
0.75	0.50	0.04977	0.04954	0.05048	0.05121
0.75	0.75	0.05048	0.05051	0.04914	0.05030

Table 2: Average chi-square statistics across SNPs

mssing	rho	oracle	target	surrogate	bivariate
0.00	0.00	1.0005141	1.0005141	1.0068409	0.9995095
0.00	0.25	1.0066156	1.0066156	1.0028439	1.0056686
0.00	0.50	1.0041801	1.0041801	0.9978135	1.0035128
0.00	0.75	1.0026144	1.0026144	1.0071133	1.0021528
0.25	0.00	0.9963335	0.9987708	0.9965970	0.9980413
0.25	0.25	1.0000021	0.9960742	1.0038414	0.9950009
0.25	0.50	0.9961937	0.9931360	0.9990870	0.9929659
0.25	0.75	1.0061180	1.0049663	1.0100163	1.0027865
0.50	0.00	0.9950634	0.9977285	0.9983578	0.9978400
0.50	0.25	1.0051427	1.0070931	1.0102441	1.0038216
0.50	0.50	1.0011917	1.0065827	0.9998531	1.0064294
0.50	0.75	0.9980753	0.9989164	0.9933880	0.9999842
0.75	0.00	1.0171249	1.0220782	1.0077877	1.0250152
0.75	0.25	0.9937208	1.0059830	1.0105010	1.0051492
0.75	0.50	0.9986351	1.0019875	1.0033156	1.0023551
0.75	0.75	1.0064001	1.0080813	1.0022739	1.0071693