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Introduction
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The latest routine international evaluation for females fertility traits took place
as scheduled at the Interbull Centre. Data from twentyone (21) countries were
included in this evaluation.

International genetic evaluations for female fertility traits of bulls from
Australia, Austria, Belgium, Canada, Czech Republic, Denmark-Finland-Sweden, France, Germany,
Ireland, Israel, Italy, Netherlands, New Zealand, Norway, Poland, Spain,
Switzerland, South Africa, the United Kingdom, Uruguay, Japan and the United States of America and Slovenia were computed.
Brown Swiss, Guernsey, Holstein, Jersey, Red Dairy Cattle and Simmental breed
data were included in this evaluation.

Based on a decision made by Interbull Steering committee in August 2007,
female fertility traits are classified as follows:

T1 (HC): Maiden (H)eifer's ability to (C)onceive. A measure of confirmed
         conception, such as conception rate (CR), will be considered for this
         trait group. In the absence of confirmed conception an alternative
         measure, such as interval first-last insemination (FL), interval first
         insemination-conception (FC), number of inseminations (NI), or
         non-return rate (NR,preferably NR56) can be submitted;
T2 (CR): Lactating (C)ow's ability to (R)ecycle after calving. The interval
         calving-first insemination (CF) is an example for this ability. In the
         abscence of such a trait, a measure of the interval calving-conception,
         such as says oprn (DO) or calving interval (CI) can be submitted;
T3 (C1): Lactating (C)ow's ability to conceive (1), expressed as a rate trait.
         Traits like conception rate (CR) and non-return rate (NR, preferably
         NR56) will be considered for this trait group;
T4 (C2): Lactating (C)ow's ability to conceive (2), expressed as an interval
         trait. The interval first insemination-conception (FC) or interval
         first-last insemination (FL) will be considered for this trait group.
         As an alternative, number of inseminations (NI) can be submitted.
         In the absence of any of these traits, a measure of interval
         calving-conception such as days open (DO), or calving interval (CI)
         can be submitted. All countries are expected to submit data for this
         trait group, and as a last resort the trait submitted under T3 can be
         submitted for T4 as well.
T5 (IT): Lactating cow's measurements of (I)nterval (T)raits calving-conception,
         such as days open (DO) and calving interval (CI).


Based on the above trait definitions the following traits have been submitted for
international genetic evaluation of female fertility traits.

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Country  Traits  Submitted traits and their definitions
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AUS      T4=C2   Calving interval converted to 42 days pregnancy rate
         T5=IT   Calving interval converted to 42 days pregnancy rate

BEL      T2=CY   PR=Pregnancy Rate (=[21/(DO-45+11)]*100, with DO=days open)
         T4=C2   PR=Pregnancy Rate (=[21/(DO-45+11)]*100, with DO=days open)
         T5=IT   PR=Pregnancy Rate (=[21/(DO-45+11)]*100, with DO=days open)

CAN      T1=HC   NR=Non Return Rate after 56 Days in heifers (NRR), %
         T2=CY   CF=Interval from Calving to First Service in cows(CF)
         T3=C1   NR=Non Return Rate after 56 Days in cows(NRR), %
         T4=C2   FC=Interval first insemination-conception in cows
         T5=IT   DO=Days open

CHE      T1=HC   CR=Heifers' Conception rate
         T2=CR   CF=Interval from Calving to First Service (ICF), days
         T3=C1   NR=Non Return Rate after 56 Days (NRR), %
         T4=C2   FL=Interval from first to last insemination cows

CZE      T1=HC   CR=Heifers' Conception rate (pregnant or not after 3 months)
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           T3=C1   CR=Cows' Conception rate (pregnant or not after 3 months)
           T4=C2   CR=Cows' Conception rate (pregnant or not after 3 months)

AUT/DEU  T1=HC   NR=Heifers' Non Return Rate after 56 days
           T2=CY   CF=Interval from calving to first insemination cows (days)
           T3=C1   NR=Cows' Non Return Rate after 56 days
           T4=C2   FL=Interval from first to last insemination cows (days)
           T5=IT   DO=Days open (days)

DFS        T1=HC   CR=Heifers' Conception rate for maiden heifers
           T2=CY   CF=Interval from calving to first insemination cows (days)
           T3=C1   CR=Cows' conception rate for cows
           T4=C2   FL=Interval from first to last insemination cows (days)
           T5=IT   DO=Days open (days)

ESP        T2=CY   Interval from Calving to First Service (ICF)
           T4=C2   Interval first insemination to conception
           T5=IT   Days Open

FRA        T1=HC   CR=Heifers' Conception rate (binary trait) for maiden heifers
           T2=CY   Interval between calving and first AI
           T3=C1   CR=Cows' Conception rate (binary trait)
           T4=C2   FL=Interval from first to last insemination cows (days)
           T5=IT   FL=Interval from first to last insemination cows (days)

GBR        T2=CY   CI=days between 1st and 2nd calvings
           T3=C1   NR=1st lactation non return at 56 days
           T4=C2   CI=days between 1st and 2nd calvings
           T5=IT   CI=days between 1st and 2nd calvings

IRL        T2=CY   CI=Calving interval
           T4=C2   CI=Calving interval
           T5=IT   CI=Calving interval

ISR        T3=C1   CR=Inverse of the number of insemination to conception (%)
           T4=C2   CR=Inverse of the number of insemination to conception (%)

ITA        T1=HC   NR= non-return rate 56 days (heifers)
           T2=CY   CF=Days to first service
           T3=C1   CR=Conception rate at first service
           T4=C2   FL=Interval from first to last insemination cows (days)
           T5=IT   DO=days open (days)

ITA(BSW) T1=HC   CR=Conception rate
           T2=CY   CF=Interval calving to first insemination
           T3=C1   CR=Conception rate
           T4=C2   DO=Days Open
           T5=IT   CI=Calving interval

NLD        T1=HC   CR=Heifers' Conception rate
           T2=CY   CF=Interval calving to first insemination (days)
           T3=C1   CR=Cows' Conception rate (binary trait) for cows
           T4=C2   FL=Interval from first to last insemination cows (days)
           T5=IT   CI=Days Open

NOR        T1=HC   NI=Number of inseminations (heifers)
           T2=CY   CF=Days from calving to first insemination (days)
           T3=C1   NI=Number of inseminations (cows)
           T4=C2   NI=Number of inseminations (cows)
           T5=IT   CF=Days from calving to first insemination (days)

NZL        T2=CY   PM=Lactating cow's ability to start cycling
           T4=C2   PR42: confirmed pregnant within 6 weeks of planned start of mating (PSM), (in days)
           T5=IT   PR42: confirmed pregnant within 6 weeks of planned start of mating (PSM), (in days)

POL        T1=HC   CR=Conception Rate (heifer)
           T2=CR   CF=Interval from calving to first insemination
           T3=C1   CR=Conception Rate (cow)
           T4=C2   FL=Interval from first to last insemination cows (days)
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        T5=IT    DO=Days open

URY     T4=C2    Days open expressed as Daughter Pregnancy Rate
        T5=IT    Days open expressed as Daughter Pregnancy Rate


USA     T1=HC    CR=Conception rate (heifer)
        T3=C1    CR=Conception rate (cow)
        T4=C2    DP=Daughter Pregnancy Rate
        T5=IT    DP=Daughter Pregnancy Rate


ZAF     T4=IT    CI=Calving Interval
        T5=IT    CI=Calving Interval


JPN     T1=HC    CR=Heifers'Conception rate
        T3=C1    CR=Cows'Conception rate
        T4=C2    DO=Days open
        T5=IT    DO=Days open


SVN     T5=IT    CI=Calving interval (days)
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CHANGES IN NATIONAL PROCEDURES

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

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JPN (HOL)       Some changes in proofs caused by additional records and in EDCs caused by modification of pedigree
DFS (HOL, RDC)  Some drops in information due to editing checks in relation to calving information: check if the herd is participating in disease regristration and if the fertility registrations is
                in agreement with calving informations. If not, the record is deleted.
FRA (ALL)       Base change
AUS (ALL)       Drops in information due to data clean-up such as pedigree changes, status change of a bull which leads to a good number of bulls no longer being qualifying. GUE-CRC:Used
                to participate with very old data now removed from the evaluation
DEA (BSW)       Base change
CAN (ALL)       Base change
DEU (ALL)       Base change
CHE (ALL)       Base change, JER: First time. HOL: Corrected a bug wrongly coding the effect for semen sexing in Holstein due to an error in data preparation. The bug has
                now been fixed and it causes bigger changes in fertility traits compared to the December run, especially for hco
SVN (HOL, BSW)  Base change
ISR (HOL)       Base change, few drops in information due to data edits
ITA (HOL)       Base change, drim of one year of phenotypic data.
ITA (BSW)       Base change, drop in information, especially herds information due to data editing
POL (HOL)       New organisation, CGen, replacing NIAP. New model and estimated new genetic parameters as part of a single step evaluation. New base change to be aligned with production traits.
                Only bulls with a minimum number of 10 herds were submitted. A new data editing pipeline has been implemented including stricter filters on herd size, contemporary group size, outliers
                identification, and the cows' breed causing a reduction in the number of daughters and herds for almost all the bulls in the evaluation. Applied the mtedc software for EDC calculation
                Changed Type Of Proof from 12 to 11 due to a new procedure for setting type of proof: The previous procedure counted daughters based on milk yield and used this information to set
                the bulls type of proof for all traits. Currently, the Type Of Proof is based on each trait-specific daughter count. Only records of cows with first calving with a cut-off year of 2005.
                Pedigree clean-up and verification. Some animals appear to be missing in this evaluation because they were either identified as duplicate of another animal during predigree
                clean-up or dropped in the numbers of daugters or herds below publication criteria or there were breed incosistency of bulls which actually were not HOL
NLD (ALL)       Base change
USA (ALL)       Base change, drops in information due to pedigree accuracy and herd-year minimum edits.
URY (HOL)       Base change
NZL (ALL)       Detected an error in the data submitted for INT and CC2 for the 2024 evaluations. Error has now been corrected but it causes several bulls showing extreme changes for these two traits.
                Added a filter for which if a daughters breed didn't match a bulls breed the daughter got dropped from a bulls proof, this has affected the national herd because of the number of cross
                bred animals present.
CZE (HOL)       Trimmed 6 months of data in cc1/cc2.
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INTERBULL CHANGES COMPARED TO THE PREVIOUS ROUTINE RUN

A new document called confdoc_DEFINITION{runid}.itb has been introduced reporting all the trait definitions applied by countries as reported in the PREP.

During 2023-2024, Interbull Centre and the Interbull Technical Committee (ITC) have worked on developing a new procedures for adjusting of the international correlations after a given test run in case

countries would decide NOT TO implement the changes tested in the next routine run.
Until now, the relative difference between the previous routineâ\200\231s and test runâ\200\231s correlations, for each pair of countries, was assessed and the average value of the two was used whenever such difference did exceed a threshold of 0.01. Otherwise, correlations from the latest test run were used.
However, in some cases, the difference in correlations between routine/test runs were way above a 1% difference so that by using the average value the newly derived correlations would still be greatly affected by the changes tested but not implemented. This remark has been made in few occasions by some participating countries.
A new approach proposed by Peter Sullivan, was developed and extensively tested. The new approach is based on first identifying the relative impact of the changes tested by a country during the test run (but not implemented in a routine run) and then correcting the whole correlation matrix detracting such estimated impact.
This new approach would assure that the new correlations would be free from any effect from any changes tested but not implemented.
The new procedure has been fully developed during 2023 and extensively tested during 2024 and introduced officially in the April 2025 routine evaluation.

DATA AND METHOD OF ANALYSIS

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

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

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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.

From this year an extra MACE test run has been scheduled in May, data submissions' deadline and
target for distribution of results are all reported in the above link.

PUBLICATION OF INTERBULL ROUTINE RUN
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Results were distributed by the Interbull Centre to designated
representatives in each country. The international evaluation file comprised
international proofs expressed on the base and unit of each country included
in the analysis. Such records readily provide more information on bull
performance in various countries, thereby minimizing the need to resort to
conversions.

At the same time, all recipients of Interbull results are expected to honor
the agreed code of practice, decided by the Interbull Steering Committee,
and only publish international evaluations on their own country scale.
Evaluations expressed on another country scale are confidential and may only
be used internally for research and review purposes.


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 fertility (April Routine Evaluation 2025).
Number of records for lactating cow's ability to conceive (cc2) by breed
--------------------------------------------------------------------------------------
Country      BSW        GUE        HOL        JER        RDC        SIM
--------------------------------------------------------------------------------------
AUS                     152        8963       1900       824
BEL                                2213
CAN          189        50         10729      686        615
CHE          3106                  3420       152
CZE                                3350
DEA          5073
DEU                                26346                 333
DFS                                17838      2562       10830
ESP                                7023
EST
FRA          457                   17602
FRM
GBR          117        259        7968       666        501
HUN
IRL                                3483       260        79
ISR                                1767
ITA          2062                  7351
JPN                                6864
KOR
LTU
LVA
NLD          248                   17146      285        106
NOR                                                      3201
NZL          58         50         9011       5177       1373
POL                                8782
PRT
SVK
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SVN
URY                                 2079
USA              1238       810    43412       5604       824
ZAF                                 1278        763       160
HRV
CAM
==================================================================================
No.Records     12548      1321    206625      18055     18846
Pub. Proofs    10974      1089    160163      14779     18514              0
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^LAPPENDIX I. Sire standard deviations in diagonal and genetic correlations below diagonal
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BSW   hco

          CAN   DEA   FRA   USA   CHE   NLD   ITA
CAN   9.21
DEA   0.86   9.91
FRA   0.74   0.88   0.75
USA   0.79   0.78   0.85   2.56
CHE   0.90   0.95   0.86   0.80   13.13
NLD   0.80   0.67   0.76   0.78   0.75   4.58
ITA   0.75   0.70   0.84   0.85   0.75   0.75   15.61

BSW   crc

          CAN   CHE   DEA   NLD   NZL   GBR   FRA   ITA
CAN   7.42
CHE   0.81   11.36
DEA   0.77   0.95   15.01
NLD   0.81   0.83   0.82   3.75
NZL   0.61   0.64   0.72   0.62   0.12
GBR   0.71   0.69   0.62   0.73   0.65   3.91
FRA   0.82   0.97   0.96   0.85   0.66   0.74   1.69
ITA   0.82   0.84   0.87   0.80   0.62   0.72   0.87   16.95

BSW   cc1

          CAN   CHE   DEA   NLD   USA   GBR   FRA   ITA
CAN   7.42
CHE   0.83   11.69
DEA   0.79   0.95   11.45
NLD   0.73   0.69   0.67   3.68
USA   0.75   0.67   0.67   0.77   2.88
GBR   0.77   0.79   0.79   0.68   0.68   0.03
FRA   0.73   0.69   0.67   0.82   0.85   0.71   0.88
ITA   0.69   0.66   0.66   0.69   0.78   0.67   0.88   16.15

BSW   cc2

          CAN   CHE   DEA   NLD   NZL   USA   GBR   FRA   ITA
CAN   6.82
CHE   0.77   11.16
DEA   0.75   0.94   12.33
NLD   0.80   0.79   0.76   3.42
NZL   0.65   0.82   0.80   0.67   0.07
USA   0.80   0.81   0.82   0.76   0.71   2.54
GBR   0.70   0.79   0.79   0.72   0.72   0.80   3.91
FRA   0.87   0.89   0.90   0.85   0.70   0.83   0.78   0.88
ITA   0.84   0.87   0.86   0.75   0.78   0.77   0.74   0.91   19.21

BSW   int

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          CAN     DEA     NLD     NZL     USA     GBR     ITA     SVN
CAN       7.81
DEA       0.80   14.38
NLD       0.82    0.86    3.39
NZL       0.71    0.85    0.71    0.07
USA       0.90    0.78    0.75    0.68    2.54
GBR       0.82    0.69    0.81    0.73    0.81    3.91
ITA       0.86    0.89    0.80    0.77    0.74    0.80   19.29
SVN       0.71    0.68    0.71    0.72    0.69    0.74    0.71   19.76


--------------------------------------------------------------------------------
GUE    crc
--------------------------------------------------------------------------------
          CAN     GBR     NZL
CAN       7.68
GBR       0.74    4.85
NZL       0.61    0.64    0.11


--------------------------------------------------------------------------------
GUE    cc1
--------------------------------------------------------------------------------
          CAN     GBR     USA
CAN       7.54
GBR       0.77    0.03
USA       0.80    0.73    3.49


--------------------------------------------------------------------------------
GUE    cc2
--------------------------------------------------------------------------------
          CAN     GBR     NZL     USA     AUS
CAN       7.21
GBR       0.69    4.84
NZL       0.64    0.72    0.07
USA       0.84    0.80    0.73    2.89
AUS       0.68    0.67    0.75    0.72   10.26


--------------------------------------------------------------------------------
GUE    int
--------------------------------------------------------------------------------
          CAN     GBR     NZL     USA     AUS
CAN       7.79
GBR       0.82    4.84
NZL       0.70    0.73    0.07
USA       0.89    0.80    0.71    2.89
AUS       0.71    0.68    0.75    0.73   10.26


--------------------------------------------------------------------------------
HOL    hco
--------------------------------------------------------------------------------
          CAN     CZE     DEU     DFS     FRA     USA     POL     CHE     NLD     ITA     JPN
CAN       7.72
CZE       0.76   17.55
DEU       0.89    0.79   15.15
DFS       0.78    0.84    0.84   13.53
FRA       0.75    0.77    0.80    0.88    0.70
USA       0.83    0.83    0.84    0.86    0.84    2.38
POL       0.62    0.56    0.66    0.70    0.62    0.67   14.06
CHE       0.96    0.78    0.92    0.77    0.77    0.85    0.54   13.54
NLD       0.81    0.78    0.85    0.87    0.83    0.83    0.64    0.79    5.35
ITA       0.82    0.85    0.87    0.90    0.91    0.93    0.73    0.86    0.85    1.97
JPN       0.85    0.70    0.85    0.71    0.69    0.82    0.62    0.84    0.75    0.82    6.24

--------------------------------------------------------------------------------
HOL    crc
--------------------------------------------------------------------------------
          BEL     CAN     CHE     DEU     DFS     ESP     GBR     IRL     ITA     NLD     NZL     POL     FRA
BEL       4.63
CAN       0.77    7.55
CHE       0.79    0.83   12.28
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DEU	0.72	0.83	0.87	10.93								
DFS	0.79	0.87	0.94	0.91	11.59							
ESP	0.83	0.78	0.80	0.79	0.79	10.92						
GBR	0.89	0.74	0.76	0.71	0.78	0.84	4.57					
IRL	0.85	0.59	0.66	0.59	0.61	0.79	0.81	3.58				
ITA	0.81	0.88	0.89	0.89	0.91	0.83	0.79	0.64	1.41			
NLD	0.78	0.82	0.88	0.84	0.92	0.78	0.75	0.58	0.85	4.69		
NZL	0.63	0.60	0.63	0.59	0.64	0.65	0.65	0.59	0.65	0.56	0.09	
POL	0.75	0.87	0.87	0.83	0.85	0.76	0.74	0.59	0.88	0.76	0.68	15.34
FRA	0.78	0.86	0.94	0.93	0.94	0.80	0.79	0.64	0.91	0.89	0.64	0.87	1.12

HOL   cc1

	CAN	CHE	CZE	DEU	DFS	FRA	GBR	ISR	ITA	NLD	USA	POL	JPN
CAN	6.77												
CHE	0.92	10.81											
CZE	0.82	0.71	17.34										
DEU	0.91	0.91	0.80	14.64									
DFS	0.74	0.68	0.86	0.79	13.11								
FRA	0.77	0.73	0.89	0.76	0.87	0.96							
GBR	0.77	0.77	0.68	0.79	0.66	0.72	0.03						
ISR	0.79	0.69	0.93	0.78	0.88	0.89	0.76	3.29					
ITA	0.70	0.66	0.89	0.68	0.81	0.88	0.66	0.89	1.21				
NLD	0.74	0.71	0.85	0.78	0.88	0.91	0.68	0.86	0.79	4.56			
USA	0.80	0.70	0.95	0.75	0.82	0.85	0.68	0.92	0.87	0.80	2.82		
POL	0.76	0.66	0.86	0.78	0.74	0.77	0.66	0.83	0.80	0.72	0.79	19.09	
JPN	0.78	0.77	0.90	0.77	0.82	0.83	0.77	0.85	0.82	0.78	0.91	0.74	7.58

HOL   cc2

	BEL	CAN	CHE	CZE	DEU	DFS	ESP	FRA	GBR	IRL	ISR	ITA	NLD	NZL	USA	POL	ZAF	AUS	URY	JPN
BEL	4.62																			
CAN	0.73	6.50																		
CHE	0.82	0.90	10.95																	
CZE	0.66	0.86	0.88	17.34																
DEU	0.78	0.93	0.92	0.91	13.46															
DFS	0.80	0.84	0.87	0.82	0.94	12.86														
ESP	0.82	0.76	0.86	0.85	0.82	0.78	10.92													
FRA	0.81	0.90	0.93	0.85	0.95	0.88	0.82	0.91												
GBR	0.88	0.69	0.74	0.66	0.75	0.79	0.82	0.75	4.57											
IRL	0.83	0.74	0.84	0.70	0.78	0.75	0.82	0.82	0.82	3.58										
ISR	0.61	0.73	0.73	0.88	0.81	0.78	0.79	0.75	0.66	0.64	3.29									
ITA	0.78	0.85	0.88	0.90	0.90	0.86	0.87	0.88	0.75	0.78	0.83	1.33								
NLD	0.78	0.83	0.86	0.81	0.92	0.88	0.76	0.90	0.72	0.77	0.79	0.83	4.68							
NZL	0.75	0.64	0.77	0.76	0.66	0.64	0.83	0.67	0.72	0.76	0.72	0.79	0.63	0.06						
USA	0.79	0.86	0.84	0.88	0.90	0.85	0.84	0.84	0.81	0.79	0.79	0.89	0.79	0.69	2.37					
POL	0.81	0.87	0.90	0.88	0.92	0.86	0.85	0.87	0.80	0.74	0.81	0.92	0.80	0.79	0.89	14.74				
ZAF	0.77	0.77	0.81	0.73	0.81	0.74	0.81	0.81	0.78	0.85	0.59	0.78	0.72	0.73	0.85	0.81	15.62			
AUS	0.70	0.67	0.73	0.63	0.70	0.63	0.69	0.73	0.68	0.83	0.59	0.68	0.63	0.70	0.71	0.67	0.78	8.49		
URY	0.71	0.68	0.66	0.64	0.67	0.67	0.66	0.66	0.69	0.69	0.58	0.64	0.68	0.78	0.69	0.64	0.76	0.67	1.40	
JPN	0.84	0.82	0.86	0.79	0.85	0.84	0.85	0.84	0.86	0.84	0.71	0.86	0.77	0.71	0.92	0.86	0.87	0.70	0.68	18.22

HOL   int

	BEL	CAN	DEU	DFS	ESP	GBR	IRL	ITA	NLD	NZL	USA	POL	ZAF	AUS	URY	FRA	JPN	SVN
BEL	4.62																	
CAN	0.88	7.06																
DEU	0.86	0.91	12.32															
DFS	0.89	0.91	0.95	12.78														
ESP	0.87	0.84	0.85	0.85	10.92													
GBR	0.89	0.83	0.85	0.89	0.87	4.57												
IRL	0.83	0.81	0.82	0.79	0.86	0.82	3.58											
ITA	0.89	0.90	0.90	0.92	0.89	0.86	0.79	2.53										
NLD	0.89	0.85	0.87	0.92	0.82	0.83	0.79	0.87	4.71									
NZL	0.76	0.70	0.69	0.67	0.76	0.73	0.77	0.74	0.67	0.06								
USA	0.79	0.92	0.91	0.85	0.86	0.81	0.80	0.87	0.78	0.67	2.37							

```
POL    0.84    0.83    0.82    0.85    0.86    0.83    0.69    0.91    0.77    0.76    0.75   13.79
ZAF    0.79    0.82    0.85    0.79    0.86    0.80    0.87    0.81    0.77    0.73    0.86    0.77   15.62
AUS    0.71    0.71    0.69    0.67    0.72    0.68    0.83    0.66    0.66    0.71    0.72    0.66    0.80    8.49
URY    0.73    0.67    0.67    0.67    0.69    0.67    0.70    0.69    0.66    0.83    0.66    0.70    0.78    0.68    1.40
FRA    0.81    0.89    0.84    0.83    0.81    0.75    0.81    0.81    0.79    0.62    0.82    0.69    0.81    0.74    0.66    0.91
JPN    0.85    0.93    0.90    0.89    0.89    0.87    0.83    0.91    0.84    0.70    0.92    0.86    0.89    0.71    0.70    0.82   18.22
SVN    0.87    0.74    0.75    0.82    0.77    0.77    0.72    0.84    0.78    0.72    0.68    0.73    0.66    0.67    0.71    0.74    0.75   19.07


-------------------------------------------------------------------------------------
JER    hco
-------------------------------------------------------------------------------------
        CAN     DFS     USA     NLD
CAN    7.99
DFS    0.72   17.38
USA    0.72    0.81    2.71
NLD    0.82    0.83    0.72    5.06


-------------------------------------------------------------------------------------
JER    crc
-------------------------------------------------------------------------------------
        CAN     DFS     GBR     NLD     NZL     IRL     CHE
CAN    7.02
DFS    0.81   13.34
GBR    0.65    0.82    3.79
NLD    0.81    0.83    0.68    3.56
NZL    0.57    0.64    0.62    0.55    0.07
IRL    0.61    0.61    0.79    0.60    0.57    2.42
CHE    0.81    0.83    0.70    0.84    0.57    0.64    8.96


-------------------------------------------------------------------------------------
JER    cc1
-------------------------------------------------------------------------------------
        CAN     DFS     GBR     NLD     USA     CHE
CAN    6.99
DFS    0.70   15.49
GBR    0.78    0.67    0.03
NLD    0.72    0.75    0.68    3.68
USA    0.75    0.75    0.67    0.68    2.91
CHE    0.90    0.69    0.78    0.72    0.68   11.47


-------------------------------------------------------------------------------------
JER    cc2
-------------------------------------------------------------------------------------
        CAN     DFS     GBR     NLD     NZL     USA     ZAF     AUS     IRL     CHE
CAN    6.68
DFS    0.81   15.62
GBR    0.70    0.73    3.79
NLD    0.80    0.78    0.71    3.59
NZL    0.64    0.64    0.69    0.64    0.05
USA    0.80    0.77    0.77    0.75    0.73    2.66
ZAF    0.66    0.65    0.74    0.66    0.79    0.83   11.25
AUS    0.64    0.64    0.64    0.64    0.68    0.64    0.70    6.51
IRL    0.74    0.73    0.76    0.75    0.67    0.75    0.78    0.72    2.42
CHE    0.81    0.86    0.68    0.77    0.84    0.72    0.69    0.66    0.75   11.13

-------------------------------------------------------------------------------------
JER    int
-------------------------------------------------------------------------------------
        CAN     DFS     GBR     NLD     NZL     USA     ZAF     AUS     IRL
CAN    6.64
DFS    0.84   15.35
GBR    0.74    0.82    3.79
NLD    0.80    0.82    0.76    3.50
NZL    0.66    0.67    0.69    0.64    0.05
USA    0.83    0.79    0.77    0.73    0.73    2.66
ZAF    0.70    0.70    0.74    0.71    0.79    0.83   11.25
AUS    0.68    0.67    0.67    0.67    0.68    0.68    0.71    6.51
IRL    0.78    0.73    0.74    0.75    0.64    0.76    0.80    0.74    2.42
```

```
------------------------------------------------------------------------------
RDC    hco
------------------------------------------------------------------------------
         CAN     DEU     DFS     NOR     USA     NLD
CAN      8.29
DEU      0.89   14.40
DFS      0.70    0.82   12.22
NOR      0.84    0.87    0.87   16.67
USA      0.83    0.83    0.79    0.73    2.80
NLD      0.80    0.84    0.80    0.65    0.74    5.89


------------------------------------------------------------------------------
RDC    crc
------------------------------------------------------------------------------
         CAN     DEU     DFS     GBR     NOR     NZL     NLD     IRL
CAN      6.71
DEU      0.83   10.11
DFS      0.83    0.90   12.71
GBR      0.79    0.71    0.68    4.13
NOR      0.83    0.80    0.83    0.61   14.29
NZL      0.66    0.59    0.55    0.66    0.59    0.11
NLD      0.82    0.84    0.87    0.72    0.78    0.57    3.53
IRL      0.60    0.60    0.62    0.80    0.61    0.60    0.60    2.90


------------------------------------------------------------------------------
RDC    cc1
------------------------------------------------------------------------------
         CAN     DEU     DFS     GBR     NOR     NLD     USA
CAN      7.58
DEU      0.90   13.75
DFS      0.70    0.81   12.97
GBR      0.77    0.79    0.67    0.03
NOR      0.81    0.88    0.93    0.78   14.11
NLD      0.74    0.78    0.82    0.68    0.69    3.88
USA      0.81    0.75    0.75    0.68    0.73    0.79    2.84


------------------------------------------------------------------------------
RDC    cc2
------------------------------------------------------------------------------
         CAN     DEU     DFS     GBR     NOR     NZL     USA     ZAF     NLD     AUS     IRL
CAN      7.15
DEU      0.91   11.49
DFS      0.80    0.93   12.85
GBR      0.70    0.75    0.74    4.12
NOR      0.77    0.81    0.88    0.71   14.11
NZL      0.69    0.69    0.68    0.72    0.66    0.07
USA      0.85    0.89    0.76    0.78    0.71    0.73    2.62
ZAF      0.68    0.80    0.72    0.70    0.77    0.68    0.78   17.03
NLD      0.83    0.91    0.84    0.72    0.72    0.68    0.78    0.72    3.70
AUS      0.66    0.68    0.63    0.67    0.64    0.71    0.67    0.64    0.64    7.66
IRL      0.74    0.79    0.75    0.79    0.71    0.74    0.77    0.82    0.76    0.78    2.90


------------------------------------------------------------------------------
RDC    int
------------------------------------------------------------------------------
         CAN     DEU     DFS     GBR     NOR     NZL     USA     ZAF     NLD     AUS     IRL
CAN      6.83
DEU      0.90   11.32
DFS      0.86    0.94   13.21
GBR      0.82    0.84    0.79    4.12
NOR      0.76    0.73    0.67    0.68   14.29
NZL      0.79    0.69    0.70    0.74    0.63    0.07
USA      0.89    0.89    0.75    0.79    0.68    0.70    2.62
ZAF      0.74    0.84    0.73    0.73    0.81    0.69    0.80   17.03
NLD      0.84    0.87    0.90    0.80    0.70    0.69    0.76    0.77    3.52
AUS      0.70    0.69    0.67    0.68    0.68    0.71    0.70    0.72    0.67    7.66
IRL      0.80    0.81    0.77    0.79    0.68    0.73    0.76    0.84    0.78    0.80    2.90


------------------------------------------------------------------------------
```

```
^LAPPENDIX II. Number of common bulls
---------------------------------------------------------------------------------------------------------------
BSW
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
       CAN  DEA  FRA  USA  CHE  NLD  ITA
 --------------------------------------------------------------------------------
  CAN    0  112   56  116  114   36  103
  DEA   98    0  209  208  647  157  542
  FRA   48  160    0   77  176   81  186
  USA  105  166   58    0  217   62  146
  CHE   96  548  135  181    0  114  471
  NLD   32  146   68   58  108    0  129
  ITA   89  427  145  105  413  103    0
 --------------------------------------------------------------------------------
BSW
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
       CAN  CHE  DEA  NLD  NZL  GBR  FRA  ITA
 --------------------------------------------------------------------------------
  CAN    0  126  125   42   21   50   74  121
  CHE  107    0  653  120   31   66  176  500
  DEA  111  544    0  170   47   63  218  673
  NLD   37  110  157    0   30   38   88  142
  NZL   20   25   41   23    0   16   23   39
  GBR   45   49   44   31   12    0   50   72
  FRA   64  134  166   73   18   38    0  197
  ITA  106  438  552  119   33   49  153    0
 --------------------------------------------------------------------------------
BSW
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
       CAN  CHE  DEA  NLD  USA  GBR  FRA  ITA
 --------------------------------------------------------------------------------
  CAN    0  131  127   42  144   50   79  124
  CHE  110    0  648  121  280   71  184  501
  DEA  112  538    0  174  252   69  230  671
  NLD   37  110  157    0   73   41   93  144
  USA  140  245  201   67    0   70  104  187
  GBR   45   53   48   33   67    0   57   78
  FRA   68  141  177   78   74   45    0  209
  ITA  108  440  548  118  135   52  165    0
 --------------------------------------------------------------------------------
BSW
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
       CAN  CHE  DEA  NLD  NZL  USA  GBR  FRA  ITA
 --------------------------------------------------------------------------------
  CAN    0  116  112   38   17  135   46   73  104
  CHE   94    0  638  121   28  336   66  184  476
  DEA   98  533    0  174   39  325   63  227  620
  NLD   34  110  157    0   25   96   38   93  141
  NZL   16   23   36   20    0   26   13   20   30
  USA  126  312  283   84   23    0   77  124  232
  GBR   40   49   44   31    9   73    0   53   70
  FRA   63  141  176   78   16   88   42    0  206
  ITA   91  408  490  114   26  161   47  159    0
 --------------------------------------------------------------------------------
BSW
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
       CAN  DEA  NLD  NZL  USA  GBR  ITA  SVN
 --------------------------------------------------------------------------------
  CAN    0  118   40   17  141   49  115   28
```

```
  DEA  103    0  173   39  324   63  735   88
  NLD   36  157    0   25   96   38  149   44
  NZL   16   36   20    0   26   13   33   10
  USA  132  283   84   23    0   77  255   34
  GBR   43   44   31    9   73    0   74   18
  ITA  100  650  123   29  183   52    0   86
  SVN   26   82   44   10   30   14   82    0
 -------------------------------------------------------------------------------
GUE
--------
GUE
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN  GBR  NZL
 -------------------------------------------------------------------------------
  CAN    0   19    3
  GBR   16    0   14
  NZL    2   12    0
 -------------------------------------------------------------------------------
GUE
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN  GBR  USA
 -------------------------------------------------------------------------------
  CAN    0   20   44
  GBR   16    0   62
  USA   43   58    0
 -------------------------------------------------------------------------------
GUE
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN  GBR  NZL  USA  AUS
 -------------------------------------------------------------------------------
  CAN    0   14    1   41   25
  GBR   11    0   12   88   38
  NZL    1   10    0   24   22
  USA   39   89   23    0   72
  AUS   21   31   21   69    0
 -------------------------------------------------------------------------------
GUE
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN  GBR  NZL  USA  AUS
 -------------------------------------------------------------------------------
  CAN    0   14    1   41   25
  GBR   11    0   12   88   38
  NZL    1   10    0   24   22
  USA   39   89   23    0   72
  AUS   21   31   21   69    0
 -------------------------------------------------------------------------------
HOL
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN  CZE  DEU  DFS  FRA  USA  POL  CHE  NLD  ITA  JPN
 -------------------------------------------------------------------------------
  CAN    0 1180 2465 1553 1377 3295 1679  909 1601 1791 1235
  CZE  890    0 1962 1355 1265 1616 1511  515 1608 1294  870
  DEU 2073 1524    0 2910 2487 3245 2899 1230 3436 2515 1407
  DFS 1490  937 2309    0 1778 1971 1851  800 2445 1551 1055
  FRA 1071  793 1478 1091    0 1759 1846  759 2056 1539 1169
  USA 3805 1354 2697 1848 1103    0 2494  962 2140 2453 1580
  POL 1590 1303 2737 1626 1358 2717    0  706 2074 1853 1025
  CHE  831  358 1156  749  705  891  593    0  971  667  495
  NLD 1602 1401 3125 2190 1416 1966 1982  966    0 1644 1147
```

```
  ITA 1447  901 1610 1162  821 1953 1555  573 1244    0 1091
  JPN  736  409  679  588  455  893  596  325  622  532    0
 -----------------------------------------------------------------------------

HOL
--------

 common bulls below diagonal
 common three quarter sib group above diagonal
        BEL  CAN  CHE  DEU  DFS  ESP  GBR  IRL  ITA  NLD  NZL  POL  FRA
 -----------------------------------------------------------------------------

 BEL    0  842  657 1336  958  986  947  562  665 1368  550  771 1038
 CAN  851    0  934 2592 1605 1752 1820  621 1648 1739  767 1514 1471
 CHE  667  867    0 1257  803  783  827  468  629 1024  453  664  769
 DEU 1379 2160 1200    0 3047 2524 2473 1012 2174 3937 1098 2565 2719
 DFS  909 1567  767 2375    0 1706 1773  838 1330 2479  930 1653 1786
 ESP 1063 1599  740 2290 1570    0 1655  776 1450 1982  782 1618 1926
 GBR  936 1927  793 1964 1455 1534    0 1115 1398 2102 1052 1490 1706
 IRL  554  621  479  900  717  796 1167    0  476 1022  832  602  803
 ITA  660 1430  559 1518 1133 1240 1137  419    0 1486  488 1514 1292
 NLD 1557 1774 1029 3742 2296 2100 1904  976 1297    0 1204 1926 2194
 NZL  454  718  381  871  692  668  927  732  412 1113    0  610  846
 POL  710 1453  555 2362 1450 1488 1340  499 1321 1836  485    0 1696
 FRA 1035 1162  710 1621 1091 1880 1155  661  808 1496  533 1222    0
 -----------------------------------------------------------------------------

HOL
--------

 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN  CHE  CZE  DEU  DFS  FRA  GBR  ISR  ITA  NLD  USA  POL  JPN
 -----------------------------------------------------------------------------

 CAN    0  948 1041 2629 1648 1490 1875  156 1670 1766 3553 1662 1382
 CHE  880    0  421 1263  809  776  837   65  630 1027 1028  703  524
 CZE  829  296    0 1537 1071  940  914  123 1074 1330 1432 1342  712
 DEU 2171 1201 1268    0 3086 2737 2522  191 2190 3933 3514 2826 1609
 DFS 1586  770  854 2396    0 1800 1830  169 1351 2499 2132 1803 1114
 FRA 1181  719  625 1631 1100    0 1738  132 1302 2207 1975 1799 1306
 GBR 1992  806  675 2012 1501 1182    0  176 1425 2146 2419 1588 1193
 ISR  109   38   94  149  128   73  133    0  130  181  229  166  128
 ITA 1444  559  841 1513 1136  816 1175   88    0 1498 2314 1643 1002
 NLD 1792 1029 1264 3727 2304 1518 1963  142 1300    0 2422 2103 1217
 USA 4188  962 1230 2836 1966 1227 2433  224 1909 2251    0 2414 1787
 POL 1557  598 1193 2648 1590 1305 1431  129 1410 2019 2532    0 1049
 JPN  852  361  404  769  652  521  657   63  560  708 1038  624    0
 -----------------------------------------------------------------------------

HOL
--------

 common bulls below diagonal
 common three quarter sib group above diagonal
        BEL  CAN  CHE  CZE  DEU  DFS  ESP  FRA  GBR  IRL  ISR  ITA  NLD  NZL  USA  POL  ZAF  AUS  URY  JPN
 -----------------------------------------------------------------------------

 BEL    0  837  658  526 1329  961  991 1036  953  565   88  665 1372  538 1065  779  335  801  375  561
 CAN  841    0  929 1028 2565 1618 1767 1455 1813  614  153 1635 1721  736 3669 1573  449 1454  827 1283
 CHE  668  856    0  421 1254  811  785  767  831  468   66  624 1027  446 1125  671  263  702  343  489
 CZE  423  804  296    0 1532 1071 1048  934  905  385  123 1068 1330  444 1461 1268  240  659  464  683
 DEU 1369 2084 1188 1258    0 3073 2557 2707 2483 1012  191 2164 3909 1083 4065 2634  562 1878  908 1521
 DFS  909 1546  771  854 2377    0 1750 1794 1800  843  171 1343 2505  915 2529 1711  515 1437  721 1049
 ESP 1066 1580  741  884 2293 1602    0 1944 1675  780  151 1466 2004  783 2444 1720  521 1312  735 1197
 FRA 1028 1130  706  619 1583 1081 1869    0 1710  810  135 1284 2187  844 2661 1720  484 1388  639 1245
 GBR  936 1898  793  668 1949 1462 1537 1148    0 1118  176 1392 2112 1031 2735 1524  508 1614  779 1135
 IRL  554  602  479  305  892  717  796  658 1168    0  120  477 1028  827  931  614  339  822  421  492
 ISR   54  106   38   94  147  128  116   72  130   94    0  130  183  126  254  159   61  129   97  127
 ITA  658 1403  556  838 1491 1131 1243  805 1133  420   88    0 1475  485 2305 1556  264  952  548  950
 NLD 1560 1738 1029 1264 3674 2306 2109 1484 1910  978  142 1282    0 1179 2993 1952  506 1639  771 1149
 NZL  435  661  370  342  831  660  648  512  892  725  100  393 1065    0 1210  627  355 1294  580  596
 USA  958 4239 1057 1249 3097 2111 2228 1499 2607  862  242 1896 2709 1162    0 2366  640 2205 1295 2082
 POL  706 1441  549 1092 2354 1472 1510 1209 1337  501  117 1321 1822  485 2408    0  322 1083  650  963
 ZAF  281  412  222  174  431  381  477  337  447  297   39  205  422  284  615  250    0  480  320  414
 AUS  701 1492  626  487 1450 1082 1095  965 1435  717   84  766 1440 1286 2271  862  421    0  745  957
 URY  271  773  257  308  653  500  633  372  625  327   54  391  606  475 1563  524  269  580    0  616
 JPN  364  721  315  364  665  572  598  456  578  309   54  495  614  294  906  529  260  519  318    0
```

```
--------------------------------------------------------------------------
HOL
--------

 common bulls below diagonal
 common three quarter sib group above diagonal
        BEL   CAN   DEU   DFS   ESP   GBR   IRL   ITA   NLD   NZL   USA   POL   ZAF   AUS   URY   FRA   JPN   SVN
--------------------------------------------------------------------------
 BEL      0   840  1327   961   991   953   565   664  1372   538  1065   783   335   801   375  1036   561   165
 CAN    846     0  2571  1627  1773  1822   621  1642  1731   742  3683  1587   453  1462   833  1463  1288   218
 DEU   1368  2094     0  3070  2556  2483  1012  2178  3906  1082  4060  2651   562  1877   908  2706  1521   362
 DFS    909  1557  2374     0  1750  1800   843  1350  2503   915  2527  1722   515  1437   721  1794  1049   263
 ESP   1066  1596  2293  1602     0  1675   780  1468  2002   783  2441  1687   521  1311   735  1943  1195   255
 GBR    936  1911  1949  1462  1537     0  1118  1400  2112  1031  2735  1535   508  1614   778  1710  1135   213
 IRL    554   611   892   717   796  1167     0   477  1027   827   931   619   339   822   421   810   492   119
 ITA    658  1411  1499  1135  1243  1137   420     0  1488   486  2327  1572   265   955   548  1289   951   238
 NLD   1560  1752  3672  2305  2109  1910   978  1292     0  1179  2992  1974   506  1639   771  2186  1148   284
 NZL    435   666   831   660   648   891   724   393  1065     0  1210   630   355  1294   579   844   596   122
 USA    958  4269  3097  2111  2228  2607   862  1917  2709  1162     0  2390   640  2205  1295  2661  2082   253
 POL    715  1465  2388  1488  1530  1351   506  1337  1854   488  2442     0   323  1090   655  1733   969   288
 ZAF    281   419   431   381   477   447   297   205   422   284   615   251     0   480   320   484   414    70
 AUS    701  1497  1450  1082  1095  1435   717   767  1440  1286  2271   870   421     0   745  1388   957   164
 URY    271   779   653   500   633   625   327   391   606   475  1563   530   269   580     0   639   616    99
 FRA   1028  1138  1583  1081  1869  1148   658   805  1484   512  1499  1225   337   965   372     0  1245   206
 JPN    364   724   665   572   598   578   309   496   614   294   906   537   260   519   318   456     0   160
 SVN    129   169   355   208   222   156    91   199   245    81   207   242    50   113    51   150    84     0
--------------------------------------------------------------------------
JER
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 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN   DFS   USA   NLD
--------------------------------------------------------------------------
 CAN      0   116   370    42
 DFS    113     0   172   111
 USA    362   164     0    85
 NLD     35   108    83     0
--------------------------------------------------------------------------
JER
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 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN   DFS   GBR   NLD   NZL   IRL   CHE
--------------------------------------------------------------------------
 CAN      0   118   167    51   188    15    50
 DFS    114     0   197   175   181    61    83
 GBR    171   193     0   108   252    91    92
 NLD     44   175   105     0   107    42    51
 NZL    192   157   259    99     0   158    77
 IRL     14    57    94    41   179     0    33
 CHE     46    82    91    44    70    29     0
--------------------------------------------------------------------------
JER
--------

 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN   DFS   GBR   NLD   USA   CHE
--------------------------------------------------------------------------
 CAN      0   121   173    51   435    53
 DFS    116     0   202   179   194    85
 GBR    171   197     0   114   250    93
 NLD     45   179   109     0   113    55
 USA    440   187   269   116     0   110
 CHE     47    83    89    47   110     0
--------------------------------------------------------------------------
JER
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 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN   DFS   GBR   NLD   NZL   USA   ZAF   AUS   IRL   CHE
```

```
------------------------------------------------------------------------
CAN     0  116  170   49  175  434  140  241   15   51
DFS   111    0  200  180  176  245  165  181   61   85
GBR   168  194    0  111  248  276  184  245   91   94
NLD    42  180  105    0  101  128   82   88   42   56
NZL   176  152  252   93    0  420  221  476  155   81
USA   440  225  303  132  493    0  336  538   56  112
ZAF   139  147  187   78  229  349    0  260   44   71
AUS   238  154  252   81  521  586  247    0   71   79
IRL    14   57   94   41  175   58   45   68    0   33
CHE    45   83   91   47   70  113   61   67   29    0
------------------------------------------------------------------------
```

JER
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 common bulls below diagonal
 common three quarter sib group above diagonal

	CAN	DFS	GBR	NLD	NZL	USA	ZAF	AUS	IRL
CAN	0	119	171	49	177	439	142	242	15
DFS	114	0	200	180	176	245	165	181	61
GBR	170	194	0	111	248	276	184	244	91
NLD	43	180	105	0	101	128	82	87	42
NZL	179	152	252	93	0	420	221	476	155
USA	447	225	303	132	493	0	336	537	56
ZAF	141	147	187	78	229	349	0	260	44
AUS	240	154	251	80	521	585	247	0	71
IRL	14	57	94	41	175	58	45	68	0

RDC
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 common bulls below diagonal
 common three quarter sib group above diagonal

	CAN	DEU	DFS	NOR	USA	NLD
CAN	0	10	189	7	110	6
DEU	10	0	69	19	25	14
DFS	199	60	0	145	181	63
NOR	6	18	125	0	76	46
USA	104	23	173	76	0	42
NLD	6	14	60	46	40	0

RDC
----
 common bulls below diagonal
 common three quarter sib group above diagonal

	CAN	DEU	DFS	GBR	NOR	NZL	NLD	IRL
CAN	0	13	192	86	8	73	7	6
DEU	12	0	76	16	17	25	19	7
DFS	202	64	0	128	158	199	66	24
GBR	87	15	124	0	79	88	46	29
NOR	7	16	131	83	0	57	52	63
NZL	74	24	193	87	56	0	28	18
NLD	7	19	63	45	52	27	0	14
IRL	6	7	19	28	62	17	14	0

RDC
----
 common bulls below diagonal
 common three quarter sib group above diagonal

	CAN	DEU	DFS	GBR	NOR	NLD	USA
CAN	0	13	192	86	8	7	155
DEU	12	0	75	16	17	19	26
DFS	202	63	0	131	147	66	209
GBR	87	15	127	0	79	46	113
NOR	7	16	124	83	0	50	85
NLD	7	19	63	45	50	0	46
USA	152	24	205	108	85	44	0
```

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RDC
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 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN  DEU  DFS  GBR  NOR  NZL  USA  ZAF  NLD  AUS  IRL
--------------------------------------------------------------------------------
  CAN     0   13  187   80    7   70  178   78    6   78    5
  DEU    12    0   74   16   17   21   27    3   19   49    7
  DFS   196   63    0  129  147  189  229   63   66  241   24
  GBR    81   15  125    0   78   84  127   47   46   99   29
  NOR     6   16  124   82    0   47   89    0   50   77   63
  NZL    70   21  183   81   46    0  122   41   25  160   17
  USA   182   25  228  125   89  123    0   77   49  148   33
  ZAF    83    3   60   44    0   39   72    0    3   46    4
  NLD     6   19   63   45   50   24   47    3    0   43   14
  AUS    80   47  217   98   66  160  150   48   41    0   23
  IRL     5    7   19   28   62   17   33    4   14   22    0
--------------------------------------------------------------------------------
RDC
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 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN  DEU  DFS  GBR  NOR  NZL  USA  ZAF  NLD  AUS  IRL
--------------------------------------------------------------------------------
  CAN     0   13  188   83    8   70  180   78    7   80    6
  DEU    12    0   74   16   17   21   27    3   19   49    7
  DFS   197   63    0  129  158  189  229   63   66  241   24
  GBR    84   15  125    0   79   84  127   47   46   99   29
  NOR     7   16  131   83    0   48   89    0   52   81   63
  NZL    70   21  183   81   47    0  122   41   25  160   17
  USA   184   25  228  125   89  123    0   77   49  148   33
  ZAF    83    3   60   44    0   39   72    0    3   46    4
  NLD     7   19   63   45   52   24   47    3    0   43   14
  AUS    82   47  217   98   70  160  150   48   41    0   23
  IRL     6    7   19   28   62   17   33    4   14   22    0
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SIM
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SIM
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