

## Introduction

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The latest international evaluation for dairy **production traits** took place as scheduled at the Interbull Centre. Data from thirty-four (34) countries were included in this evaluation.

International genetic evaluations for milk, fat and protein yields of bulls from Australia, Austria-Germany, Belgium, Canada, Croatia, Czech Republic, Denmark-Finland-Sweden, Estonia, France, Hungary, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Netherlands, New Zealand, Norway, Poland, Republic of South Africa, Slovak Republic, Slovenia, Spain, Switzerland, the United Kingdom, the United States of America, Portugal, Korea, Uruguay and Mexico were computed. Brown Swiss, Guernsey, Holstein, Jersey, Red Dairy Cattle and Simmental breed data were included in this evaluation.

## Changes in national procedures

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Changes in the national genetic evaluation of production traits are as follows:

- ISR HOL            Data editing and paternity rejection resulting in decrease in the number of records and herds
- JPN HOL            Decreased information of daughters due to changes of pedigree
- FRA ALL            Base change
- DEU HOL/RDC      Base change  
JER
- ITA HOL            Cut off one year of data and base change
- CHE BSW/HOL      Changed pre-adjustment for pregnancy based on number of days after SIM conception for HOL, SIM and BSW. To account for stage of pregnancy, we pre-adjust the phenotypic data. Pregnancy effect estimates (from a previous study) are used for additive pre adjustment of test-day records. Due to an error in a program code, pre-adjustment for days pregnant didn't work properly (since the introduction of the RRTDM in 2005). As a consequence of this error, nearly all the records got the maximum correction. Now, this error is fixed and the pre-adjustment for days pregnant should work correctly.
- CHE JER            First time
- AUS BSW/GUE/      Changes to the rules for the official publication resulting in many JER/RDC/HOL      bulls changing status to N Changes in pedigree resulting in changes in proportion of first and second crop daughters, As following effect there is a change for some animals in proof type from 12 previous(second cropt dau) back to 11 (only first crop dau). Data corrections. In previous run some daughters were wrongly allocated. After correction, some changes in BV and slope are observed.
- BEL HOL            Change the "national standards" for official publication in our country (Walloon Region of Belgium) for type of proof = 21. Now, these "national standards" for this type of proof are the same than for type of proof= 11 or 12, i.e. if REL >= 50%
- NZL ALL            Continuous DNA parentage testing.

HRV HOL/SIM Changes in heritability due to estimated variance components based on larger (new) data set. Decrease in information due to pedigree changes and completeness

IRL ALL Some drop in information due to more routine checking done on ancestry now based on genotypes (i.e. remove/change sires if genotypes don't match).

CAM RDC Base change

CAN ALL Base change

ITA SIM Base change

ITA BSW Base change

URY HOL Change in variance components

USA RDC Discovered a bug in the system related to RDC pedigrees. Previously cow heterosis had been computed as if mating AY to Scandinavian does not cause heterosis, whereas bull heterosis assumed they were different breeds. Now we apply the same math to both sexes. The correction is a post-adjustment to the PTAs, not part of the genetic model.

#### INTERBULL CHANGES COMPARED TO THE DECEMBER ROUTINE RUN

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Subsetting:  
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As decided by the ITC in Orlando, new subsetting was introduced in the september test run. Sub-setting is necessary for operational purposes and restrictions of time scales. To minimize the effect of subsetting, larger subsets with 10-12 countries and with 4 link providing countries have been applied.

Window:  
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According to the decision taken by ITC in Orlando, the following changes have been introduced in regards to the windows used for post processing:

The upper bounds have been set to 0.99 as these were judged to have very little effect on evaluations. The lower values have been set to about the 25% percentile value. The largest changes are for the lower values for conformation traits, with the lowest window being 40% for OFL otherwise it is about 50% for all other confirmation traits. It is anticipated that these low values may not have large impact on evaluations since there were very few countries combinations whose estimated correlations fell between the old limit of 0.30 and these new limits.

#### DATA AND METHOD OF ANALYSIS

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Data were national genetic evaluations of AI sampled bulls with at least 10 daughters or 10 EDC (for clinical mastitis and maternal calving traits at least 50 daughters or 50 EDC, and for direct calving traits at least 50 calvings or 50 EDC) in at least 10 herds. Table 1 presents the amount of data included in this Interbull evaluation for all breeds.

National proofs were first de-regressed within country and then analysed jointly with a linear model including the effects of evaluation country, genetic group of bull and bull merit. Heritability estimates used in both the de-regression and international evaluation were as in each country's national evaluation.

Table 2 presents the date of evaluation as supplied by each country

Estimated genetic parameters and sire standard deviations are shown in APPENDIX I and the corresponding number of common bulls are listed in APPENDIX II.

#### SCIENTIFIC LITERATURE

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The international genetic evaluation procedure is based on international work described in the following scientific publications:

International genetic evaluation computation:

- Schaeffer. 1994. J. Dairy Sci. 77:2671-2678
- Klei, 1998. Interbull Bulletin 17:3-7

Verification and Genetic trend validation:

- Klei et al., 2002. Interbull Bulletin 29:178-182.
- Boichard et al., 1995. J. Dairy Sci. 78:431-437

Weighting factors:

- Fikse and Banos, 2001. J. Dairy Sci. 84:1759-1767

De-regression:

- Sigurdsson and G. Banos. 1995. Acta Agric. Scand. 45:207-219
- Jairath et al. 1998. J. Dairy Sci. Vol. 81:550-562

Genetic parameter estimation:

- Klei and Weigel, 1998, Interbull Bulletin 17:8-14
- Sullivan, 1999. Interbull Bulletin 22:146-148

Post-processing of estimated genetic correlations:

- Mark et al., 2003, Interbull Bulletin 30:126-135
- Jorjani et al., 2003. J. Dairy Sci. 86:677-679
- <https://wiki.interbull.org/public/rG%20procedure?action=print>

Time edits

- Weigel and Banos. 1997. J. Dairy Sci. 80:3425-3430

International reliability estimation

- Harris and Johnson. 1998. Interbull Bulletin 17:31-36

#### NEXT ROUTINE INTERNATIONAL EVALUATION

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Dates for the next routine evaluation can be found on  
<http://www.interbull.org/ib/servicecalendar>.

#### NEXT TEST INTERNATIONAL EVALUATION

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Dates for the next test run can be found on  
<http://www.interbull.org/ib/servicecalendar>.

#### PUBLICATION OF INTERBULL TEST RUN

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Test evaluation results are meant for review purposes only and should not be published.

^LTable 1. National evaluation data considered in the Interbull evaluation for dairy production traits (April Routine Evaluation 2018). Number of records for milk yield by breed

Country SIM	BSW	GUE	HOL	JER	RDC
AUS	190	131	7392	1627	687
BEL			1924		
CAN	217	99	11801	692	786
CHE	2850		3236	84	
3119					
CZE			4156		
DEA	5819				
23208					
DEU			27047	185	420
DFS			12715	2086	7547
ESP			3546		
EST			1082		417
FRA	378		16715		
454					
FRM					
4506					
GBR	142	324	6882	870	597
92					
HUN			3144		
214					
IRL			2604	162	49
93					
ISR			1367		
ITA	2048		9022	170	
1600					
JPN			5648		
KOR			1283		
LTU			765		433
LVA			1066		694
NLD	177		14926	139	63
323					
NOR					4056
NZL	51	60	7364	4715	1340
POL			9900		
PRT			2333		
SVK			1095		
570					
SVN	355		501		
595					
URY			998		
USA	1068	771	36659	4420	693
43					
ZAF			1273	690	141
HRV			721		
801					
MEX			605		
CAM					38
No. Records	13295	1385	197770	15840	17961
35618					



BSW pro

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	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL
GBR	AUS								
CAN	22.63								
FRA	0.84	20.52							
USA	0.90	0.86	18.95						
CHE	0.86	0.85	0.83	16.66					
ITA	0.85	0.82	0.83	0.85	20.91				
DEA	0.86	0.81	0.82	0.92	0.89	14.36			
NLD	0.86	0.84	0.84	0.83	0.82	0.84	20.30		
SVN	0.82	0.81	0.82	0.81	0.81	0.81	0.82	9.43	
NZL	0.70	0.70	0.70	0.71	0.70	0.74	0.70	0.75	10.39
GBR	0.85	0.86	0.83	0.85	0.81	0.82	0.85	0.83	0.70
7.28									
AUS	0.70	0.71	0.69	0.70	0.69	0.71	0.71	0.73	0.81
0.72	11.92								

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GUE mil

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	CAN	USA	AUS	GBR	NZL
CAN	742.82				
USA	0.94	690.66			
AUS	0.82	0.77	478.94		
GBR	0.86	0.83	0.77	241.85	
NZL	0.71	0.70	0.84	0.71	325.88

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GUE fat

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	CAN	USA	AUS	GBR	NZL
CAN	30.11				
USA	0.93	25.11			
AUS	0.79	0.76	17.83		
GBR	0.86	0.84	0.75	10.64	
NZL	0.72	0.71	0.84	0.70	16.41

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GUE pro

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	CAN	USA	AUS	GBR	NZL
CAN	22.67				
USA	0.91	19.07			
AUS	0.73	0.70	13.99		
GBR	0.85	0.83	0.73	7.27	
NZL	0.70	0.69	0.83	0.69	10.82

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HOL mil

	CAN	DEU	DFS	FRA	ITA	NLD	USA	CHE	GBR	
NZL	AUS	BEL	IRL	ESP	CZE	SVN	EST	ISR	HUN	POL
ZAF	JPN	LVA	SVK	LTU	PRT	KOR	URY	HRV	MEX	
CAN	770.09									
DEU	0.92	624.57								
DFS	0.94	0.93	11.13							
FRA	0.91	0.89	0.93	661.59						
ITA	0.90	0.87	0.89	0.88	576.32					
NLD	0.92	0.92	0.93	0.91	0.87	665.11				
USA	0.94	0.90	0.93	0.91	0.91	0.90	671.10			
CHE	0.90	0.90	0.92	0.94	0.88	0.91	0.89	678.59		
GBR	0.87	0.83	0.87	0.87	0.83	0.87	0.85	0.89	271.95	
NZL	0.69	0.69	0.71	0.76	0.69	0.71	0.70	0.77	0.70	
313.08										
AUS	0.78	0.76	0.75	0.80	0.73	0.78	0.76	0.80	0.77	
0.84	415.68									
BEL	0.85	0.87	0.82	0.83	0.81	0.84	0.81	0.81	0.81	
0.69	0.78	494.86								
IRL	0.84	0.83	0.85	0.90	0.80	0.87	0.83	0.88	0.83	
0.85	0.83	0.80	184.01							
ESP	0.93	0.91	0.92	0.92	0.89	0.91	0.93	0.90	0.84	
0.69	0.78	0.85	0.84	542.08						
CZE	0.86	0.87	0.83	0.81	0.81	0.82	0.83	0.81	0.81	
0.69	0.70	0.82	0.74	0.84	738.67					
SVN	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	
0.70	0.70	0.81	0.70	0.81	0.81	11.58				
EST	0.88	0.85	0.90	0.86	0.84	0.86	0.88	0.87	0.81	
0.72	0.76	0.81	0.79	0.86	0.84	0.82	534.19			
ISR	0.83	0.82	0.83	0.83	0.84	0.82	0.84	0.83	0.82	
0.63	0.72	0.82	0.69	0.84	0.82	0.83	0.83	382.44		
HUN	0.86	0.84	0.87	0.88	0.90	0.85	0.89	0.85	0.83	
0.69	0.69	0.81	0.79	0.86	0.82	0.81	0.85	0.84	666.86	
POL	0.89	0.89	0.89	0.88	0.88	0.89	0.88	0.84	0.82	
0.69	0.76	0.81	0.82	0.90	0.86	0.80	0.87	0.83	0.88	409.95
ZAF	0.84	0.81	0.81	0.83	0.81	0.81	0.83	0.81	0.81	
0.69	0.81	0.81	0.78	0.83	0.81	0.81	0.82	0.84	0.81	0.81
523.55										
JPN	0.94	0.90	0.93	0.91	0.89	0.91	0.93	0.89	0.84	
0.71	0.79	0.84	0.83	0.91	0.85	0.81	0.88	0.87	0.85	0.91
0.84	631.24									
LVA	0.80	0.81	0.81	0.81	0.81	0.81	0.80	0.81	0.81	
0.70	0.70	0.81	0.72	0.81	0.81	0.82	0.81	0.83	0.81	0.80
0.81	0.81	441.78								
SVK	0.80	0.81	0.83	0.81	0.81	0.81	0.81	0.82	0.81	
0.69	0.70	0.81	0.74	0.81	0.81	0.82	0.83	0.84	0.85	0.82
0.81	0.82	0.82	389.31							
LTU	0.81	0.81	0.81	0.82	0.81	0.81	0.80	0.82	0.81	
0.70	0.70	0.82	0.72	0.81	0.81	0.83	0.82	0.84	0.81	0.80
0.82	0.82	0.81	0.82	355.34						
PRT	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	
0.68	0.68	0.80	0.71	0.80	0.80	0.81	0.81	0.83	0.80	0.80
0.80	0.80	0.80	0.80	0.81	603.12					
KOR	0.86	0.81	0.85	0.82	0.81	0.81	0.84	0.81	0.81	
0.72	0.74	0.82	0.74	0.84	0.81	0.82	0.84	0.83	0.81	0.80
0.81	0.86	0.81	0.82	0.82	0.80	484.89				
URY	0.80	0.80	0.80	0.80	0.81	0.80	0.80	0.81	0.80	
0.77	0.75	0.80	0.75	0.80	0.80	0.82	0.81	0.84	0.80	0.80
0.80	0.81	0.81	0.81	0.81	0.80	0.80	170.86			

HRV	0.81	0.81	0.81	0.81	0.81	0.81	0.80	0.81	0.81	
0.70	0.70	0.81	0.69	0.81	0.81	0.82	0.82	0.83	0.81	0.80
0.81	0.81	0.81	0.82	0.81	0.80	0.82	0.81	11.60		
MEX	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.81	0.80	
0.69	0.69	0.80	0.69	0.80	0.80	0.82	0.81	0.84	0.80	0.80
0.80	0.80	0.81	0.81	0.82	0.80	0.80	0.80	0.81	380.88	

HOL fat

	CAN	DEU	DFS	FRA	ITA	NLD	USA	CHE	GBR	
NZL	AUS	BEL	IRL	ESP	CZE	SVN	EST	ISR	HUN	POL
ZAF	JPN	LVA	SVK	LTU	PRT	KOR	URY	HRV	MEX	
CAN	30.67									
DEU	0.90	24.16								
DFS	0.93	0.91	11.12							
FRA	0.91	0.89	0.92	26.78						
ITA	0.89	0.86	0.86	0.89	23.83					
NLD	0.90	0.91	0.91	0.89	0.85	25.25				
USA	0.93	0.90	0.91	0.91	0.92	0.89	24.90			
CHE	0.88	0.88	0.91	0.91	0.84	0.89	0.87	26.38		
GBR	0.86	0.86	0.88	0.89	0.83	0.88	0.87	0.90	9.35	
NZL	0.68	0.69	0.70	0.72	0.69	0.69	0.70	0.73	0.70	
12.62										
AUS	0.75	0.72	0.73	0.77	0.71	0.72	0.76	0.74	0.74	
0.83	14.50									
BEL	0.84	0.86	0.82	0.84	0.81	0.84	0.81	0.81	0.81	
0.71	0.76	20.26								
IRL	0.82	0.80	0.85	0.86	0.75	0.83	0.79	0.84	0.80	
0.84	0.80	0.83	7.04							
ESP	0.91	0.89	0.87	0.91	0.90	0.89	0.93	0.86	0.84	
0.69	0.75	0.83	0.80	21.79						
CZE	0.85	0.86	0.84	0.82	0.82	0.81	0.85	0.81	0.81	
0.69	0.70	0.81	0.70	0.85	22.32					
SVN	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	
0.70	0.70	0.81	0.70	0.81	0.81	11.57				
EST	0.87	0.87	0.91	0.87	0.87	0.85	0.87	0.86	0.81	
0.80	0.78	0.87	0.84	0.85	0.85	0.82	20.85			
ISR	0.83	0.82	0.82	0.82	0.82	0.82	0.85	0.82	0.82	
0.63	0.68	0.82	0.63	0.82	0.82	0.83	0.83	14.33		
HUN	0.85	0.84	0.82	0.87	0.90	0.83	0.90	0.81	0.82	
0.69	0.69	0.81	0.69	0.88	0.82	0.81	0.82	0.83	25.89	
POL	0.89	0.90	0.87	0.90	0.89	0.86	0.90	0.81	0.81	
0.68	0.70	0.83	0.76	0.92	0.87	0.80	0.89	0.83	0.88	16.34
ZAF	0.80	0.81	0.81	0.81	0.81	0.81	0.80	0.81	0.81	
0.69	0.69	0.81	0.68	0.81	0.81	0.82	0.82	0.83	0.81	0.80
17.36										
JPN	0.92	0.89	0.92	0.90	0.86	0.89	0.90	0.88	0.84	
0.71	0.72	0.83	0.82	0.86	0.83	0.81	0.88	0.82	0.81	0.88
0.81	24.28									
LVA	0.80	0.81	0.81	0.81	0.81	0.81	0.80	0.81	0.81	
0.70	0.70	0.81	0.69	0.81	0.81	0.82	0.84	0.83	0.81	0.80
0.81	0.81	18.87								
SVK	0.80	0.81	0.81	0.81	0.82	0.81	0.80	0.82	0.81	
0.70	0.70	0.81	0.69	0.81	0.81	0.82	0.86	0.84	0.83	0.81
0.81	0.81	0.82	15.15							
LTU	0.81	0.81	0.81	0.82	0.81	0.81	0.80	0.82	0.81	
0.70	0.71	0.82	0.70	0.81	0.81	0.83	0.82	0.84	0.81	0.80
0.82	0.81	0.81	0.82	15.35						







JER fat

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	CAN	DFS	USA	NZL	AUS	GBR	NLD	ZAF	ITA
DEU	IRL	CHE							
CAN	26.06								
DFS	0.90	11.39							
USA	0.91	0.90	24.67						
NZL	0.69	0.70	0.74	12.08					
AUS	0.79	0.71	0.76	0.84	13.61				
GBR	0.83	0.84	0.82	0.69	0.71	10.25			
NLD	0.88	0.87	0.86	0.70	0.72	0.85	24.67		
ZAF	0.81	0.81	0.80	0.69	0.71	0.81	0.81	14.32	
ITA	0.88	0.84	0.86	0.70	0.73	0.83	0.84	0.82	24.85
DEU	0.89	0.89	0.86	0.70	0.74	0.84	0.89	0.82	0.86
23.32									
IRL	0.80	0.79	0.76	0.81	0.81	0.76	0.80	0.72	0.74
0.79	6.48								
CHE	0.87	0.86	0.85	0.72	0.78	0.85	0.86	0.81	0.84
0.89	0.80	15.57							

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JER pro

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	CAN	DFS	USA	NZL	AUS	GBR	NLD	ZAF	ITA
DEU	IRL	CHE							
CAN	18.36								
DFS	0.91	10.40							
USA	0.89	0.92	18.61						
NZL	0.69	0.70	0.69	8.49					
AUS	0.73	0.70	0.69	0.81	10.40				
GBR	0.84	0.85	0.81	0.69	0.71	6.60			
NLD	0.88	0.89	0.85	0.70	0.71	0.85	19.32		
ZAF	0.83	0.82	0.80	0.69	0.72	0.81	0.82	11.43	
ITA	0.85	0.84	0.85	0.70	0.70	0.82	0.83	0.85	18.63
DEU	0.86	0.91	0.86	0.70	0.71	0.83	0.88	0.82	0.84
17.26									
IRL	0.75	0.76	0.73	0.85	0.81	0.74	0.77	0.71	0.72
0.75	5.90								
CHE	0.84	0.85	0.83	0.70	0.71	0.83	0.84	0.81	0.83
0.85	0.78	10.39							

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RDC mil

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	CAN	NOR	USA	NZL	AUS	GBR	DFS	DEU	ZAF
EST	LVA	LTU	IRL	NLD	CAM				
CAN	590.66								
NOR	0.89	12.28							
USA	0.91	0.89	666.20						
NZL	0.69	0.72	0.69	319.08					
AUS	0.76	0.77	0.76	0.84	419.53				
GBR	0.84	0.83	0.83	0.70	0.78	258.17			
DFS	0.91	0.92	0.90	0.69	0.79	0.84	10.20		
DEU	0.91	0.91	0.89	0.70	0.77	0.83	0.92	598.33	
ZAF	0.82	0.88	0.84	0.70	0.77	0.81	0.81	0.81	546.02
EST	0.88	0.85	0.88	0.75	0.76	0.83	0.87	0.84	0.83
483.57									
LVA	0.82	0.83	0.81	0.73	0.72	0.82	0.83	0.82	0.82
0.83	311.19								
LTU	0.83	0.83	0.82	0.72	0.72	0.82	0.81	0.82	0.84
0.83	0.82	322.78							
IRL	0.83	0.73	0.82	0.85	0.83	0.81	0.83	0.82	0.79
0.80	0.75	0.75	162.90						
NLD	0.92	0.90	0.89	0.72	0.79	0.86	0.93	0.92	0.81
0.85	0.83	0.83	0.86	733.94					
CAM	0.89	0.89	0.95	0.76	0.77	0.88	0.89	0.89	0.88
0.90	0.89	0.89	0.84	0.88	434.02				

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RDC fat

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	CAN	NOR	USA	NZL	AUS	GBR	DFS	DEU	ZAF
EST	LVA	LTU	IRL	NLD	CAM				
CAN	22.50								
NOR	0.88	11.70							
USA	0.91	0.84	24.54						
NZL	0.69	0.75	0.69	13.48					
AUS	0.74	0.75	0.78	0.86	15.72				
GBR	0.84	0.82	0.84	0.69	0.75	8.88			
DFS	0.90	0.89	0.89	0.70	0.78	0.85	10.31		
DEU	0.90	0.90	0.89	0.70	0.75	0.86	0.90	24.31	
ZAF	0.81	0.87	0.85	0.70	0.70	0.81	0.81	0.81	19.24
EST	0.87	0.85	0.86	0.79	0.75	0.83	0.86	0.85	0.83
18.48									
LVA	0.82	0.83	0.82	0.73	0.72	0.82	0.82	0.83	0.83
0.84	13.59								
LTU	0.83	0.83	0.82	0.73	0.72	0.83	0.81	0.82	0.85
0.83	0.82	15.21							
IRL	0.81	0.72	0.79	0.83	0.82	0.79	0.82	0.79	0.71
0.83	0.74	0.76	6.73						
NLD	0.90	0.89	0.88	0.70	0.75	0.87	0.91	0.91	0.81
0.85	0.83	0.83	0.82	29.02					
CAM	0.90	0.88	0.95	0.76	0.80	0.89	0.89	0.89	0.90
0.89	0.89	0.89	0.83	0.89	21.86				

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RDC pro

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	CAN	NOR	USA	NZL	AUS	GBR	DFS	DEU	ZAF
EST	LVA	LTU	IRL	NLD	CAM				
CAN	17.67								
NOR	0.88	11.74							
USA	0.89	0.86	18.94						
NZL	0.69	0.72	0.69	9.54					
AUS	0.69	0.77	0.71	0.80	12.38				
GBR	0.83	0.83	0.83	0.69	0.73	7.12			
DFS	0.89	0.89	0.89	0.69	0.72	0.84	10.38		
DEU	0.87	0.93	0.86	0.70	0.72	0.83	0.90	18.36	
ZAF	0.81	0.89	0.81	0.70	0.73	0.81	0.81	0.81	15.79
EST	0.83	0.83	0.85	0.75	0.73	0.83	0.82	0.84	0.83
14.54									
LVA	0.82	0.83	0.82	0.73	0.72	0.82	0.82	0.82	0.83
0.82	8.99								
LTU	0.83	0.83	0.82	0.73	0.72	0.83	0.81	0.82	0.85
0.83	0.82	9.75							
IRL	0.74	0.73	0.76	0.82	0.82	0.78	0.77	0.73	0.72
0.74	0.74	0.76	5.16						
NLD	0.88	0.90	0.86	0.70	0.73	0.86	0.89	0.89	0.81
0.84	0.83	0.83	0.79	25.39					
CAM	0.89	0.89	0.91	0.76	0.78	0.89	0.89	0.89	0.89
0.89	0.89	0.89	0.83	0.89	10.27				

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SIM mil

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	CHE	DEA	FRM	ITA	SVN	FRA	HUN	NLD	IRL
SVK	GBR	HRV	USA						
CHE	648.29								
DEA	0.87	509.81							
FRM	0.96	0.88	625.96						
ITA	0.84	0.81	0.81	492.38					
SVN	0.84	0.81	0.84	0.81	8.75				
FRA	0.93	0.89	0.89	0.85	0.82	675.59			
HUN	0.85	0.82	0.89	0.87	0.84	0.87	401.08		
NLD	0.89	0.94	0.90	0.83	0.82	0.89	0.85	754.99	
IRL	0.83	0.73	0.84	0.74	0.73	0.89	0.79	0.80	170.81
SVK	0.83	0.81	0.82	0.81	0.82	0.82	0.85	0.82	0.76
323.23									
GBR	0.88	0.88	0.88	0.82	0.82	0.87	0.83	0.86	0.80
0.83	215.22								
HRV	0.82	0.81	0.89	0.81	0.82	0.82	0.83	0.82	0.73
0.82	0.81	10.55							
USA	0.89	0.84	0.88	0.89	0.81	0.91	0.89	0.90	0.83
0.81	0.85	0.81	571.19						

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SIM fat

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	CHE	DEA	FRM	ITA	SVN	FRA	HUN	NLD	IRL
SVK	GBR	HRV	USA						
CHE	25.39								
DEA	0.88	19.33							
FRM	0.94	0.90	24.59						
ITA	0.83	0.82	0.81	19.55					
SVN	0.83	0.81	0.84	0.81	9.05				
FRA	0.90	0.91	0.89	0.85	0.82	27.19			
HUN	0.81	0.82	0.88	0.88	0.84	0.87	15.43		
NLD	0.88	0.93	0.90	0.83	0.82	0.88	0.83	28.83	
IRL	0.75	0.71	0.78	0.72	0.73	0.85	0.70	0.79	7.27
SVK	0.83	0.81	0.82	0.81	0.82	0.82	0.84	0.82	0.74
12.88									
GBR	0.91	0.87	0.87	0.83	0.82	0.89	0.82	0.87	0.77
0.82	8.19								
HRV	0.82	0.81	0.88	0.81	0.82	0.82	0.83	0.82	0.75
0.82	0.81	10.56							
USA	0.86	0.84	0.84	0.90	0.81	0.91	0.90	0.89	0.78
0.81	0.86	0.81	19.39						

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SIM pro

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	CHE	DEA	FRM	ITA	SVN	FRA	HUN	NLD	IRL
SVK	GBR	HRV	USA						
CHE	19.79								
DEA	0.85	15.50							
FRM	0.93	0.88	19.42						
ITA	0.82	0.81	0.81	15.63					
SVN	0.83	0.81	0.84	0.81	9.00				
FRA	0.90	0.86	0.89	0.82	0.82	21.36			
HUN	0.82	0.82	0.89	0.85	0.84	0.85	12.90		
NLD	0.85	0.93	0.87	0.82	0.82	0.85	0.82	23.68	
IRL	0.77	0.71	0.81	0.71	0.73	0.81	0.69	0.75	6.09
SVK	0.83	0.81	0.82	0.81	0.82	0.82	0.85	0.82	0.73
9.92									
GBR	0.85	0.89	0.88	0.81	0.82	0.86	0.81	0.86	0.76
0.83	6.76								
HRV	0.82	0.81	0.89	0.81	0.82	0.82	0.83	0.82	0.73
0.82	0.81	10.52							
USA	0.85	0.83	0.84	0.87	0.81	0.88	0.87	0.86	0.75
0.81	0.84	0.81	14.97						

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^LAPPENDIX II. Number of common bulls

BSW

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common bulls below diagonal  
common three quarter sib group above diagonal

	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	0	77	160	117	111	125	47	28	23	65	82
FRA	65	0	116	152	177	203	80	50	21	57	56
USA	144	78	0	303	227	307	74	37	28	89	119
CHE	92	114	285	0	416	546	88	68	24	72	104
ITA	91	141	158	359	0	658	116	87	26	78	108
DEA	99	150	269	442	555	0	133	93	32	77	117
NLD	44	66	64	79	96	127	0	38	23	41	51
SVN	25	49	30	65	86	86	39	0	8	23	23
NZL	21	17	24	19	19	27	16	7	0	19	25
GBR	58	45	80	53	54	52	32	18	17	0	55
AUS	81	42	110	63	75	79	38	19	20	45	0

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BSW

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common bulls below diagonal  
common three quarter sib group above diagonal

	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	0	77	160	117	111	125	47	28	23	65	82
FRA	65	0	116	152	177	203	80	50	21	57	56
USA	144	78	0	303	227	307	74	37	28	89	119
CHE	92	114	285	0	416	546	88	68	24	72	104
ITA	91	141	158	359	0	658	116	87	26	78	108
DEA	99	150	269	442	555	0	133	93	32	77	117
NLD	44	66	64	79	96	127	0	38	23	41	51
SVN	25	49	30	65	86	86	39	0	8	23	23
NZL	21	17	24	19	19	27	16	7	0	19	25
GBR	58	45	80	53	54	52	32	18	17	0	55
AUS	81	42	110	63	75	79	38	19	20	45	0

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BSW

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common bulls below diagonal  
common three quarter sib group above diagonal

	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	0	77	160	117	111	125	47	28	23	65	82
FRA	65	0	116	152	177	203	80	50	21	57	56
USA	144	78	0	303	227	307	74	37	28	89	119
CHE	92	114	285	0	416	546	88	68	24	72	104
ITA	91	141	158	359	0	658	116	87	26	78	108
DEA	99	150	269	442	555	0	133	93	32	77	117
NLD	44	66	64	79	96	127	0	38	23	41	51
SVN	25	49	30	65	86	86	39	0	8	23	23
NZL	21	17	24	19	19	27	16	7	0	19	25
GBR	58	45	80	53	54	52	32	18	17	0	55
AUS	81	42	110	63	75	79	38	19	20	45	0

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GUE

common bulls below diagonal  
common three quarter sib group above diagonal  
CAN USA AUS GBR NZL

CAN	0	68	45	30	14
USA	59	0	57	87	31
AUS	42	52	0	35	27
GBR	25	89	30	0	15
NZL	11	29	27	13	0

GUE

common bulls below diagonal  
common three quarter sib group above diagonal  
CAN USA AUS GBR NZL

CAN	0	68	45	30	14
USA	59	0	57	87	31
AUS	42	52	0	35	27
GBR	25	89	30	0	15
NZL	11	29	27	13	0

GUE

common bulls below diagonal  
common three quarter sib group above diagonal  
CAN USA AUS GBR NZL

CAN	0	67	45	30	13
USA	58	0	57	87	31
AUS	42	52	0	35	27
GBR	25	89	30	0	15
NZL	11	29	27	13	0

HOL

common bulls below diagonal  
common three quarter sib group above diagonal  
CAN DEU DFS FRA ITA NLD USA CHE GBR NZL AUS BEL IRL ESP CZE SVN  
EST ISR HUN POL ZAF JPN LVA SVK LTU PRT KOR URY HRV MEX

CAN	0	2202	1198	1296	1429	1247	2882	765	1438	653	1118	699	483	1130	965	173
214	99	858	1116	467	1164	391	395	206	928	593	434	246	358			
DEU	1390	0	2589	2407	2322	3213	3398	1071	1980	921	1419	1182	849	1419	1799	272
375	147	1162	2109	577	1365	660	702	460	1194	566	467	563	350			
DFS	899	1573	0	1509	1406	1865	1836	647	1403	766	1033	778	695	909	1158	214
258	129	822	1367	490	868	421	389	277	874	433	388	353	284			
FRA	777	1143	719	0	1568	1809	2317	596	1417	748	1061	845	691	1026	1164	178
231	116	861	1447	462	1105	366	400	211	875	462	374	254	295			
ITA	948	1324	923	724	0	1506	2314	638	1395	674	957	725	593	1118	1175	210
237	115	905	1361	459	1040	434	371	248	933	517	403	328	324			
NLD	1092	2803	1505	1018	1091	0	2220	799	1576	956	1183	1182	829	989	1365	220
320	137	876	1542	502	944	454	506	266	991	430	395	388	297			
USA	2910	2141	1252	1139	1335	1830	0	893	1955	989	1548	882	718	1383	1527	204
304	151	1175	1754	619	1743	536	512	299	1225	765	628	328	444			
CHE	610	914	565	515	555	771	793	0	625	367	485	560	368	500	500	127
146	54	406	592	257	419	249	218	107	479	231	195	182	173			



GBR	1583	1365	980	804	940	1301	1644	565	0	858	1120	796	867	981	979	188
226	116	784	1151	496	934	371	354	234	903	445	408	295	316			
NZL	639	699	524	416	458	862	921	307	727	0	987	479	672	491	575	119
123	100	462	598	358	510	218	244	146	535	284	328	192	193			
AUS	1002	868	609	605	535	905	1351	388	823	919	0	606	588	705	691	137
173	86	568	770	411	716	277	263	174	634	343	355	212	239			
BEL	675	1207	712	816	669	1349	761	567	778	390	479	0	489	603	613	158
175	74	496	730	324	485	270	283	142	632	263	231	239	197			
IRL	440	742	565	535	487	778	631	372	885	580	451	485	0	467	493	113
128	88	415	554	325	407	198	199	130	478	219	253	169	172			
ESP	643	866	645	706	752	851	839	406	749	367	425	590	452	0	789	169
179	99	691	919	435	812	314	302	189	781	414	342	249	277			
CZE	636	1338	707	678	762	1167	1121	346	626	393	368	473	363	528	0	194
236	115	843	1202	382	760	389	447	224	764	433	350	321	270			
SVN	120	258	178	122	173	188	153	94	136	81	85	130	88	124	145	0
81	41	143	216	94	145	105	76	48	151	87	69	94	63			
EST	112	261	151	104	129	230	196	82	123	62	65	109	68	82	148	49
0	44	176	277	101	178	165	107	73	176	94	92	110	68			
ISR	65	122	101	62	73	111	137	36	80	81	47	49	68	60	86	31
28	0	100	121	58	91	62	47	38	97	51	61	58	41			
HUN	757	894	620	550	743	702	1121	326	675	366	365	430	368	541	743	110
108	76	0	840	381	641	283	302	176	668	406	341	230	282			
POL	815	1746	1022	846	950	1327	1558	475	884	439	435	659	456	626	943	194
195	96	721	0	400	862	515	413	303	941	497	381	407	312			
ZAF	401	441	367	316	340	419	593	209	427	292	329	275	290	384	253	64
50	39	313	292	0	407	158	176	95	418	255	264	141	208			
JPN	504	496	418	349	425	443	680	257	431	248	323	297	248	354	301	82
60	39	341	412	266	0	298	288	171	648	483	359	187	289			
LVA	218	528	264	168	274	303	440	127	218	123	120	171	123	172	265	71
107	43	218	416	91	125	0	165	149	369	192	162	221	135			
SVK	267	526	200	204	210	341	331	111	198	144	118	173	105	150	361	44
49	19	213	278	95	101	79	0	85	308	191	168	121	122			
LTU	94	434	140	52	117	141	189	41	105	64	57	62	57	76	137	22
34	17	106	223	36	46	109	39	0	184	119	96	128	65			
PRT	928	1086	756	722	840	991	1269	423	820	434	435	638	435	734	622	121
122	72	659	948	373	370	290	210	113	0	426	369	290	333			
KOR	543	369	293	253	404	291	875	160	323	203	211	191	155	292	305	54
47	32	339	413	193	275	110	117	54	359	0	277	118	247			
URY	406	329	274	218	295	311	785	144	341	260	253	180	202	273	255	39
57	32	292	320	221	210	101	112	58	333	227	0	118	231			
HRV	123	577	269	151	235	347	244	121	207	111	114	198	123	189	237	77
79	43	178	356	93	85	178	61	87	234	53	70	0	107			
MEX	356	284	233	226	293	242	527	149	281	150	174	182	147	248	219	46
49	25	268	288	193	216	90	75	29	343	231	217	73	0			

HOL

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 common bulls below diagonal

common three quarter sib group above diagonal

	CAN	DEU	DFS	FRA	ITA	NLD	USA	CHE	GBR	NZL	AUS	BEL	IRL	ESP	CZE	SVN
EST	ISR	HUN	POL	ZAF	JPN	LVA	SVK	LTU	PRT	KOR	URY	HRV	MEX			
CAN	0	2203	1198	1297	1433	1247	2883	765	1438	653	1118	699	483	1130	965	173
214	99	858	1117	467	1163	391	395	206	928	594	434	246	134			
DEU	1393	0	2589	2407	2325	3213	3398	1071	1979	921	1419	1182	849	1419	1799	272
375	147	1162	2109	577	1363	660	702	460	1194	566	467	563	129			
DFS	900	1573	0	1509	1409	1865	1836	647	1402	766	1033	778	695	909	1158	214
258	129	822	1367	490	867	421	389	277	874	433	388	353	115			
FRA	778	1143	719	0	1570	1809	2317	596	1416	748	1061	845	691	1026	1164	178
231	116	861	1447	462	1103	366	400	211	875	462	374	254	119			

ITA	954	1329	928	729	0	1509	2317	639	1397	677	958	727	595	1121	1176	210
237	116	907	1362	461	1040	434	372	248	935	517	404	328	117			
NLD	1094	2803	1505	1018	1096	0	2220	799	1575	956	1183	1182	829	989	1365	220
320	137	876	1542	502	942	454	506	266	991	430	395	388	121			
USA	2913	2141	1252	1139	1342	1830	0	893	1955	989	1548	882	718	1383	1527	204
304	151	1175	1754	619	1740	536	512	299	1225	765	628	328	141			
CHE	611	914	565	515	556	771	793	0	624	367	485	560	368	500	500	127
146	54	406	592	257	417	249	218	107	479	231	195	182	92			
GBR	1584	1365	980	804	946	1301	1644	565	0	857	1120	795	867	981	978	188
226	116	784	1150	496	932	370	354	234	902	445	408	294	124			
NZL	640	699	524	416	464	862	921	307	727	0	987	479	672	491	575	119
123	100	462	598	358	510	218	244	146	535	284	328	192	97			
AUS	1002	868	609	605	538	905	1351	388	823	919	0	606	588	705	691	137
173	86	568	770	411	714	277	263	174	634	343	355	212	111			
BEL	675	1207	712	816	672	1349	761	567	778	390	479	0	489	603	613	158
175	74	496	730	324	484	270	283	142	632	263	231	239	101			
IRL	441	742	565	535	492	778	631	372	885	580	451	485	0	467	493	113
128	88	415	554	325	406	198	199	130	478	219	253	169	87			
ESP	644	866	645	706	756	851	839	406	749	367	425	590	452	0	789	169
179	99	691	919	435	811	314	302	189	781	414	342	249	115			
CZE	637	1337	706	678	765	1166	1121	346	626	393	368	472	363	527	0	194
236	115	843	1202	382	759	389	447	224	764	433	350	321	91			
SVN	120	258	178	122	173	188	153	94	136	81	85	130	88	124	145	0
81	41	143	216	94	144	105	76	48	151	87	69	94	32			
EST	112	261	151	104	129	230	196	82	123	62	65	109	68	82	148	49
0	44	176	277	101	176	165	107	73	176	94	92	110	25			
ISR	66	122	101	62	75	111	137	36	80	81	47	49	68	60	86	31
28	0	100	121	58	91	62	47	38	97	51	61	58	14			
HUN	758	894	620	550	747	702	1121	326	675	366	365	430	368	541	743	110
108	76	0	840	381	640	283	302	176	668	406	341	230	105			
POL	817	1746	1022	846	953	1327	1558	475	884	439	435	659	456	626	942	194
195	96	721	0	400	860	515	413	303	941	497	381	407	99			
ZAF	402	441	367	316	343	419	593	209	427	292	329	275	290	384	253	64
50	39	313	292	0	406	158	176	95	418	255	264	141	100			
JPN	503	494	417	346	424	440	674	255	428	247	320	295	247	352	300	81
58	39	340	409	265	0	297	287	171	647	483	358	187	122			
LVA	218	528	264	168	274	303	440	127	218	123	120	171	123	172	265	71
107	43	218	416	91	124	0	165	149	369	192	162	221	42			
SVK	267	526	200	204	212	341	331	111	198	144	118	173	105	150	360	44
49	19	213	278	95	100	79	0	85	308	191	168	121	55			
LTU	94	434	140	52	117	141	189	41	105	64	57	62	57	76	137	22
34	17	106	223	36	46	109	39	0	184	119	96	128	24			
PRT	929	1086	756	721	843	991	1269	423	820	434	435	638	435	734	622	121
122	72	659	948	373	369	290	210	113	0	426	369	290	121			
KOR	544	369	293	253	404	291	874	160	323	203	211	191	155	292	305	54
47	32	339	413	193	274	110	117	54	359	0	277	118	90			
URY	406	329	274	218	297	311	785	144	341	260	253	180	202	273	255	39
57	32	292	320	221	207	101	112	58	333	227	0	118	99			
HRV	123	577	269	151	235	347	244	121	207	111	114	198	123	189	237	77
79	43	178	356	93	85	178	61	87	234	53	70	0	45			
MEX	160	139	117	120	122	128	179	92	146	93	103	111	96	129	71	25
16	9	110	97	108	117	26	41	7	140	93	105	31	0			

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HOL

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common bulls below diagonal

common three quarter sib group above diagonal

	CAN	DEU	DFS	FRA	ITA	NLD	USA	CHE	GBR	NZL	AUS	BEL	IRL	ESP	CZE	SVN	
EST	ISR	HUN	POL	ZAF	JPN	LVA	SVK	LTU	PRT	KOR	URY	HRV	MEX				
CAN		0	2201	1198	1295	1429	1246	2875	764	1438	652	1118	698	483	1130	965	173
214	99	858	1115	467	1160	391	395	206	927	592	434	246	132				
DEU	1390		0	2589	2407	2322	3213	3394	1071	1979	921	1419	1182	849	1419	1799	272
375	147	1162	2109	577	1363	660	702	460	1194	566	467	563	127				
DFS	899	1573		0	1509	1406	1865	1834	647	1402	766	1033	778	695	909	1158	214
258	129	822	1367	490	867	421	389	277	874	433	388	353	113				
FRA	776	1143	719		0	1568	1809	2316	596	1416	748	1061	845	691	1026	1164	178
231	116	861	1447	462	1103	366	400	211	875	462	374	254	117				
ITA	948	1324	923	724		0	1506	2314	638	1394	674	957	725	593	1118	1175	210
237	115	905	1361	459	1039	434	371	248	933	517	403	328	114				
NLD	1091	2803	1505	1018	1091		0	2219	799	1575	956	1183	1182	829	989	1365	220
320	137	876	1542	502	941	454	506	266	991	430	395	388	119				
USA	2906	2139	1252	1139	1335	1830		0	893	1954	989	1545	881	718	1382	1527	204
304	151	1175	1754	619	1737	536	511	299	1225	766	628	328	139				
CHE	609	914	565	515	555	771	793		0	624	367	485	560	368	500	500	127
146	54	406	592	257	416	249	218	107	479	231	195	182	90				
GBR	1583	1365	980	804	940	1301	1644	565		0	857	1120	795	867	981	978	188
226	116	784	1150	496	932	370	354	234	902	445	408	294	122				
NZL	638	699	524	416	458	862	921	307	727		0	987	479	672	491	575	119
123	100	462	598	358	510	218	244	146	535	284	328	192	96				
AUS	1002	868	609	605	535	905	1350	388	823	919		0	606	588	705	691	137
173	86	568	770	411	714	277	263	174	634	343	355	212	109				
BEL	674	1207	712	816	669	1349	760	567	778	390	479		0	489	603	613	158
175	74	496	730	324	484	270	283	142	632	263	231	239	99				
IRL	440	742	565	535	487	778	631	372	885	580	451	485		0	467	493	113
128	88	415	554	325	406	198	199	130	478	219	253	169	85				
ESP	643	866	645	706	752	851	839	406	749	367	425	590	452		0	789	169
179	99	691	919	435	811	314	302	189	781	414	342	249	113				
CZE	636	1337	706	678	762	1166	1121	346	626	393	368	472	363	527		0	194
236	115	843	1202	382	759	389	447	224	764	433	350	321	89				
SVN	120	258	178	122	173	188	153	94	136	81	85	130	88	124	145		0
81	41	143	216	94	144	105	76	48	151	87	69	94	32				
EST	112	261	151	104	129	230	196	82	123	62	65	109	68	82	148		49
0	44	176	277	101	175	165	107	73	176	94	92	110	25				
ISR	65	122	101	62	73	111	137	36	80	81	47	49	68	60	86		31
28	0	100	121	58	91	62	47	38	97	51	61	58	14				
HUN	757	894	620	550	743	702	1121	326	675	366	365	430	368	541	743		110
108	76	0	840	381	640	283	302	176	668	406	341	230	103				
POL	814	1746	1022	846	950	1327	1558	475	884	439	435	659	456	626	942		194
195	96	721	0	400	860	515	413	303	941	497	381	407	97				
ZAF	401	441	367	316	340	419	593	209	427	292	329	275	290	384	253		64
50	39	313	292	0	406	158	176	95	418	255	264	141	98				
JPN	501	494	417	346	423	439	673	255	428	247	320	295	247	352	300		81
57	39	340	409	265	0	297	287	171	647	483	358	187	120				
LVA	218	528	264	168	274	303	440	127	218	123	120	171	123	172	265		71
107	43	218	416	91	124	0	165	149	369	192	162	221	41				
SVK	267	526	200	204	210	341	330	111	198	144	118	173	105	150	360		44
49	19	213	278	95	100	79	0	85	308	191	168	121	55				
LTU	94	434	140	52	117	141	189	41	105	64	57	62	57	76	137		22
34	17	106	223	36	46	109	39	0	184	119	96	128	23				
PRT	926	1085	756	720	840	990	1267	423	819	434	434	638	434	734	621		121
121	72	659	947	372	369	289	210	112	0	426	369	290	119				

KOR	542	369	293	253	404	291	876	160	323	203	211	191	155	292	305	54
47	32	339	413	193	274	110	117	54	359	0	277	118	90			
URY	406	329	274	218	295	311	785	144	341	260	253	180	202	273	255	39
57	32	292	320	221	207	101	112	58	332	227	0	118	98			
HRV	123	577	269	151	235	347	244	121	207	111	114	198	123	189	237	77
79	43	178	356	93	85	178	61	87	234	53	70	0	44			
MEX	157	137	116	119	120	127	177	91	144	92	102	110	95	128	69	25
15	9	109	96	107	115	26	41	7	139	93	103	30	0			

JER

common bulls below diagonal

common three quarter sib group above diagonal

	CAN	DFS	USA	NZL	AUS	GBR	NLD	ZAF	ITA	DEU	IRL	CHE
CAN	0	74	368	159	205	141	33	137	67	66	10	35
DFS	59	0	147	118	109	139	85	123	96	112	33	53
USA	380	117	0	331	416	210	71	276	99	113	39	59
NZL	169	92	405	0	378	193	65	186	84	84	102	47
AUS	204	73	437	414	0	174	59	206	77	72	42	43
GBR	140	122	226	196	168	0	73	153	102	95	54	64
NLD	26	82	75	58	44	67	0	66	55	57	26	37
ZAF	133	99	286	193	188	152	61	0	90	85	31	52
ITA	64	92	106	82	71	103	54	83	0	73	19	45
DEU	64	104	115	78	60	92	53	81	75	0	22	45
IRL	6	26	40	113	36	55	24	30	18	22	0	17
CHE	29	49	59	39	34	62	32	47	42	42	14	0

JER

common bulls below diagonal

common three quarter sib group above diagonal

	CAN	DFS	USA	NZL	AUS	GBR	NLD	ZAF	ITA	DEU	IRL	CHE
CAN	0	74	368	159	205	140	33	137	67	66	10	35
DFS	59	0	147	118	109	138	85	123	96	112	33	53
USA	380	117	0	331	416	209	71	276	99	113	39	59
NZL	169	92	405	0	378	192	65	186	84	84	102	48
AUS	204	73	437	414	0	173	59	206	77	72	42	43
GBR	140	122	226	196	168	0	73	153	101	95	54	64
NLD	26	82	75	58	44	67	0	66	55	57	26	37
ZAF	133	99	286	193	188	152	61	0	90	85	31	52
ITA	64	92	106	82	71	103	54	83	0	73	19	45
DEU	64	104	115	78	60	92	53	81	75	0	22	45
IRL	6	26	40	113	36	55	24	30	18	22	0	17
CHE	29	49	59	39	34	62	32	47	42	42	14	0





SIM

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common bulls below diagonal

common three quarter sib group above diagonal

	CHE	DEA	FRM	ITA	SVN	FRA	HUN	NLD	IRL	SVK	GBR	HRV	USA
CHE	0	308	179	84	6	12	2	83	56	31	55	1	18
DEA	272	0	240	815	177	251	46	228	58	363	52	504	17
FRM	230	286	0	155	17	3	3	110	69	56	72	2	28
ITA	86	716	188	0	101	139	21	159	57	137	47	211	20
SVN	6	163	17	95	0	55	12	44	1	46	0	69	0
FRA	9	211	1	125	52	0	12	54	1	53	0	84	0
HUN	1	32	1	17	10	9	0	6	1	13	0	20	0
NLD	84	237	132	155	42	54	6	0	51	60	51	83	15
IRL	53	51	74	55	1	1	1	46	0	11	39	3	15
SVK	25	370	55	115	44	45	11	51	4	0	10	87	3
GBR	63	55	92	52	0	0	0	52	34	5	0	0	18
HRV	1	527	1	201	59	78	18	82	2	70	0	0	0
USA	19	24	43	27	0	0	0	18	15	3	25	0	0

SIM

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common bulls below diagonal

common three quarter sib group above diagonal

	CHE	DEA	FRM	ITA	SVN	FRA	HUN	NLD	IRL	SVK	GBR	HRV	USA
CHE	0	309	179	84	6	12	2	83	56	31	55	1	18
DEA	273	0	240	815	177	251	46	228	58	363	52	502	17
FRM	230	286	0	155	17	3	3	110	69	56	72	2	28
ITA	86	716	188	0	101	139	21	159	57	137	47	209	20
SVN	6	163	17	95	0	55	12	44	1	46	0	69	0
FRA	9	211	1	125	52	0	12	54	1	53	0	84	0
HUN	1	32	1	17	10	9	0	6	1	13	0	20	0
NLD	84	237	132	155	42	54	6	0	51	60	51	83	15
IRL	53	51	74	55	1	1	1	46	0	11	39	3	15
SVK	25	370	55	115	44	45	11	51	4	0	10	85	3
GBR	63	55	92	52	0	0	0	52	34	5	0	0	18
HRV	1	525	1	199	59	78	18	82	2	68	0	0	0
USA	19	24	43	27	0	0	0	18	15	3	25	0	0

SIM

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common bulls below diagonal

common three quarter sib group above diagonal

	CHE	DEA	FRM	ITA	SVN	FRA	HUN	NLD	IRL	SVK	GBR	HRV	USA
CHE	0	308	179	84	6	12	2	83	56	31	55	1	18
DEA	272	0	240	815	177	251	46	228	58	363	52	503	17
FRM	230	286	0	155	17	3	3	110	69	56	72	2	28
ITA	86	716	188	0	101	139	21	159	57	137	47	210	20
SVN	6	163	17	95	0	55	12	44	1	46	0	69	0
FRA	9	211	1	125	52	0	12	54	1	53	0	84	0
HUN	1	32	1	17	10	9	0	6	1	13	0	20	0
NLD	84	237	132	155	42	54	6	0	51	60	51	83	15
IRL	53	51	74	55	1	1	1	46	0	11	39	3	15
SVK	25	370	55	115	44	45	11	51	4	0	10	86	3
GBR	63	55	92	52	0	0	0	52	34	5	0	0	18
HRV	1	526	1	200	59	78	18	82	2	69	0	0	0
USA	19	24	43	27	0	0	0	18	15	3	25	0	0