Exercises Day 2

Part 1

Exercise 1.1 Multiple Trait Breeding Value Accuracy

Use the program *mtindex.xlsm* (2Traits sheet) to

➔ **explore the effect of information from correlated traits.**

Start with equal variance (1.0) , equal genetic parameters - heritability (0.25),
genetic correlation = 0.5 and phenotypic correlation = 0.1.

Consider the information available per trait:

- Limited information: record on sires and record on dam
- Moderate information: record on own, sire, dam, 25 half sibs
- Much information: record on own, sire, dam, 25 half sibs, 25 progeny records

Assuming equal information available for each trait, compare for each of these cases single trait accuracy versus multiple trait accuracy, i.e. the accuracy of estimating the EBV for a trait, using information on both traits.
Also, write down the correlation between the EBVs for the two traits.

Repeat the exercise with genetic correlation = 0.5 and phenotypic correlation = 0.5.
Repeat the exercise with genetic correlation = 0.5 and phenotypic correlation = -0.5.

Assume now unequal heritability, with h^2 of first trait = 0.5, and of second trait = 0.1,
Genetic correlation = 0.5 and phenotypic correlation = -0.1.
Consider the cases
Trait 1 has limited information, trait 2 has much information
Trait 1 has much information, trait 2 has limited information

Can you think of some cases in breeding programs where the EBV of a trait leans heavily on a correlated trait? Consider the correlation between EBVs in that case, and its effect on selection response.

Note that for the purpose of this exercise, to mimic the cases with different amounts of information available for each trait, you can simply vary the progeny number, corresponding to the same single trait accuracy. You can use that in the next exercise.

However, for a proper comparison of breeding programs, information on parents and sibs is not equivalent to information on progeny! Why not?

h21	h22	rp	rg								
0.5	0.1	0.1	0.5							relative accuracy	
Accuracy		correl									
MT-EBV	ST-EBV	ebv1,ebv2	own	dam	sire	full sibs	half sibs	progeny			
0.381	0.354	0.760	0	1	1	0	0	0		1.077783	
0.647	0.622	0.690	1	1	1	0	25	0		1.040093	
0.843	0.835	0.610	1	1	1	0	25	25		1.010419	
h21	h22	rp	rg								
0.25	0.25	0.5	0.5								
Accuracy		correl									
MT-EBV	ST-EBV	ebv1,ebv2	own	dam	sire	full sibs	half sibs	progeny			
0.354	0.354	0.500	0	1	1	0	0	0		1.000	
0.622	0.622	0.500	1	1	1	0	25	0		1.000	
0.835	0.835	0.500	1	1	1	0	25	25		1.000	
h21	h22	rp	rg								
0.25	0.25	-0.5	0.5								
Accuracy		correl									
MT-EBV	ST-EBV	ebv1,ebv2	own	dam	sire	full sibs	half sibs	progeny			
0.540	0.354	0.930	0	1	1	0	0	0		1.527525	
0.798	0.622	0.860	1	1	1	0	25	0		1.282433	
0.887	0.835	0.730	1	1	1	0	25	25		1.062084	

We observe more gain in accuracy (from single trait EBV to multiple trait EBV) if there is initially little information. If the STEBV accuracy is already high, there is little to gain.

The correlation structure has some effect, it seems the larger the difference between rg and rp, the more information is gained from the correlated trait. When rp is equal to rg and also the heritabilities are the same, there is no extra gain at al. This is not easy to explain, but the genetic regression and the phenotypic regression are the same, so there is no information coming from the correlated trait.

In general we see that as more information is borrowed from the correlated trait (i.e. the lager the difference between STEBV and MTEBV), the higher the correlation between EBV1 and EBV2.

Also in the next example we see that the low heritable trait borrows more information from the correlated trait, it gains more from STEBV to MTEBV, because by itself the accuracy is very low for such a trait.

	h21	h22	rp	rg							
	0.5	0.1	0.1	0.5							
	Accuracy		correl								
	MT-EBV	ST-EBV	ebv1,ebv2	own	dam	sire	full sibs	half sibs	progeny		
Trait 1	0.504	0.500	0.85	0	1	1	0	0	0		1.008
Trait 2	0.320	0.224		0	1	1	0	0	0		1.431
Trait 1	0.777	0.774	0.76	1	1	1	0	25	0		1.005
Trait 2	0.547	0.457		1	1	1	0	25	0		1.197
Trait 1	0.915	0.914	0.66	1	1	1	0	25	25		1.001
Trait 2	0.730	0.689									