crystallographically symmetry related. This is not the case in the present compound, which also shows an apparent difference between the two hydrogen-bridged formate groups. As mentioned previously, the distances C(2)–O(3) and C(2)–O(4) differ significantly in contrast to C(1)–O(1) and C(1)–O(2) which are of about the same length (*cf.* Table 4). Furthermore, the number of ionic contacts to potassium is different: one formate group has 4+1 whereas the other has 3+0 potassium–oxygen contacts.

According to the facts given above there may be a tendency towards less ionization in one of the groups than in the other. This has important bearings on the symmetry character of the hydrogen bond in the dimer.

As mentioned earlier the positions of the hydrogen atoms have not been located experimentally. Naturally nothing definite can be said about the character of the hydrogen bond from the X-ray data. Attempts will be made to attack this problem with other methods.

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The Crystal Structure of $La_2Be_2O_5$*

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The crystal structure of $La_2Be_2O_5$ has been derived and refined from Mo $K\alpha$ X-ray diffraction data. The *C*-centered monoclinic unit cell with $a_0=7{\cdot}536$, $b_0=7{\cdot}348$, $c_0=7{\cdot}439$ Å, $\beta=91°33'$ contains four formula weights. The atomic arrangement in this equilibrium phase consists of a three-dimensional framework of cornersharing beryllium–oxygen tetrahedra with lanthanum atoms irregularly coordinated to ten oxygen atoms. The structure is compared with those of other oxide compounds containing beryllium and, in particular, with the structures of the recently reported nonequilibrium phases $Ca_{12}Be_{17}O_{29}$ and Y_2BeO_4.

Introduction

The work described in this paper is part of a continuing study of binary oxide compounds that contain beryllia as a member. We have previously reported the crystal structures of the compounds $Ca_{12}Be_{17}O_{29}$ and Y_2BeO_4 (Harris & Yakel, 1966, 1967). Unusual trigonal beryllium–oxygen coordinations appeared in these probably metastable crystals which we could form only by quenching from the liquid state.

In both $Ca_{12}Be_{17}O_{29}$ and Y_2BeO_4, the heavy cations have a large radius (0·99 and 0·97 Å, respectively) relative to those in the known equilibrium compounds

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of BeO with Al_2O_3, SiO_2, and Cr_2O_3 (R_{cat}=0·51, 0·42, and 0·69 Å, respectively) where regular, or nearly regular, tetrahedral beryllium–oxygen coordinations are found. We were thus prompted to investigate the crystal structure of an apparent equilibrium phase at the 1:2 composition of the La_2O_3–BeO system in which the heavy cation radius is still larger (1·14 Å).

The compound $La_2Be_2O_5$ was first reported by Weir & Van Valkenburg (1960) who established its formula on the basis of solid-state synthesis and listed optical and powder-pattern X-ray diffraction data. An equilibrium phase diagram for the La_2O_3–BeO system presented by Levin, Robbins & McMurdie (1961) shows a low-melting eutectic near the 1:2 composition and suggests that the $La_2Be_2O_5$ phase itself may form peritectically just to the BeO-rich side of the eutectic. A 1:2 phase was also observed in this system by Kuo & Yen (1964). They postulated an orthorhombic unit cell for their compound, with $a_0=3·81$, $b_0=9·95$, $c_0=11·07$ Å, $Z=4$ formula weights per cell, and gave refractive indices $n_\alpha=1·980$ and $n_\gamma=2·035$. Bragg spacings computed from these cell parameters are not in good agreement with the powder pattern for $La_2Be_2O_5$ listed by Weir & Van Valkenburg (1960) although the optical data show fair correspondence with the earlier results.

Experimental

We grew lath-like crystals of $La_2Be_2O_5$ by cooling melts near the eutectic of the La_2O_3–BeO system. Our experiments confirmed the equilibrium nature of this phase. Powder patterns from crushed crystals were in excellent agreement with the $La_2Be_2O_5$ pattern reported by Weir & Van Valkenburg (1960). The crystal selected for the X-ray diffraction investigation had a shape roughly approximating a right triangular prism with an altitude of 0·17 mm, a base width of 0·08 mm, and a uniform thickness of 0·03 mm. Later results showed that the triangular faces were parallel to {101} planes; smaller faces seemed to be parallel to $\{11\bar{1}\}$ planes, but most were too uneven for positive identification. The **b** axis was approximately parallel to the long triangular edge of the crystal.

Preliminary diffraction film data provided estimates of crystal orientation and lattice parameters. The crystal system was monoclinic and systematic reflection absences occurred consistent with space groups $C2/c$ or Cc. The crystal was transferred to a computer-controlled four-circle diffractometer (Busing, Ellison & Levy, 1964, 1965) for refinement of lattice parameters and collection of intensity data. The **b** axis was offset about 5° from the φ axis of the diffractometer and zirconium- or niobium-filtered Mo $K\alpha$ X-radiation (λ $K\alpha_1$=0·70926 Å) was used for all experiments. A least-squares fit to measurements of scattering angles of 12 high-angle reflections gave the following lattice parameters:

$a_0=7·5356\pm0·0006$ Å $\beta=91°33'\pm1'$
$b_0=7·3476\pm0·0017$ $U=411·7\pm0·2$ Å^3
$c_0=7·4387\pm0·0006$ $\varrho_x=6·061\pm0·003$ g.cm^{-3}, assuming $Z=4$ formula weights per cell.

Table 1. *Atomic parameters for* $La_2Be_2O_5$

Least-squares standard errors in the last significant figure are given in parentheses.
Fractional position parameters.

Positions	Atom	x	y	z
8(f)	La	0·23777 (2)	0·03494 (2)	0·19645 (2)
8(f)	Be	0·4693 (5)	0·2183 (5)	−0·4697 (5)
8(f)	O(1)	0·0987 (3)	0·1569 (3)	−0·0845 (2)
4(d)	O(2)	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{2}$
4(e)	O(3)	0	0·2493 (4)	$\frac{1}{4}$
4(b)	O(4)	0	$\frac{1}{2}$	0

Thermal vibration parameters*.

B_{11}	B_{22}	B_{33}	B_{12}	B_{13}	B_{23}
0·00214 (1)	0·00179 (1)	0·00171 (1)	0·00052 (1)	0·00052 (1)	0·00011 (1)
0·0021 (4)	0·0017 (4)	0·0018 (3)	−0·0002 (3)	−0·0000 (3)	−0·0002 (3)
0·0030 (2)	0·0029 (2)	0·0019 (2)	0·0011 (2)	0·0005 (1)	−0·0003 (1)
0·0010 (2)	0·0031 (3)	0·0033 (3)	−0·0004 (2)	−0·0003 (2)	0·0005 (2)
0·0019 (2)	0·0029 (3)	0·0011 (2)	0	−0·0002 (2)	0
0·0033 (3)	0·0015 (2)	0·0055 (4)	0·0001 (2)	0·0021 (3)	0·0010 (3)

R.M.S. thermal displacements (Å) along principal axes.

Positions	Atom	Axis 1	Axis 2	Axis 3
8(f)	La	0·0598 (3)	0·0673 (3)	0·0876 (3)
8(f)	Be	0·064 (8)	0·073 (7)	0·079 (7)
8(f)	O(1)	0·060 (4)	0·081 (3)	0·107 (3)
4(d)	O(2)	0·051 (6)	0·086 (4)	0·103 (4)
4(e)	O(3)	0·054 (5)	0·075 (5)	0·089 (4)
4(b)	O(4)	0·056 (6)	0·079 (5)	0·138 (4)

* Coefficients in the expression $B_{11}h^2+B_{22}k^2+B_{33}l^2+2B_{12}hk+2B_{13}hl+2B_{23}kl$.

We can find no relationship between this unit cell and that reported by Kuo & Yen (1964).

θ–2θ scans were used to measure intensities of reflections from $2\theta = 28°$ to $130°$; low-angle data were observed in an ω-scanning mode. A total of 3605 independent reflections allowed by the possible space groups were examined. Replicate measurements brought the total number of observations, not including standards, to 3974.

The observed data were corrected for Lorentz–polarization and absorption effects. The latter corrections were made by approximating the crystal shape with six bounding planes and using the ORABS computer program of Wehe, Busing & Levy (1962). Replicate measurements were then averaged and relative F^2 values placed on an approximate absolute scale by Wilson's (1942) method. Statistical tests suggested a centrosymmetric intensity distribution. After a satisfactory trial structure had been derived, secondary extinction corrections were applied to all data following the procedure of Zachariasen (1963).

Results

Peaks on the Harker sections of a three-dimensional Patterson function synthesized from the 3605 corrected and scaled independent F^2 values gave initial parameters for lanthanum atoms in the 8(*f*) general positions of the space group $C2/c$. Tentative parameters for sixteen oxygen atoms, eight in 8(*f*), four in 4(*e*), and four in 4(*d*), were also deduced. Standard Fourier methods confirmed these tentative locations and showed the remaining four oxygen atoms [in 4(*b*) positions] and eight beryllium atoms [in 8(*f*) positions].

Iterative structure-factor, least-squares calculations (Busing, Martin & Levy, 1962) were employed to refine the trial structure. The least-squares procedure minimized residuals in weighted F^2. We assumed the X-ray scattering factors for La^{3+} and Be^{2+} given by Cromer & Waber (1965) and those for O^{-1} given in *International Tables for X-ray Crystallography* (1962). Anomalous dispersion corrections for the scattering of Mo $K\alpha$ X-rays by lanthanum atoms were also taken from the latter source. The real part of this correction was applied by drawing a smooth curve through the given values of $\Delta f'$ as a function of $\sin\theta/\lambda$ and making an appropriate adjustment in each entry of the La^{3+} scattering-factor table used by the least-squares program. An average value of +2·8 electrons was assumed for the imaginary part of the dispersion correction. The observations were weighted in inverse proportion to a variance defined as

$$\sigma^2(F^2) = s(A^{-1}\,\mathrm{Lp})^2[\sigma^2_{\rm st} + (0{\cdot}04N)^2] + [0{\cdot}10(F^2_{\rm corr} - F^2_{\rm uncorr})]^2\,,$$

where s is a scale factor, A^{-1} is an absorption correction, Lp is a Lorentz–polarization correction, $\sigma^2_{\rm st}$ is the statistical variance of N (the net count), and $F^2_{\rm uncorr}$ and $F^2_{\rm corr}$ are the observed values of F^2 before and after correction for secondary extinction. The final term in the above equation is an attempt to allow for uncertainties in determining the constants governing the secondary extinction corrections.

Four least-squares cycles, the last three with anisotropic thermal vibration parameters, produced the following measures of agreement between observed and calculated $|F|$ and F^2 values:

$$R_1[\equiv \Sigma(|F|_o - s|F|_c)/\Sigma|F|_o] = 0{\cdot}066$$
$$R_2[\equiv \Sigma(|F^2_o - sF^2_c|)/\Sigma F^2_o] = 0{\cdot}056$$
$$\sigma_1[\equiv \sqrt{\Sigma w(F^2_o - sF^2_c)^2}/\sqrt{n-m}] = 1{\cdot}106\,,$$

where w is a weight $[\equiv 1/\sigma^2(F^2_o)]$, n is the number of observations, and m is the number of variable parameters. The sums and averages were taken over all 3605 independent reflections.

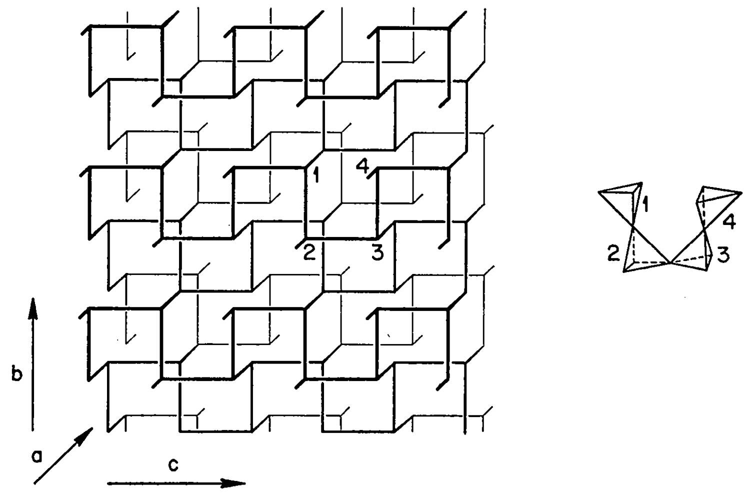

Fig. 1. A schematic representation of the tetrahedral framework in $La_2Be_2O_5$. Tetrahedra have been replaced by sets of three orthogonal Be–O vectors, as described in the text. Unit-cell vectors are shown at the lower left, and two units of a 'square-wave' string of tetrahedra are shown at the right.

Table 2. *Comparison of observed and calculated |F| values*

$FC = 10\cdot|F|_{calc}$, with the sign of A_{calc}. $FO = 10\cdot|F|_{obs}$. $SIG = 10\cdot\sigma(|F|_{obs})$, where $\sigma(|F|_{obs})$ is defined as $\sigma(F^2_{obs})/2|F|_{obs}$ unless F^2_{obs} is less than 1 (indicated by a W to the right of the entry for SIG in the table), in which case $SIG = \sigma(F^2_{obs})$. All F^2_{obs} have been scaled with the least-squares scale factor; all $|F|_{obs}$ have been scaled with the square root of that factor.

L	FC	FO	SIG
*** 0	0	L ***	
2	-2379	2461	51
4	1149	1160	24
6	1034	1056	22
8	-1741	1725	34
10	1723	1704	35
12	-673	649	22
14	5	0	165 W
16	568	563	22
18	-787	782	20
*** 2	0	L ***	
-18	629	630	19
-16	-509	500	22
-14	-321	255	31
-12	1039	1048	24
-10	-1694	1684	34
-8	1861	1868	37
-6	-899	917	19
-4	-1236	1276	26
-2	2733	3056	65
0	-3274	3537	86
2	2802	2760	53
4	250	267	18
6	-1498	1468	29
8	1869	1821	36
10	-1642	1613	33
12	707	708	20
14	151	154	43
16	-586	577	20
18	605	627	17
*** 4	0	L ***	
-18	-612	622	18
-16	377	366	21
-14	243	267	22
-12	-1122	1129	25
-10	1606	1604	33
-8	-1169	1172	25
-6	515	528	14
-4	1725	1776	34
-2	-2951	3096	61
0	3407	3502	71
2	-1354	1314	28
4	459	464	13
6	1783	1732	34
8	-1582	1527	31
10	1225	1181	26
12	-379	380	20
14	-287	239	29
16	762	767	21
18	-628	637	18
*** 6	0	L ***	
-18	566	601	18
-16	-106	91	67
-14	-525	529	20
-12	1079	1078	25
-10	-1662	1637	33
-8	1075	1079	23
-6	14	39	92
-4	-1262	1251	25
-2	2368	2406	45
0	-2321	2290	43
2	817	802	18
4	667	659	16
6	-1380	1366	28
8	1774	1722	35
10	-1044	1023	24
12	206	207	29
14	277	281	22
16	-625	626	19
*** 8	0	L ***	
-16	147	201	29
-14	632	643	20
-12	-1005	1024	24
-10	1171	1159	26
-8	-761	763	19
-6	-333	356	14
-4	1680	1701	34
-2	-1860	1867	37
0	1945	1930	37
2	-545	551	16
4	-548	549	16
6	1445	1413	29
8	-1058	1063	24
10	871	863	22
12	73	137	36
14	-470	461	19
16	619	617	17

L	FC	FO	SIG
*** 10	0	L ***	
-16	79	0	278 W
-14	-625	612	30
-12	1113	1096	28
-10	-1035	1001	26
-8	416	475	24
-6	265	313	32
-4	-1376	1390	29
-2	1585	1586	33
0	-1052	1034	22
2	170	219	19
4	744	758	19
6	-1312	1294	28
8	1079	1044	24
10	-503	520	20
12	26	0	100 W
14	428	411	19
*** 12	0	L ***	
-14	613	658	20
-12	-801	795	23
-10	853	844	24
-8	-91	92	108
-6	-577	583	23
-4	1176	1203	27
-2	-1317	1309	29
0	922	914	21
2	131	115	47
4	-567	559	19
6	1014	1041	24
8	-735	738	20
10	325	331	19
12	273	262	25
14	-384	400	15
*** 14	0	L ***	
-12	756	757	24
-10	-587	594	26
-8	117	0	273 W
-6	568	560	29
-4	-1008	1021	27
-2	813	803	28
0	-544	547	19
2	-243	266	23
4	739	749	20
6	-842	867	21
8	592	606	18
10	-249	208	31
12	-208	238	18
*** 16	0	L ***	
-10	370	68	195
-8	161	0	255 W
-6	-506	426	40
-4	942	905	28
-2	-696	606	35
0	299	273	27
2	217	210	31
4	-532	560	20
6	692	702	19
8	-313	304	21
10	69	56	76
*** 18	0	L ***	
-6	483	446	30
-4	-625	642	26
-2	482	426	35
0	-121	0	107 W
2	-374	390	17
4	475	480	18
6	-555	577	16
*** 1	1	L ***	
-18	-242	256	23
-17	168	240	24
-16	690	677	21
-15	-271	284	31
-14	-1105	1102	26
-13	278	331	23
-12	998	953	23
-11	-138	0	105 W
-10	-217	192	23
-9	206	217	17
-8	-1071	1054	23
-7	610	619	15
-6	2131	2125	40
-5	-217	215	10
-4	-3273	3400	69
-3	420	425	13
-2	1763	1857	35
-1	-32	34	22
0	247	247	6

L	FC	FO	SIG
*** 1	1	L ***	
1	-389	407	11
2	-2524	2542	49
3	1309	1318	27
4	2831	2799	53
5	-494	499	12
6	-2323	2280	43
7	416	430	14
8	595	584	16
9	-199	158	28
10	440	440	16
11	-215	230	22
12	-1053	1035	24
13	204	209	40
14	1073	1100	26
15	-91	122	63
16	-632	656	19
17	105	0	136 W
18	75	133	35
*** 3	1	L ***	
-18	326	339	20
-17	-77	145	37
-16	-838	859	21
-15	168	177	35
-14	999	982	24
-13	-252	286	22
-12	-858	873	21
-11	-54	51	87
-10	-5	0	77 W
-9	161	189	18
-8	1268	1280	26
-7	-392	412	13
-6	-2368	2394	45
-5	881	904	19
-4	2291	2349	45
-3	-606	635	16
-2	-1801	1913	36
-1	-52	87	29
0	-1089	1093	22
1	-313	325	16
2	2438	2377	45
3	-687	683	19
4	-2721	2679	50
5	391	406	12
6	1689	1671	33
7	-182	179	21
8	-514	522	16
9	-201	228	19
10	-754	762	20
11	109	181	29
12	1069	1065	25
13	-424	419	19
14	-943	932	23
15	155	173	34
16	519	513	19
17	-88	95	53
18	5	80	52
*** 5	1	L ***	
-18	-395	387	18
-17	197	222	26
-16	843	841	22
-15	-188	218	28
-14	-1013	1016	24
-13	297	270	24
-12	547	561	18
-11	-104	129	32
-10	184	223	18
-9	-132	166	20
-8	-1360	1351	28
-7	397	409	13
-6	2154	2159	41
-5	-156	155	17
-4	-2051	2061	39
-3	649	640	14
-2	557	570	13
-1	502	507	12
0	746	727	17
1	-413	435	11
2	-2466	2431	46
3	633	608	15
4	2241	2175	42
5	-488	477	15
6	-1325	1292	27
7	341	405	15
8	80	92	43
9	114	105	41
10	708	685	19
11	-137	209	21
12	-1119	1087	25
13	138	174	29
14	807	799	21
15	-148	197	25
16	-345	349	19

L	FC	FO	SIG
*** 5	1	L ***	
17	-13	24	183
18	-73	117	30
*** 7	1	L ***	
-17	-186	208	25
-16	-808	836	21
-15	135	117	48
-14	856	854	22
-13	-105	98	55
-12	-449	469	17
-11	-33	0	96 W
-10	-513	501	17
-9	183	141	33
-8	1275	1270	27
-7	-558	578	16
-6	-1873	1888	37
-5	390	394	13
-4	1504	1514	30
-3	-263	277	13
-2	-317	340	12
-1	152	155	18
0	-1264	1256	25
1	361	385	13
2	1811	1786	35
3	-435	435	15
4	-1939	1867	37
5	117	95	42
6	887	867	20
7	-145	123	36
8	136	161	26
9	-198	194	24
10	-817	813	21
11	250	239	27
12	922	915	22
13	-266	224	31
14	-725	720	20
15	80	0	116 W
16	209	205	27
17	-112	0	104 W
*** 9	1	L ***	
-17	141	186	24
-16	761	759	20
-15	-251	266	22
-14	-689	709	20
-13	161	183	31
-12	219	261	23
-11	53	189	23
-10	517	510	18
-9	-74	183	23
-8	-1356	1341	28
-7	319	343	17
-6	1432	1450	30
-5	-255	270	15
-4	-1069	1096	24
-3	116	127	27
-2	-28	82	38
-1	347	355	15
0	1132	1120	23
1	-153	138	27
2	-1737	1733	35
3	629	646	17
4	1282	1259	27
5	-207	192	26
6	-650	662	18
7	99	137	30
8	-307	292	20
9	75	124	36
10	800	802	21
11	-109	148	30
12	-823	794	22
13	178	157	37
14	510	510	18
15	-18	88	46
16	-141	156	27
*** 11	1	L ***	
-15	59	0	271 W
-14	517	515	33
-13	-140	0	315 W
-12	-42	0	329 W
-11	-151	0	332 W
-10	-616	598	32
-9	231	28	551
-8	1110	1098	28
-7	-316	316	46
-6	-1271	1278	29
-5	238	223	57
-4	582	555	28
-3	-212	117	104
-2	211	148	78
-1	-173	26	456
0	-1055	1038	23

L	FC	FO	SIG
*** 11	1	L ***	
1	222	251	19
2	1354	1346	29
3	-175	220	22
4	-1047	999	24
5	164	202	25
6	234	252	23
7	27	103	44
8	320	327	22
9	-237	254	23
10	-742	741	20
11	135	159	30
12	696	689	20
13	-195	157	35
14	-376	390	16
15	77	146	21
*** 13	1	L ***	
-14	-433	390	27
-13	51	43	209
-12	-118	202	47
-11	-12	0	202 W
-10	632	633	23
-9	-158	187	55
-8	-983	996	25
-7	246	234	48
-6	882	924	24
-5	-42	93	111
-4	-437	412	30
-3	39	0	202 W
-2	-435	461	26
-1	209	292	36
0	910	931	21
1	-254	273	25
2	-1060	1067	26
3	331	358	18
4	715	723	20
5	-29	87	61
6	-124	76	74
7	126	154	36
8	-451	438	20
9	144	157	32
10	600	589	19
11	-95	18	314
12	-556	558	17
13	68	103	37
*** 15	1	L ***	
-12	133	0	172 W
-11	-167	112	87
-10	-648	592	25
-9	106	109	95
-8	814	798	24
-7	-285	194	62
-6	-657	674	25
-5	116	0	234 W
-4	157	212	51
-3	-22	0	230 W
-2	378	447	29
-1	-123	244	47
0	-862	884	21
1	100	157	36
2	791	797	22
3	-189	243	24
4	-465	465	21
5	-11	45	108
6	-13	39	123
7	83	54	101
8	404	380	20
9	-123	184	24
10	-558	557	17
11	133	90	50
*** 17	1	L ***	
-9	-121	0	245 W
-8	-698	652	26
-7	92	0	257 W
-6	447	393	37
-5	-50	0	267 W
-4	-23	0	287 W
-3	-27	0	287 W
-2	-435	367	41
-1	219	0	282 W
0	651	648	19
1	-124	107	59
2	-647	678	19
3	174	184	31
4	269	239	28
5	-41	140	28
6	106	185	21
7	14	0	96 W
8	-368	381	17

L	FC	FO	SIG
*** 19	1	L ***	
-3	-41	0	198 W
-2	407	369	30
-1	-119	0	196 W
0	-547	549	16
1	85	166	26
2	426	438	16
*** 0	2	L ***	
0	2910	3135	71
1	-1289	1333	25
2	-2548	2706	54
3	1145	1158	24
4	426	440	14
5	268	275	10
6	1114	1127	23
7	-722	731	17
8	-1729	1706	34
9	686	683	17
10	1509	1486	31
11	-564	575	18
12	-824	820	21
13	228	227	26
14	53	161	33
15	197	70	105
16	491	500	21
17	-266	275	23
18	-574	586	18
*** 2	2	L ***	
-18	694	680	19
-17	-217	198	34
-16	-362	369	21
-15	60	127	40
-14	-23	92	56
-13	168	188	29
-12	952	956	23
-11	-666	661	18
-10	-1352	1357	28
-9	761	787	19
-8	1547	1562	31
-7	-450	454	13
-6	-351	343	12
-5	61	68	28
-4	-792	803	19
-3	740	765	18
-2	3310	3695	81
-1	-1928	2076	40
0	-3191	3276	69
1	1060	1011	22
2	2371	2297	44
3	-425	424	17
4	-233	243	21
5	-51	149	15
6	-1000	991	21
7	850	835	19
8	1750	1714	34
9	-762	780	19
10	-1162	1156	25
11	398	408	18
12	583	577	19
13	-131	138	44
14	230	265	23
15	-145	153	40
16	-560	553	19
17	344	310	23
18	697	691	18
*** 4	2	L ***	
-18	-560	565	18
-17	278	292	23
-16	263	254	27
-15	49	0	115 W
-14	393	363	22
-13	-304	274	26
-12	-971	968	23
-11	511	539	17
-10	1543	1553	32
-9	-785	790	19
-8	-1324	1354	28
-7	404	429	13
-6	343	362	13
-5	314	337	11
-4	1104	1118	23
-3	-753	779	16
-2	-2285	2331	44
-1	1203	1228	25
0	2461	2436	46
1	-1311	1286	27
2	-1421	1402	30
3	130	70	38
4	-504	475	13
5	415	426	14
6	1266	1233	26

L	FC	FO	SIG
*** 4	2	L ***	
7	-589	579	16
8	-1715	1669	34
9	766	763	19
10	1178	1149	26
11	-370	362	20
12	-421	419	18
13	-26	69	79
14	-235	218	32
15	178	203	27
16	529	530	18
17	-271	290	21
18	-545	547	17
*** 6	2	L ***	
-18	544	571	16
-17	-179	188	26
-16	-174	193	30
-15	13	0	116 W
-14	-321	330	20
-13	415	413	19
-12	1097	1105	25
-11	-559	557	19
-10	-1076	1068	24
-9	494	480	16
-8	1071	1097	24
-7	-393	404	14
-6	248	228	17
-5	-333	315	14
-4	-1249	1267	26
-3	938	962	20
-2	2432	2480	47
-1	-926	943	20
0	-1873	1862	35
1	711	702	17
2	1162	1138	24
3	-278	284	16
4	451	426	15
5	-553	531	15
6	-1246	1218	26
7	677	690	17
8	1333	1316	28
9	-482	472	17
10	-804	771	20
11	350	355	19
12	209	213	29
13	43	54	97
14	449	446	19
15	-261	261	23
16	-578	585	18
17	238	206	28
*** 8	2	L ***	
-17	90	110	86
-16	-8	140	34
-15	88	0	178 W
-14	529	541	23
-13	-302	372	19
-12	-1017	1019	24
-11	604	627	19
-10	1209	1222	27
-9	-431	440	19
-8	-621	614	18
-7	65	0	94 W
-6	-137	149	25
-5	230	268	20
-4	1232	1228	26
-3	-811	792	19
-2	-1759	1771	35
-1	889	898	20
0	1368	1351	27
1	-425	405	15
2	-410	389	16
3	-13	0	76 W
4	-702	665	18
5	350	334	17
6	1207	1195	26
7	-675	656	18
8	-1313	1303	28
9	447	438	18
10	617	606	19
11	-127	138	38
12	-137	192	27
13	-25	0	111 W
14	-372	361	20
15	240	211	27
16	502	489	18
*** 10	2	L ***	
-16	84	128	91
-15	-179	182	72
-14	-489	492	33
-13	334	298	49
-12	917	925	27

L	FC	FO	SIG
*** 10	2	L ***	
-11	-411	475	31
-10	-775	782	25
-9	429	411	32
-8	490	509	27
-7	9	0	215 W
-6	652	669	22
-5	-425	429	25
-4	-1057	1060	25
-3	539	520	22
-2	1638	1647	34
-1	-698	700	21
0	-997	981	21
1	356	348	16
2	306	344	17
3	162	151	33
4	707	683	19
5	-407	428	17
6	-936	965	22
7	441	441	18
8	922	915	22
9	-414	422	18
10	-397	410	19
11	90	60	87
12	-114	0	112 W
13	142	130	38
14	454	478	16
15	-174	159	30
*** 12	2	L ***	
-15	154	0	197 W
-14	608	577	26
-13	-373	305	45
-12	-835	789	26
-11	356	215	69
-10	709	702	29
-9	-210	0	288 W
-8	-222	141	95
-7	33	100	122
-6	-422	418	32
-5	408	450	28
-4	1064	1091	26
-3	-572	556	26
-2	-1028	1053	26
-1	388	407	30
0	646	628	18
1	-248	252	24
2	54	82	62
3	-137	124	47
4	-748	750	20
5	422	433	19
6	909	912	22
7	-383	404	18
8	-770	771	21
9	226	183	37
10	278	261	24
11	-90	46	105
12	72	62	75
13	-141	144	33
14	-408	410	16
*** 14	2	L ***	
-13	300	234	47
-12	710	714	25
-11	-344	301	44
-10	-412	399	36
-9	128	72	191
-8	49	0	248 W
-7	112	156	79
-6	632	662	25
-5	-776	340	33
-4	-822	869	24
-3	480	484	29
-2	1070	1066	26
-1	-358	408	30
0	-337	357	21
1	30	142	35
2	-42	0	125 W
3	123	112	52
4	634	624	20
5	-326	316	22
6	-654	667	20
7	349	338	23
8	526	530	18
9	-160	205	22
10	-70	168	24
11	-12	87	47
12	-194	180	76
*** 16	2	L ***	
-10	371	272	45
-9	-116	0	216 W
-8	61	0	223 W
-7	-152	83	140

L	FC	FO	SIG
*** 16	2	L ***	
-6	-498	498	28
-5	309	263	52
-4	694	691	27
-3	-300	261	52
-2	-588	608	28
-1	276	242	55
0	221	221	27
1	-31	42	151
2	283	301	23
3	-218	243	25
4	-585	590	19
5	237	251	23
6	577	584	18
7	-245	280	18
8	-424	428	18
9	137	153	28
*** 18	2	L ***	
-6	551	530	26
-5	-285	115	107
-4	-567	466	33
-3	265	0	267 W
-2	513	413	36
-1	-127	0	239 W
0	-63	135	29
1	13	126	34
2	-166	152	37
3	168	158	33
4	510	524	17
5	-251	266	19
*** 1	3	L ***	
-18	-146	198	25
-17	247	274	23
-16	608	661	20
-15	-578	605	20
-14	-874	893	22
-13	556	573	19
-12	650	652	19
-11	-437	445	17
-10	-350	340	19
-9	-374	415	14
-8	-872	874	20
-7	969	969	21
-6	1838	1858	36
-5	-1908	1919	36
-4	-1999	2059	39
-3	1394	1435	29
-2	1385	1433	28
-1	-1074	1123	23
0	-262	278	11
1	-838	814	20
2	-2204	2156	41
3	1425	1395	29
4	2119	2087	39
5	-1442	1435	28
6	-1501	1489	30
7	784	779	18
8	624	624	16
9	7	41	88
10	339	341	18
11	-577	588	18
12	-963	969	23
13	723	699	21
14	728	720	21
15	-577	583	20
16	-514	539	20
17	256	289	20
18	101	133	31
*** 3	3	L ***	
-18	217	224	25
-17	-350	333	22
-16	-627	647	20
-15	667	681	20
-14	864	867	22
-13	-645	659	19
-12	-664	664	20
-11	341	345	17
-10	-150	134	36
-9	297	286	17
-8	750	766	18
-7	-996	1011	22
-6	-1912	1942	37
-5	1442	1475	29
-4	1933	2007	38
-3	-1058	1065	22
-2	-822	833	19
-1	99	103	32
0	-591	593	15
1	1207	1171	25
2	1570	1554	32
3	-1599	1556	30

Table 2 (*cont.*)

L	FC	FO	SIG
*** 3 3 L ***			
4	-2277	2203	42
5	1627	1636	33
6	1272	1265	26
7	-592	579	16
8	-227	235	19
9	79	72	69
10	-455	453	18
11	590	625	18
12	857	834	22
13	-562	562	20
14	-828	828	22
15	466	472	20
16	312	296	24
17	-87	89	56
18	-11	32	147
*** 5 3 L ***			
-18	-389	394	18
-17	364	361	20
-16	605	594	20
-15	-546	530	20
-14	-770	765	21
-13	470	439	21
-12	513	533	18
-11	-162	179	27
-10	183	171	26
-9	-618	632	17
-8	-1193	1196	25
-7	1029	1033	22
-6	1404	1414	29
-5	-1528	1518	30
-4	-1697	1710	33
-3	849	860	19
-2	570	581	13
-1	-258	250	11
0	940	919	19
1	-1106	1069	22
2	-1673	1629	32
3	1159	1122	24
4	1625	1552	31
5	-1139	1111	24
6	-1143	1126	24
7	360	365	16
8	13	95	36
9	277	329	17
10	659	654	19
11	-633	624	19
12	-773	749	21
13	639	643	19
14	658	662	19
15	-435	456	20
16	-321	317	21
17	110	175	20
*** 7 3 L ***			
-17	-418	448	16
-16	-728	742	19
-15	623	622	19
-14	586	586	20
-13	-413	441	18
-12	-344	358	19
-11	126	0	117 W
-10	-327	363	16
-9	510	522	16
-8	1045	1059	23
-7	-943	962	21
-6	-1558	1554	31
-5	1017	1047	22
-4	900	906	20
-3	-511	525	14
-2	-381	384	13
-1	-274	293	13
0	-907	907	19
1	1071	1069	23
2	1631	1627	33
3	-1265	1269	27
4	-1336	1325	28
5	962	963	22
6	648	649	17
7	-269	298	17
8	33	0	88 W
9	-172	217	22
10	-690	671	19
11	593	603	19
12	780	780	20
13	-429	427	20
14	-482	512	18
15	298	307	21
16	185	194	26
17	32	30	133
*** 9 3 L ***			
-16	595	613	18

L	FC	FO	SIG
*** 9 3 L ***			
-15	-466	475	19
-14	-625	649	19
-13	285	296	23
-12	62	104	56
-11	112	143	40
-10	402	412	18
-9	-622	632	19
-8	-990	1023	23
-7	878	888	21
-6	1174	1193	26
-5	-993	1011	23
-4	-881	907	21
-3	305	331	18
-2	-235	240	18
-1	165	171	24
0	754	735	17
1	-920	916	21
2	-1314	1335	28
3	815	805	20
4	1136	1131	25
5	-683	675	18
6	-363	363	19
7	-31	109	40
8	-259	243	25
9	331	343	21
10	573	585	19
11	-579	564	19
12	-691	697	19
13	473	462	19
14	420	435	17
15	-250	237	23
16	-47	97	38
*** 11 3 L ***			
-15	458	473	28
-14	405	369	39
-13	-219	308	44
-12	-105	214	64
-11	-67	107	128
-10	-609	637	28
-9	572	558	30
-8	835	869	25
-7	-652	687	25
-6	-929	933	25
-5	618	631	24
-4	495	514	25
-3	-111	0	221 W
-2	152	165	68
-1	-425	432	29
0	-979	971	22
1	831	857	21
2	940	924	22
3	-787	761	20
4	-800	797	21
5	511	549	17
6	264	251	23
7	-21	0	112 W
8	365	381	18
9	-285	263	27
10	-579	582	18
11	443	438	20
12	503	514	19
13	-283	277	20
14	-321	320	17
15	147	68	67
*** 13 3 L ***			
-14	-266	215	40
-13	83	0	178 W
-12	-89	171	53
-11	215	265	36
-10	445	478	25
-9	-552	578	24
-8	-881	915	24
-7	648	665	24
-6	635	661	23
-5	-505	530	25
-4	-281	304	37
-3	32	0	222 W
-2	-300	327	33
-1	280	297	36
0	719	711	19
1	-680	685	21
2	-918	900	23
3	470	461	21
4	454	499	18
5	-305	288	22
6	-86	71	83
7	-170	202	27
8	-308	306	21
9	312	305	22
10	550	565	18
11	-458	449	18
12	-418	418	16

L	FC	FO	SIG
13	267	270	17
*** 15 3 L ***			
-11	-182	0	242 W
-10	-498	430	34
-9	461	404	37
-8	590	513	34
-7	-417	367	37
-6	-600	543	29
-5	328	323	36
-4	45	0	218 W
-3	137	173	59
-2	338	371	34
-1	-372	417	30
0	-639	661	19
1	583	615	21
2	624	652	20
3	-448	457	21
4	-408	394	21
5	221	244	24
6	-97	148	36
7	116	134	38
8	316	308	22
9	-245	228	27
10	-408	434	16
11	300	293	19
*** 17 3 L ***			
-8	-517	382	37
-7	382	317	43
-6	310	175	85
-5	-231	0	302 W
-4	-71	0	287 W
-3	-90	0	324 W
-2	-409	270	63
-1	294	0	316 W
0	530	519	18
1	-429	463	19
2	-462	485	19
3	234	220	29
4	211	234	22
5	-104	96	51
6	73	146	27
7	-209	225	21
*** 19 3 L ***			
-1	-278	169	62
0	-480	478	15
*** 0 4 L ***			
0	2413	2454	47
1	-2424	2495	47
2	-1375	1410	28
3	929	936	21
4	859	868	18
5	76	97	26
6	852	852	19
7	-1129	1140	24
8	-866	857	20
9	1345	1333	28
10	939	935	22
11	-929	914	22
12	-469	468	19
13	250	179	42
14	-49	93	62
15	176	182	37
16	422	454	18
17	-508	516	18
18	-419	430	17
*** 2 4 L ***			
-18	386	343	21
-17	-490	501	19
-16	-223	220	30
-15	140	138	45
-14	-137	140	42
-13	491	488	20
-12	599	582	20
-11	-921	922	22
-10	-1153	1160	23
-9	1302	1317	28
-8	975	1000	22
-7	-967	973	21
-6	-454	470	13
-5	-88	127	22
-4	-330	328	11
-3	1517	1576	30
-2	1674	1722	34
-1	-2007	2055	39
0	-1737	1716	33
1	2192	2057	40

L	FC	FO	SIG
2	989	955	23
3	-928	903	19
4	-10	96	26
5	-628	631	16
6	-803	807	19
7	1101	1090	23
8	1276	1223	26
9	-1283	1272	27
10	-898	882	21
11	815	834	21
12	374	371	20
13	-164	116	54
14	-19	83	72
15	-348	340	23
16	-401	400	20
17	469	462	18
18	381	369	19
*** 4 4 L ***			
-18	-430	438	17
-17	346	342	23
-16	256	268	25
-15	-73	95	57
-14	239	234	31
-13	-530	532	19
-12	-540	550	18
-11	1090	1101	25
-10	941	942	22
-9	-1061	1054	23
-8	-763	773	19
-7	743	757	18
-6	133	176	17
-5	280	302	12
-4	1082	1087	23
-3	-1493	1519	30
-2	-1272	1299	26
-1	2116	2153	41
0	2140	2128	40
1	-1435	1399	28
2	-720	722	16
3	615	611	16
4	64	38	132
5	607	609	16
6	923	897	21
7	-1337	1308	28
8	-838	817	20
9	1048	1037	24
10	835	840	21
11	-655	652	20
12	-93	121	48
13	66	52	116
14	-213	214	27
15	382	394	19
16	428	423	21
17	-515	518	18
18	-425	419	16
*** 6 4 L ***			
-17	-308	343	19
-16	-118	153	32
-15	-124	117	48
-14	-350	339	22
-13	534	533	20
-12	754	754	20
-11	-993	993	23
-10	-885	900	22
-9	1054	1069	24
-8	641	646	17
-7	-333	339	15
-6	-128	117	29
-5	-428	471	14
-4	-901	919	20
-3	1385	1404	28
-2	1309	1329	27
-1	-1758	1770	35
0	-1057	1043	21
1	1263	1219	26
2	588	600	16
3	-77	93	39
4	447	418	15
5	-645	640	17
6	-981	998	22
7	1129	1102	24
8	947	941	22
9	-1047	1046	24
10	-618	611	19
11	389	380	22
12	189	174	35
13	41	0	110 W
14	235	198	31
15	-384	361	22
16	-385	400	18
17	478	487	16

L	FC	FO	SIG
-17	245	0	164 W
-16	51	0	137 W
-15	178	223	24
-14	316	313	22
-13	-666	644	21
-12	-603	602	19
-11	831	840	21
-10	778	797	20
-9	-818	839	20
-8	-257	239	22
-7	280	302	17
-6	-179	177	24
-5	706	714	18
-4	949	971	22
-3	-1199	1216	26
-2	-1214	1215	26
-1	1382	1393	29
0	1121	1098	23
1	-878	849	20
2	-130	148	26
3	-14	113	33
4	-170	198	22
5	830	812	20
6	905	888	21
7	-941	959	22
8	-658	646	19
9	787	780	20
10	415	409	19
11	-358	364	20
12	94	161	30
13	-197	156	40
14	-253	266	23
15	379	395	18
16	453	422	17
*** 10 4 L ***			
-15	-212	183	68
-14	-444	412	36
-13	632	619	29
-12	602	608	27
-11	-818	824	25
-10	-663	648	25
-9	530	512	27
-8	294	291	41
-7	-78	123	92
-6	292	260	43
-5	-596	568	23
-4	-769	769	22
-3	1203	1198	27
-2	827	804	22
-1	-1002	982	24
0	-696	695	17
1	557	543	18
2	-21	91	52
3	156	142	36
4	562	561	18
5	-718	717	20
6	-716	713	20
7	894	888	22
8	673	656	20
9	-552	561	19
10	-346	340	20
11	186	218	26
12	-75	0	115 W
13	168	138	38
14	246	236	24
15	-415	422	16
*** 12 4 L ***			
-14	431	434	28
-13	-561	546	27
-12	-487	523	27
-11	677	718	25
-10	423	472	31
-9	-446	444	33
-8	-36	0	259 W
-7	-146	61	212
-6	-327	347	38
-5	585	605	27
-4	864	881	24
-3	-904	898	25
-2	-701	750	24
-1	873	843	26
0	511	543	18
1	-255	259	26
2	40	0	128 W
3	-257	274	22
4	-379	378	23
5	633	629	20
6	665	671	19
7	-703	698	19
8	-321	314	24
9	464	466	19
10	202	191	32

L	FC	FO	SIG
11	-40	127	37
12	190	173	31
13	-209	186	27
*** 14 4 L ***			
-12	511	521	22
-11	-510	523	22
-10	-358	392	24
-9	291	353	24
-8	-25	156	53
-7	161	194	47
-6	306	376	26
-5	-633	657	22
-4	-588	629	22
-3	720	729	23
-2	534	592	22
-1	-569	612	22
0	-227	252	25
1	205	219	28
2	-231	166	45
3	358	389	21
4	408	422	22
5	-556	566	19
6	-575	593	19
7	533	534	19
8	361	349	20
9	-315	340	18
10	-90	132	35
11	7	0	84 W
12	-122	96	44
*** 16 4 L ***			
-10	254	149	64
-9	-138	0	200 W
-8	155	0	219 W
-7	-205	60	199
-6	-378	306	44
-5	518	490	32
-4	555	543	31
-3	-637	605	30
-2	-385	324	46
-1	367	252	60
0	232	203	30
1	-36	0	132 W
2	225	226	30
3	-282	310	22
4	-323	364	20
5	518	537	18
6	377	391	19
7	-408	410	18
8	-180	161	32
9	187	188	25
*** 18 4 L ***			
-5	-435	384	33
-4	-414	291	42
-3	466	396	32
-2	215	100	120
-1	-286	157	80
0	-40	0	90 W
1	-63	135	31
2	-237	208	29
3	293	314	19
4	340	365	16
*** 1 5 L ***			
-18	-88	86	56
-17	443	433	19
-16	303	249	32
-15	-764	752	21
-14	-466	469	20
-13	1063	1056	25
-12	430	469	17
-11	-537	528	19
-10	-102	126	37
-9	-227	227	20
-8	-442	447	15
-7	1241	1247	26
-6	787	804	18
-5	-1847	1833	36
-4	-1255	1269	26
-3	2066	2113	40
-2	468	484	12
-1	-147	139	14
0	-81	99	14
1	-966	955	20
2	-1028	1028	21
3	2045	2022	39
4	935	928	20
5	-2166	2135	41
6	-954	951	21
7	1215	1209	25

L	FC	FO	SIG
8	191	149	31
9	-17	31	143
10	192	167	32
11	-550	536	18
12	-450	447	19
13	907	901	23
14	464	445	21
15	-729	757	20
16	-251	235	29
17	253	257	23
18	28	0	95 W
*** 3 5 L ***			
-18	145	157	30
-17	-533	506	19
-16	-347	340	20
-15	733	721	21
-14	442	433	20
-13	-778	782	21
-12	-347	325	22
-11	400	365	20
-10	-3	98	44
-9	545	536	16
-8	519	540	15
-7	-1605	1620	33
-6	-954	965	21
-5	1841	1868	36
-4	820	835	18
-3	-1730	1772	34
-2	-674	675	15
-1	450	467	12
0	-519	512	11
1	1224	1201	24
2	749	726	17
3	-1949	1857	37
4	-1152	1120	24
5	1501	1470	30
6	557	542	16
7	-996	992	22
8	-221	199	26
9	-292	326	17
10	-366	370	19
11	823	813	21
12	456	451	21
13	-927	947	23
14	-398	376	22
15	653	650	20
16	212	244	23
17	-300	284	22
*** 5 5 L ***			
-17	557	548	19
-16	370	387	19
-15	-891	882	23
-14	-420	443	20
-13	746	733	21
-12	235	290	20
-11	-178	213	25
-10	100	102	53
-9	-430	427	16
-8	-573	586	16
-7	1511	1505	31
-6	850	849	19
-5	-1609	1629	32
-4	-801	815	18
-3	1053	1075	23
-2	128	170	16
-1	218	226	15
0	268	229	22
1	-1169	1130	24
2	-1066	1051	23
3	2159	2082	41
4	765	744	18
5	-1422	1380	29
6	-583	569	17
7	629	610	18
8	-68	77	58
9	191	199	25
10	298	305	23
11	-765	769	21
12	-496	504	19
13	841	815	22
14	332	352	21
15	-425	427	19
16	-123	119	40
17	107	112	42
*** 7 5 L ***			
-17	-537	554	17
-16	-358	367	20
-15	673	690	19
-14	364	344	23
-13	-654	641	21

L	FC	FO	SIG
-12	-153	166	34
-11	-101	0	118 W
-10	-224	251	20
-9	762	755	20
-8	559	577	17
-7	-1338	1345	28
-6	-760	762	19
-5	1522	1533	31
-4	560	560	16
-3	-917	926	21
-2	-89	84	38
-1	-396	406	14
0	-584	591	14
1	1107	1097	24
2	688	681	18
3	-1506	1496	31
4	-835	843	20
5	1155	1138	25
6	240	241	22
7	-274	269	19
8	50	112	36
9	-540	541	18
10	-415	385	21
11	708	721	20
12	382	410	19
13	-833	817	21
14	-304	314	20
15	426	447	16
16	62	79	56
*** 9 5 L ***			
-16	312	325	19
-15	-652	617	20
-14	-299	302	23
-13	473	491	19
-12	65	173	27
-11	27	86	62
-10	262	311	19
-9	-758	758	20
-8	-572	566	18
-7	1211	1241	27
-6	586	608	17
-5	-923	936	22
-4	-400	395	16
-3	567	593	17
-2	-90	117	34
-1	591	564	18
0	494	504	14
1	-1228	1234	27
2	-749	751	20
3	1377	1346	29
4	461	454	18
5	-801	786	20
6	-268	318	17
7	305	310	20
8	-229	232	25
9	514	510	20
10	332	324	22
11	-661	694	19
12	-374	378	18
13	545	545	18
14	189	198	26
15	-270	281	19
*** 11 5 L ***			
-15	556	530	26
-14	185	110	119
-13	-253	189	77
-12	3	0	308 W
-11	-288	290	55
-10	-297	226	73
-9	689	689	29
-8	501	508	31
-7	-1178	1179	28
-6	-497	504	29
-5	836	858	24
-4	202	295	39
-3	-233	294	40
-2	146	195	57
-1	-452	480	27
0	-490	501	17
1	961	957	23
2	557	545	20
3	-1073	1043	25
4	-416	429	19
5	462	437	20
6	21	0	115 W
7	41	0	115 W
8	155	146	39
9	-498	495	19
10	-374	378	19
11	672	687	19
12	272	244	25
13	-543	531	18

L	FC	FO	SIG
14	-151	134	33
*** 13 5 L ***			
-13	233	0	236 W
-12	-111	0	263 W
-11	323	185	75
-10	281	246	48
-9	-649	679	23
-8	-435	476	25
-7	794	841	23
-6	357	392	27
-5	-592	604	24
-4	-119	194	52
-3	33	189	49
-2	-238	244	42
-1	691	695	23
0	414	416	19
1	-799	805	22
2	-456	459	21
3	900	922	23
4	256	313	20
5	-396	416	20
6	-9	0	122 W
7	-80	198	22
8	-249	248	24
9	467	474	18
10	258	257	25
11	-438	438	18
12	-248	271	18
*** 15 5 L ***			
-11	-358	277	39
-10	-326	257	46
-9	670	596	28
-8	335	277	47
-7	-728	674	28
-6	-255	0	288 W
-5	359	285	53
-4	25	0	300 W
-3	-48	0	303 W
-2	228	114	140
-1	-554	526	33
0	-385	373	23
1	692	670	22
2	324	319	23
3	-539	552	20
4	-163	129	49
5	176	127	50
6	-61	145	33
7	163	178	31
8	208	106	59
9	-499	526	16
10	-257	275	16
*** 17 5 L ***			
-7	553	527	26
-6	138	0	249 W
-5	-182	0	258 W
-4	32	0	286 W
-3	-172	0	297 W
-2	-227	0	287 W
-1	501	396	40
0	306	307	21
1	-595	598	20
2	-257	247	27
3	501	502	19
4	73	0	95 W
5	-56	65	69
6	84	129	35
*** 0 6 L ***			
0	696	686	16
1	-2339	2371	45
2	-329	344	12
3	1214	1213	25
4	-78	65	45
5	260	277	14
6	157	155	25
7	-1162	1159	25
8	-500	483	16
9	1568	1576	32
10	441	431	18
11	-1006	1006	24
12	-137	143	42
13	347	360	21
14	49	138	41
15	256	244	28
16	73	155	30
17	-605	584	18
18	-177	123	42

Table 2 (*cont.*)

L	FC	FO	SIG
***	2	6 L	***
-17	-541	546	18
-16	-151	197	25
-15	166	0	146 W
-14	15	0	138 W
-13	515	546	18
-12	260	275	23
-11	-1157	1138	26
-10	-133	165	29
-9	1381	1395	29
-8	468	489	16
-7	-1153	1152	25
-6	29	88	33
-5	-193	206	15
-4	-301	303	13
-3	1415	1436	29
-2	669	693	16
-1	-2324	2347	44
0	-487	482	12
1	2109	2011	39
2	777	773	19
3	-892	886	20
4	131	109	35
5	-517	518	15
6	-181	187	20
7	1396	1367	29
8	323	350	17
9	-1366	1339	29
10	-233	165	38
11	976	978	24
12	156	43	161
13	-147	75	87
14	210	225	28
15	-367	351	22
16	-128	136	38
17	594	604	18
***	4	6 L	***
-17	460	481	17
-16	42	153	27
-15	-25	93	58
-14	69	0	114 W
-13	-597	597	20
-12	-339	319	23
-11	1203	1213	27
-10	407	393	18
-9	-1310	1333	28
-8	-227	254	18
-7	711	699	18
-6	206	222	18
-5	246	248	15
-4	218	184	18
-3	-1698	1692	33
-2	-599	619	15
-1	2114	2112	40
0	293	293	11
1	-1724	1681	34
2	-190	189	24
3	540	537	16
4	-91	149	27
5	715	708	18
6	449	421	17
7	-1382	1338	28
8	-476	462	17
9	1307	1261	28
10	199	152	37
11	-678	671	20
12	-161	176	33
13	85	0	122 W
14	-59	131	40
15	473	430	21
16	168	116	50
17	-591	593	17
***	6	6 L	***
-17	-352	325	21
-16	26	92	59
-15	-107	192	28
-14	-27	0	127 W
-13	692	687	21
-12	236	249	26
-11	-1131	1156	26
-10	-247	219	28
-9	1143	1122	25
-8	241	226	23
-7	-500	522	16
-6	312	315	25
-5	-632	663	17
-4	-161	178	21
-3	1438	1436	29
-2	703	727	17
-1	-1999	2023	39
0	-450	468	13
1	1256	1241	26
2	202	184	27
3	-196	297	18
4	192	121	43
5	-827	801	20
6	-142	184	38
7	1302	1269	28
8	406	411	18
9	-1112	1104	25
10	-89	157	28
11	535	525	19
12	-50	170	28
13	115	99	68
14	151	125	46
15	-442	463	17
16	-162	203	21
***	8	6 L	***
-16	-9	86	51
-15	230	265	20
-14	238	261	23
-13	-734	735	20
-12	-254	236	27
-11	1045	1013	24
-10	264	277	22
-9	-888	912	22
-8	-219	251	20
-7	264	271	20
-6	-80	151	27
-5	703	712	18
-4	369	405	15
-3	-1490	1505	31
-2	-258	236	19
-1	1455	1438	30
0	260	264	14
1	-1027	1027	23
2	-62	75	66
3	-106	139	37
4	-377	386	18
5	870	867	21
6	318	293	21
7	-1143	1138	25
8	-297	314	22
9	899	874	22
10	185	209	29
11	-350	333	24
12	-15	72	69
13	-186	214	22
14	-154	210	20
15	494	491	16
***	10	6 L	***
-15	-262	241	43
-14	-77	0	241 W
-13	756	728	26
-12	311	210	74
-11	-923	910	27
-10	-60	0	280 W
-9	671	638	28
-8	60	0	235 W
-7	-35	0	220 W
-6	228	214	54
-5	-735	748	23
-4	-296	255	41
-3	1266	1256	28
-2	531	543	23
-1	-1255	1227	28
0	-56	54	82
1	523	546	19
2	134	204	25
3	156	0	120 W
4	215	203	29
5	-886	886	22
6	-244	231	27
7	986	1003	23
8	189	172	36
9	-680	662	20
10	44	0	112 W
11	197	230	23
12	-32	95	53
13	243	274	18
14	201	202	24
***	12	6 L	***
-13	-655	648	24
-12	-212	63	205
-11	803	828	26
-10	227	0	281 W
-9	-469	456	34
-8	28	135	95
-7	-125	233	50
-6	-153	125	92
-5	749	718	27
-4	193	117	104
-3	-1062	1066	26
-2	-251	313	31
-1	924	903	24
0	86	123	45
1	-369	392	21
2	180	159	46
3	-383	377	21
4	-238	244	25
5	719	714	21
6	227	204	33
7	-839	850	22
8	-255	273	25
9	503	491	20
10	-3	0	97 W
11	-59	0	97 W
12	48	0	89 W
13	-273	263	20
***	14	6 L	***
-11	-591	630	19
-10	-16	111	67
-9	327	334	28
-8	26	52	196
-7	222	196	52
-6	325	356	27
-5	-714	699	24
-4	-201	214	51
-3	876	881	25
-2	244	293	35
-1	-660	633	28
0	-37	0	125 W
1	156	96	81
2	18	142	36
3	363	380	22
4	271	300	21
5	-718	745	21
6	-74	127	39
7	606	628	19
8	98	0	112 W
9	-369	362	19
10	43	0	95 W
11	-20	116	29
***	16	6 L	***
-9	-126	0	193 W
-8	50	0	228 W
-7	-254	217	50
-6	-118	0	227 W
-5	640	620	26
-4	202	0	265 W
-3	-713	671	27
-2	-95	0	270 W
-1	457	394	39
0	-74	0	111 W
1	-17	60	99
2	105	147	37
3	-380	393	20
4	-213	193	29
5	569	601	17
6	176	164	33
7	-511	514	18
8	-73	0	91 W
***	18	6 L	***
-3	545	486	27
-2	174	0	226 W
-1	-308	188	59
0	70	115	35
1	-75	52	94
2	-70	68	64
***	1	7 L	***
-17	384	388	17
-16	-58	0	127 W
-15	-838	841	22
-14	-81	0	138 W
-13	824	824	22
-12	32	127	41
-11	-580	573	19
-10	-6	0	103 W
-9	-342	329	19
-8	-63	169	21
-7	1345	1348	28
-6	-60	85	41
-5	-2078	2062	40
-4	-193	175	21
-3	1647	1664	33
-2	24	73	37
-1	-842	868	19
0	142	133	17
1	-916	925	21
2	63	0	68 W
3	1819	1814	36
4	81	88	40
5	-1805	1800	36
6	-131	166	24
7	999	984	23
8	-116	129	34
9	-77	94	53
10	-6	0	101 W
11	-815	816	21
12	-41	22	313
13	982	997	24
14	35	161	32
15	-777	756	22
16	-34	0	105 W
17	357	363	16
***	3	7 L	***
-17	-494	508	17
-16	-86	134	38
-15	921	909	23
-14	-69	113	49
-13	-899	909	23
-12	-106	172	31
-11	411	421	19
-10	-35	0	95 W
-9	435	444	18
-8	43	66	64
-7	-1284	1285	27
-6	-108	132	27
-5	1913	1934	38
-4	-85	145	20
-3	-1289	1293	27
-2	-137	146	20
-1	161	190	15
0	-100	141	14
1	1202	1182	25
2	189	166	28
3	-1920	1833	37
4	54	89	48
5	1880	1890	38
6	47	0	100 W
7	-768	780	20
8	-23	0	98 W
9	-43	107	49
10	-137	169	32
11	765	746	21
12	15	145	35
13	-891	878	23
14	-8	0	127 W
15	644	626	20
16	4	83	57
17	-141	132	37
***	5	7 L	***
-17	535	574	17
-16	24	0	108 W
-15	-795	778	21
-14	-89	151	39
-13	707	740	20
-12	-117	154	36
-11	-214	198	27
-10	-71	106	46
-9	-787	795	20
-8	-103	85	52
-7	1379	1395	29
-6	63	124	29
-5	-1765	1766	35
-4	-51	0	71 W
-3	1150	1174	25
-2	-148	138	25
-1	-17	126	24
0	-38	95	23
1	-1302	1276	27
2	-125	0	103 W
3	1574	1542	32
4	118	120	38
5	-1457	1436	30
6	118	144	31
7	493	484	18
8	-26	106	44
9	384	389	20
10	34	0	120 W
11	-877	881	22
12	-109	141	38
13	854	869	22
14	-24	68	80
15	-611	618	18
16	28	104	38
***	7	7 L	***
-16	-11	0	103 W
-15	830	823	21
-14	6	0	107 W
-13	-577	615	20
-12	-61	128	41
-11	124	198	27
-10	-188	202	32
-9	733	750	20
-8	-70	73	68
-7	-1320	1334	28
-6	-108	66	71
-5	1340	1338	28
-4	-19	153	27
-3	-639	609	18
-2	52	0	78 W
-1	-284	306	16
0	-186	212	17
1	1411	1397	29
2	-18	149	27
3	-1572	1538	32
4	-59	42	118
5	1171	1146	26
6	11	0	105 W
7	-340	353	22
8	155	170	35
9	-341	351	20
10	-30	120	37
11	841	828	22
12	18	86	57
13	-665	687	20
14	-34	0	111 W
15	394	408	18
16	-57	93	42
***	9	7 L	***
-15	-716	700	19
-14	21	0	111 W
-13	387	381	22
-12	-38	0	122 W
-11	164	155	41
-10	-11	105	54
-9	-827	841	21
-8	-196	186	34
-7	1222	1225	27
-6	-106	150	30
-5	-1243	1253	27
-4	-32	0	103 W
-3	383	402	17
-2	-90	117	37
-1	382	401	17
0	99	0	78 W
1	-1152	1161	26
2	-110	132	42
3	1235	1229	27
4	-74	0	123 W
5	-837	821	21
6	31	98	57
7	-24	0	109 W
8	-55	130	39
9	476	496	19
10	124	179	27
11	-805	814	21
12	10	0	109 W
13	658	629	19
14	-25	0	93 W
***	11	7 L	***
-14	-33	0	210 W
-13	-331	296	41
-12	54	0	266 W
-11	-204	264	52
-10	-73	0	284 W
-9	811	814	27
-8	-20	0	295 W
-7	-945	954	26
-6	-132	0	263 W
-5	849	802	26
-4	-187	130	102
-3	-145	150	87
-2	30	0	268 W
-1	-612	587	29
0	-100	152	35
1	1128	1165	27
2	49	162	34
3	-1009	1038	24
4	-6	146	33
5	683	668	21
6	-120	171	31
7	52	0	124 W
8	54	0	129 W
9	-474	497	19
10	-37	77	67
11	632	641	19
12	50	185	19
13	-445	449	16
***	13	7 L	***
-12	-80	0	261 W
-11	297	0	292 W
-10	70	0	291 W
-9	-817	827	26
-8	-38	0	286 W
-7	892	864	27
-6	-60	0	303 W
-5	-626	609	31
-4	-34	0	307 W
-3	27	0	317 W
-2	-197	80	199
-1	497	460	39
0	22	52	121
1	-952	934	24
2	-21	73	92
3	712	742	21
4	-27	76	76
5	-353	334	23
6	69	0	125 W
7	-192	175	34
8	-106	70	75
9	503	520	18
10	23	0	91 W
11	-621	617	17
***	15	7 L	***
-9	646	556	28
-8	15	0	269 W
-7	-667	583	31
-6	26	0	301 W
-5	409	278	59
-4	-114	0	315 W
-3	202	0	334 W
-2	16	0	322 W
-1	-544	471	39
0	-144	178	29
1	811	820	22
2	-44	129	45
3	-618	632	20
4	46	0	118 W
5	246	239	27
6	-62	144	31
7	221	198	30
8	63	69	65
9	-383	399	16
***	17	7 L	***
-5	-301	0	254 W
-4	78	0	251 W
-3	-187	42	294
-2	-92	0	259 W
-1	490	425	31
0	-12	0	97 W
1	-597	608	19
2	-44	0	106 W
3	368	381	19
4	-87	153	24
***	0	8 L	***
0	-173	143	31
1	-1851	1856	36
2	364	360	15
3	1101	1115	24
4	101	125	36
5	190	236	19
6	-66	150	23
7	-1211	1230	26
8	366	368	19
9	1176	1170	26
10	-209	231	26
11	-1019	1013	24
12	229	250	32
13	328	293	29
14	-15	163	29
15	309	317	23
16	-12	155	30
17	-534	511	17
***	2	8 L	***
-17	-475	446	17
-16	86	79	73
-15	139	204	25
-14	5	131	34
-13	402	364	25
-12	-105	141	45
-11	-1061	1075	25
-10	186	174	34
-9	1353	1360	29
-8	-178	168	31
-7	-734	730	19
-6	43	0	84 W
-5	81	130	28
-4	179	175	22
-3	1276	1294	27
-2	-356	379	14
-1	-2025	2032	39
0	448	457	12
1	1660	1610	33
2	-340	352	18
3	-708	693	18
4	124	107	44
5	-384	362	19
6	77	102	46
7	1202	1194	26
8	-186	144	44
9	-1356	1339	29
10	171	153	41
11	690	681	22
12	-95	184	33
13	-226	189	38
14	-33	0	115 W
15	-356	335	23
16	97	113	48
17	606	622	17
***	4	8 L	***
-16	9	95	51
-15	19	69	83
-14	-37	0	119 W
-13	-575	544	21
-12	251	253	26
-11	1016	1026	24
-10	-188	181	31
-9	-1210	1202	26
-8	337	352	18
-7	728	749	19
-6	-36	17	238
-5	489	482	16
-4	41	136	22
-3	-1187	1204	25
-2	362	383	14
-1	1877	1903	37
0	-152	179	17
1	-1511	1480	31
2	306	272	23
3	342	332	19
4	121	189	26
5	649	635	19
6	-108	104	47
7	-1172	1136	26
8	347	321	22
9	1175	1148	26
10	-184	206	28
11	-692	689	20
12	197	181	36
13	-66	175	28
14	2	111	45
15	372	366	21
16	-25	0	107 W
***	6	8 L	***
-16	63	17	289
-15	-67	0	119 W
-14	13	0	113 W
-13	702	683	21
-12	-122	158	34
-11	-1027	1007	24
-10	185	190	32
-9	955	960	23
-8	-122	106	48
-7	-461	471	17
-6	17	0	86 W
-5	-473	468	17
-4	180	74	74
-3	1518	1523	31
-2	-343	362	17
-1	-1456	1459	30
0	361	376	13
1	1176	1144	26
2	-252	228	28
3	-188	129	44
4	69	105	47
5	-831	828	21
6	88	92	57
7	1149	1152	26
8	-188	190	32
9	-954	946	23
10	129	69	91
11	481	493	19
12	-67	124	42
13	75	148	34
14	-51	86	57
15	-519	508	17
***	8	8 L	***
-15	176	249	20
-14	-52	152	34
-13	-671	679	20
-12	221	230	30
-11	1015	1005	24
-10	-178	237	21
-9	-789	818	21
-8	276	277	34
-7	150	215	27
-6	28	145	31
-5	590	610	18
-4	21	90	66
-3	-1260	1270	27
-2	301	315	20
-1	1465	1486	31
0	-140	175	22
1	-651	654	19
2	200	190	35
3	-31	0	118 W
4	135	41	152
5	773	780	21
6	-107	151	37
7	-1110	1074	25
8	298	304	24
9	787	786	21
10	-154	132	46
11	-271	271	24
12	140	142	43
13	-169	201	25
14	19	0	95 W
15	449	430	16
***	10	8 L	***
-14	51	96	104
-13	656	679	24
-12	-117	122	81
-11	-828	832	24
-10	140	0	218 W
-9	662	653	25
-8	-104	57	211
-7	34	0	237 W
-6	-19	140	81
-5	-728	703	25
-4	188	224	49
-3	1104	1109	27
-2	-263	310	39
-1	-1065	1074	27
0	259	246	26
1	594	599	19
2	-189	135	52
3	352	354	20
4	-3	0	128 W
5	-732	747	21
6	86	98	63
7	882	874	23
8	-151	190	30
9	-665	699	19
10	93	163	30
11	128	75	77
12	-43	94	52
13	265	267	21
***	12	8 L	***
-12	215	0	211 W
-11	666	643	26
-10	-134	0	261 W
-9	-418	408	35
-8	184	248	47
-7	-95	0	288 W
-6	28	0	295 W
-5	737	745	27
-4	-30	0	283 W
-3	-1004	1038	27
-2	254	163	95
-1	768	797	27
0	-75	65	94
1	-288	345	22
2	124	138	46
3	-288	276	28
4	118	191	30
5	809	843	22
6	-118	35	176
7	-702	710	20
8	231	183	33
9	440	445	18
10	-102	123	39
11	-73	0	96 W
12	97	0	92 W
***	14	8 L	***
-10	129	177	43
-9	212	199	46
-8	-53	178	48
-7	236	307	31
-6	-56	167	58
-5	-629	604	24
-4	136	157	60
-3	856	856	24
-2	-216	132	86
-1	-594	597	25
0	184	196	29
1	78	143	41
2	-99	0	119 W
3	368	390	20
4	-29	107	48
5	-612	643	18
6	66	0	121 W
7	644	653	19
8	-133	134	40
9	-266	277	19
***	16	8 L	***
-7	-338	183	61
-6	60	0	237 W
-5	588	485	33
-4	-50	0	291 W
-3	-628	554	31
-2	168	0	293 W
-1	431	315	48
0	-55	0	109 W
1	13	18	294
2	71	100	53
3	-413	436	18
4	124	123	41
5	530	540	18
6	-91	115	39
***	1	9 L	***
-16	-196	159	35
-15	-721	717	20
-14	342	314	27
-13	795	784	21
-12	-319	326	22
-11	-486	448	22
-10	-26	0	112 W
-9	-115	72	72
-8	227	204	29
-7	1026	1019	23
-6	-569	534	18
-5	-1402	1420	30
-4	627	625	17
-3	1232	1241	26
-2	-527	533	16
-1	-374	359	15
0	-263	267	13
1	-688	700	18
2	240	253	20
3	1596	1587	33
4	-768	763	19
5	-1382	1359	29
6	518	519	18
7	950	950	22
8	-201	161	41
9	-55	88	59
10	-125	155	41
11	-538	516	21
12	249	277	26
13	787	782	22
14	-358	371	20
15	-550	526	20
16	226	215	23
***	3	9 L	***
-16	281	259	24
-15	665	671	19
-14	-270	229	34
-13	-727	750	21
-12	276	292	24
-11	207	220	31
-10	-44	62	92
-9	376	395	17
-8	-401	408	19
-7	-1172	1195	26
-6	500	462	18
-5	1467	1487	31
-4	-604	601	17
-3	-1196	1201	26
-2	317	331	16
-1	97	107	33
0	26	81	36
1	708	682	20
2	-690	674	19
3	-1453	1405	30
4	431	431	18
5	1255	1262	27
6	-586	582	19

Table 2 (*cont.*)

L	FC	FO	SIG
*** 3 9 L ***			
7	-570	587	19
8	145	200	26
9	-202	247	23
10	161	134	48
11	658	608	21
12	-311	300	25
13	-846	835	22
14	266	286	21
15	548	535	18
16	-215	195	27
*** 5 9 L ***			
-16	-292	279	21
-15	-683	684	19
-14	317	340	18
-13	669	667	21
-12	-150	77	91
-11	-194	205	29
-10	-12	179	24
-9	-507	535	18
-8	305	346	19
-7	1101	1087	25
-6	-650	654	18
-5	-1182	1183	26
-4	431	439	16
-3	855	864	20
-2	-274	267	18
-1	206	188	26
0	-179	200	17
1	-1028	1012	24
2	432	442	19
3	1419	1408	30
4	-714	715	20
5	-1111	1130	26
6	241	179	39
7	534	518	20
8	-186	213	29
9	329	387	19
10	-182	178	36
11	-608	597	20
12	329	319	23
13	689	701	20
14	-269	251	24
15	-403	399	18
*** 7 9 L ***			
-15	625	628	18
-14	-319	290	23
-13	-449	431	20
-12	165	145	44
-11	-44	160	30
-10	139	191	27
-9	603	606	19
-8	-301	300	23
-7	-1213	1231	27
-6	481	483	18
-5	1062	1089	24
-4	-525	531	17
-3	-627	619	19
-2	63	150	26
-1	-262	285	20
0	178	197	18
1	929	910	23
2	-476	480	20
3	-1247	1236	28
4	473	481	20
5	744	745	21
6	-416	417	20
7	-220	136	55
8	-74	138	45
9	-431	428	22
10	114	85	75
11	722	741	20
12	-295	306	22
13	-652	659	19
14	261	254	22
*** 9 9 L ***			
-14	193	204	27
-13	410	413	17
-12	-167	170	34
-11	153	234	21
-10	-132	151	46
-9	-594	605	21
-8	384	406	20
-7	968	984	23
-6	-405	411	19
-5	-844	859	21
-4	337	363	19
-3	281	263	27
-2	-165	170	32
-1	520	494	20
0	-321	332	17
1	-930	938	24
2	389	384	23
3	1127	1123	26
4	-425	461	18
5	-656	648	21
6	230	197	32
7	87	124	46
8	-51	99	69
9	427	447	20
10	-272	257	30
11	-558	590	18
12	210	284	15
13	531	540	17
*** 11 9 L ***			
-12	28	216	50
-11	-267	201	57
-10	84	0	241 W
-9	706	690	27
-8	-341	344	44
-7	-903	909	27
-6	420	425	37
-5	642	663	27
-4	-220	290	42
-3	-227	88	152
-2	26	81	174
-1	-532	509	33
0	184	202	33
1	805	832	23
2	-454	447	23
3	-809	801	22
4	317	324	23
5	383	326	25
6	-175	214	25
7	71	109	47
8	-35	108	50
9	-535	545	19
10	161	146	42
11	548	537	18
12	-277	250	23
*** 13 9 L ***			
-11	273	121	100
-10	-197	0	251 W
-9	-586	559	29
-8	237	88	167
-7	747	699	29
-6	-357	303	54
-5	-383	227	75
-4	218	92	170
-3	-35	0	330 W
-2	56	0	344 W
-1	553	485	39
0	-223	192	37
1	-781	770	23
2	289	285	29
3	709	723	20
4	-334	357	21
5	-242	245	28
6	88	79	72
7	-92	130	39
8	63	74	62
9	433	449	17
10	-172	185	23
*** 15 9 L ***			
-8	-291	107	109
-7	-616	587	26
-6	216	135	96
-5	317	293	45
-4	-165	46	289
-3	101	0	287 W
-2	-37	0	302 W
-1	-510	447	37
0	254	230	27
1	557	590	19
2	-262	278	25
3	-501	499	19
4	199	140	45
5	80	95	50
6	-110	145	30
7	221	229	22
*** 0 10 L ***			
0	-1083	1084	24
1	-1283	1292	27
2	788	801	20
3	669	679	18
4	-191	129	44
5	160	190	28
6	-203	168	35
7	-703	692	19
8	635	614	20
9	989	976	24
10	-620	630	19
11	-650	627	21
12	253	184	42
13	204	247	27
14	-24	0	127 W
15	186	235	24
16	-239	237	22
*** 2 10 L ***			
-16	219	173	34
-15	112	36	158
-14	168	162	41
-13	345	323	25
-12	-418	386	24
-11	-742	747	21
-10	654	666	20
-9	877	877	22
-8	-619	619	19
-7	-701	677	20
-6	399	428	16
-5	-136	134	35
-4	459	460	17
-3	802	805	19
-2	-570	614	16
-1	-1289	1301	27
0	997	981	21
1	1160	1118	26
2	-560	569	19
3	-476	506	18
4	115	69	86
5	-343	358	19
6	585	547	21
7	861	866	22
8	-553	561	19
9	-858	851	23
10	704	700	21
11	625	650	20
12	-303	274	28
13	-70	0	132 W
14	-23	19	294
15	-279	271	23
*** 4 10 L ***			
-15	-21	0	111 W
-14	-72	0	123 W
-13	-417	417	20
-12	443	428	20
-11	797	810	21
-10	-598	601	20
-9	-806	803	21
-8	414	419	18
-7	432	443	19
-6	-157	112	48
-5	176	161	32
-4	-418	421	17
-3	-1023	1004	23
-2	954	956	22
-1	1194	1165	26
0	-824	823	19
1	-958	939	23
2	588	602	20
3	274	290	23
4	-87	150	37
5	474	458	21
6	-458	407	22
7	-884	850	22
8	615	652	20
9	814	797	22
10	-425	425	21
11	-418	395	22
12	211	245	24
13	21	0	112 W
14	90	125	42
15	355	335	19
*** 6 10 L ***			
-15	-82	28	186
-14	235	217	29
-13	475	494	17
-12	-404	393	20
-11	-771	781	21
-10	707	697	21
-9	719	729	20
-8	-412	430	18
-7	-262	229	29
-6	86	0	113 W
-5	-411	426	17
-4	419	414	17
-3	888	888	21
-2	-635	668	18
-1	-1192	1183	26
0	880	860	19
1	678	722	20
2	-186	211	31
3	-57	118	51
4	-45	100	59
5	-552	537	20
6	549	522	20
7	848	833	22
8	-603	588	20
9	-710	700	21
10	526	519	19
11	306	333	18
12	-100	167	30
13	119	119	46
14	-40	0	101 W
*** 8 10 L ***			
-14	-234	248	23
-13	-505	518	18
-12	411	410	20
-11	697	684	21
-10	-451	485	18
-9	-572	584	19
-8	355	395	18
-7	113	105	61
-6	86	169	32
-5	512	561	18
-4	-558	573	19
-3	-927	947	23
-2	676	688	20
-1	884	877	22
0	-674	671	17
1	-588	601	21
2	367	408	22
3	-158	190	36
4	193	198	34
5	597	598	20
6	-421	448	20
7	-746	750	22
8	451	459	21
9	574	589	19
10	-365	355	22
11	-188	234	24
12	44	0	122 W
13	-183	170	27
*** 10 10 L ***			
-12	-456	453	29
-11	-607	587	27
-10	497	490	31
-9	406	375	36
-8	-192	0	249 W
-7	14	0	255 W
-6	37	0	260 W
-5	-546	521	30
-4	506	495	31
-3	839	797	25
-2	-557	527	29
-1	-751	743	24
0	474	484	19
1	273	250	38
2	-78	163	39
3	165	197	39
4	-141	262	21
5	-648	655	20
6	584	616	19
7	649	670	20
8	-411	430	19
9	-419	425	19
10	320	330	22
11	88	0	111 W
12	-52	139	28
*** 12 10 L ***			
-11	559	534	26
-10	-386	350	37
-9	-250	314	40
-8	110	125	107
-7	-147	284	39
-6	202	359	30
-5	534	539	26
-4	-423	456	34
-3	-728	711	29
-2	569	553	32
-1	575	543	32
0	-448	466	19
1	-152	0	165 W
2	49	0	127 W
3	-314	358	20
4	171	228	26
5	517	514	20
6	-357	376	20
7	-577	601	19
8	372	371	19
9	291	284	20
10	-168	202	22
*** 14 10 L ***			
-8	-105	93	86
-7	234	212	42
-6	-144	179	49
-5	-527	503	25
-4	430	410	29
-3	575	540	34
-2	-324	286	57
-1	-417	307	57
0	324	319	23
1	29	0	132 W
2	46	79	72
3	326	364	20
4	-251	283	21
5	-510	524	18
6	391	394	19
7	399	395	18
*** 16 10 L ***			
-3	-473	367	35
-2	362	219	56
-1	252	0	240 W
0	-200	174	26
1	44	143	31
2	-9	0	97 W
*** 1 11 L ***			
-15	-397	394	18
-14	522	489	21
-13	494	514	19
-12	-511	527	20
-11	-272	239	35
-10	58	183	29
-9	-230	233	27
-8	399	382	21
-7	560	564	20
-6	-901	897	22
-5	-953	964	23
-4	974	963	23
-3	850	872	21
-2	-629	612	18
-1	-238	229	22
0	-95	38	99
1	-397	400	22
2	713	670	21
3	676	683	19
4	-1024	1018	24
5	-939	933	23
6	813	787	21
7	400	408	20
8	-345	402	19
9	49	0	139 W
10	-220	251	27
11	-398	408	23
12	470	435	22
13	513	509	19
14	-572	552	19
15	-470	476	17
*** 3 11 L ***			
-15	468	438	20
-14	-569	567	19
-13	-433	405	23
-12	351	300	26
-11	310	292	26
-10	-65	119	45
-9	273	272	25
-8	-585	609	19
-7	-636	649	19
-6	859	853	22
-5	795	790	21
-4	-941	950	22
-3	-543	546	17
-2	461	472	17
-1	145	158	32
0	193	203	20
1	722	714	22
2	-808	758	23
3	-840	811	22
4	963	968	24
5	787	793	22
6	-721	706	21
7	-442	426	21
8	208	215	33
9	-83	0	140 W
10	268	277	25
11	458	441	20
12	-541	526	19
13	-408	416	19
14	483	516	17
15	326	320	19
*** 5 11 L ***			
-14	495	483	18
-13	300	309	21
-12	-352	308	24
-11	-57	0	127 W
-10	-145	177	34
-9	-340	341	23
-8	504	499	19
-7	754	760	21
-6	-939	913	23
-5	-862	858	21
-4	749	738	20
-3	410	419	17
-2	-342	340	20
-1	-13	141	28
0	-336	306	18
1	-554	573	20
2	798	794	23
3	835	850	23
4	-914	904	23
5	-609	624	21
6	584	592	20
7	108	210	23
8	-103	106	62
9	156	71	103
10	-325	259	32
11	-542	541	19
12	511	532	18
13	476	458	19
14	-459	450	17
*** 7 11 L ***			
-13	-361	443	19
-12	206	328	22
-11	-20	0	115 W
-10	137	169	35
-9	421	415	21
-8	-666	661	20
-7	-554	562	21
-6	729	748	20
-5	710	729	20
-4	-734	740	21
-3	-225	255	26
-2	131	213	26
-1	-271	311	22
0	375	391	16
1	697	703	22
2	-786	780	24
3	-699	720	21
4	774	738	23
5	647	649	21
6	-467	476	20
7	-51	0	148 W
8	-7	101	53
9	-249	222	34
10	362	371	20
11	395	420	19
12	-480	478	18
13	-372	378	18
*** 9 11 L ***			
-12	-173	132	47
-11	63	0	118 W
-10	-261	226	31
-9	-554	552	19
-8	557	570	19
-7	630	607	20
-6	-772	789	21
-5	-518	502	20
-4	441	439	19
-3	207	232	29
-2	-116	157	36
-1	257	256	27
0	-478	478	17
1	-661	662	23
2	708	720	23
3	538	544	22
4	-662	702	21
5	-335	351	23
6	328	336	23
7	-26	124	47
8	67	0	116 W
9	357	351	22
10	-369	398	18
11	-475	474	17
12	437	433	17
*** 11 11 L ***			
-11	-148	0	244 W
-10	245	187	76
-9	403	376	42
-8	-594	599	30
-7	-548	572	31
-6	574	561	33
-5	375	459	34
-4	-436	497	30
-3	93	72	210
-2	-111	187	80
-1	-299	332	46
0	387	388	23
1	652	670	23
2	-668	681	22
3	-530	540	21
4	521	566	20
5	263	315	20
6	-215	268	25
7	113	111	51
8	-133	183	26
9	-241	252	24
10	350	370	18
*** 13 11 L ***			
-8	477	357	39
-7	413	384	37
-6	-522	493	33
-5	-351	263	60
-4	234	152	103
-3	-90	0	337 W
-2	78	0	345 W
-1	360	267	65
0	-481	498	18
1	-448	452	22
2	505	482	22
3	356	392	21
4	-434	423	21
5	-139	115	49
6	124	62	90
7	-223	232	22
8	168	149	33
*** 15 11 L ***			
-4	-185	0	254 W
-3	144	0	230 W
-2	-179	0	243 W
-1	-371	298	41
0	366	345	19
1	485	486	19
2	-487	493	18
3	-232	211	27
*** 0 12 L ***			
0	-1016	1021	24
1	-641	646	19
2	941	942	23
3	251	237	28
4	-186	193	30
5	30	0	113 W
6	-457	469	19
7	-396	373	24
8	887	880	23
9	492	505	20
10	-731	705	21
11	-342	322	27
12	561	564	21
13	73	68	83
14	14	0	108 W
*** 2 12 L ***			
-14	60	68	75
-13	209	253	22
-12	-475	494	19
-11	-341	343	24
-10	832	797	22
-9	470	500	19
-8	-665	657	20
-7	-318	315	23
-6	256	276	22
-5	-33	157	28
-4	372	409	18
-3	472	467	18
-2	-1073	1095	25
-1	-559	553	18
0	1168	1155	25
1	584	549	23
2	-784	772	23
3	-239	197	42
4	147	144	50
5	-254	247	30
6	463	450	21
7	383	423	20
8	-853	824	23
9	-468	486	21
10	670	667	21
11	285	233	33
12	-307	261	32
13	-25	0	117 W
14	-57	0	101 W
*** 4 12 L ***			
-14	-187	152	37
-13	-217	212	27
-12	622	616	20
-11	448	443	21
-10	-754	748	21
-9	-374	357	23
-8	800	805	21
-7	224	260	23
-6	-64	0	120 W
-5	125	189	26
-4	-392	379	21
-3	-483	501	18
-2	979	984	23
-1	640	678	18
0	-994	975	22
1	-378	390	25
2	632	681	20
3	122	56	131
4	176	183	47
5	256	235	32
6	-561	579	20
7	-514	501	21
8	874	862	23
9	368	310	28
10	-669	665	20
11	-213	212	28
12	289	237	29
13	-26	42	114
*** 6 12 L ***			
-13	244	239	25
-12	-582	556	19
-11	-383	400	20
-10	693	710	20
-9	398	378	22
-8	-489	478	20
-7	-51	87	68
-6	44	0	122 W
-5	-212	192	35
-4	683	693	19
-3	490	502	19
-2	-980	977	24
-1	-552	571	19
0	900	897	21
1	358	305	33
2	-549	494	27
3	78	106	68
4	-169	183	42
5	-293	208	42
6	610	591	21
7	429	445	21
8	-709	669	23
9	-388	394	21
10	493	504	19
11	83	130	40
12	-167	178	31
13	83	0	94 W
*** 8 12 L ***			
-12	684	695	19
-11	334	331	22
-10	-641	647	19
-9	-271	273	24
-8	461	464	20
-7	52	0	133 W
-6	129	195	31
-5	339	337	23
-4	-481	487	20
-3	-465	468	20
-2	981	980	24
-1	435	461	20
0	-635	637	17
1	-225	218	44
2	286	194	47
3	-103	167	38
4	294	302	26
5	396	439	21
6	-637	650	21
7	-373	371	23
8	745	740	21
9	267	301	20
10	-399	390	20
11	-83	0	111 W
12	119	151	28
*** 10 12 L ***			
-11	-339	220	50
-10	580	562	26
-9	154	0	259 W
-8	-243	0	256 W
-7	72	0	245 W
-6	-232	0	268 W
-5	-286	137	100
-4	640	601	29
-3	494	462	34
-2	-783	785	26
-1	-332	238	66
0	671	661	21
1	96	160	47
2	-160	200	37
3	161	125	64
4	-320	346	23
5	-342	358	23
6	510	513	20
7	371	389	20
8	-582	615	18
9	-167	177	32
10	285	301	18
*** 12 12 L ***			
-8	266	273	43
-7	-166	293	38
-6	290	355	29
-5	312	324	35
-4	-529	536	26
-3	-358	443	32
-2	682	706	25
-1	291	285	49
0	-354	347	22
1	4	100	64
2	101	59	114
3	-226	232	29
4	437	424	21
5	308	354	19
6	-528	497	20
7	-279	296	21
8	486	491	17
*** 14 12 L ***			
-5	-337	271	47
-4	570	496	30
-3	302	241	57
-2	-581	508	32
-1	-148	0	280 W
0	315	308	22
1	-15	0	131 W
2	20	0	125 W
3	244	196	32
4	-309	312	20
*** 1 13 L ***			
-13	203	215	27
-12	-497	485	20
-11	-151	134	47
-10	138	0	150 W
-9	-7	88	65
-8	438	419	22
-7	190	216	27
-6	-1032	1021	25
-5	-273	230	32
-4	917	920	23
-3	219	173	38
-2	-709	725	20
-1	-37	142	33
0	-93	99	49
1	-155	238	31
2	754	743	22
3	398	394	24
4	-1107	1104	26
5	-256	265	30
6	766	783	22
7	248	241	34
8	-415	386	24
9	36	44	158
10	-248	251	31
11	-99	162	34
12	598	594	20
13	204	213	24
*** 3 13 L ***			
-13	-164	230	19
-12	421	441	19
-11	-13	0	125 W
-10	23	0	131 W
-9	67	206	23
-8	-529	540	19
-7	-333	320	26
-6	947	950	23

Table 2 (*cont.*)

L	FC	FO	SIG
*** 3 13 L ***			
−5	282	292	24
−4	−1036	1064	25
−3	−288	260	27
−2	360	353	22
−1	−38	70	82
0	164	188	25
1	118	121	74
2	−858	789	25
3	−316	306	29
4	1031	997	26
5	220	198	44
6	−786	760	23
7	−53	113	59
8	128	174	38
9	−105	158	38
10	246	290	23
11	207	223	28
12	−614	624	19
13	−217	245	20
*** 5 13 L ***			
−12	−403	419	18
−11	−22	0	122 W
−10	−161	174	35
−9	−126	150	42
−8	641	651	20
−7	220	196	35
−6	−914	927	22
−5	−236	232	29
−4	819	801	21
−3	110	35	171
−2	−396	388	20
−1	134	142	42
0	−482	477	17
1	−277	221	48
2	786	768	25
3	341	343	29
4	−962	969	24
5	−212	255	30
6	619	626	21
7	104	146	44
8	−86	0	147 W
9	155	227	26
10	−436	437	20
11	−127	128	44
12	532	539	17
*** 7 13 L ***			
−12	220	0	247 W
−11	−64	0	270 W
−10	158	0	286 W
−9	187	33	419
−8	−714	702	25
−7	−334	326	23
−6	873	901	22
−5	173	198	33
−4	−648	684	20
−3	−147	302	23
−2	153	196	51
−1	−157	230	36
0	402	433	17
1	204	187	50
2	−945	943	25
3	−278	259	36
*** 7 13 L ***			
4	763	760	23
5	69	172	32
6	−481	488	21
7	24	85	75
8	−25	0	139 W
9	−195	214	27
10	417	381	21
11	218	143	43
*** 9 13 L ***			
−10	−321	301	41
−9	−142	213	59
−8	603	589	28
−7	239	290	42
−6	−837	840	24
−5	−121	211	61
−4	512	483	32
−3	−49	131	102
−2	7	73	185
−1	205	0	277 W
0	−504	492	19
1	−275	300	30
2	742	743	24
3	273	303	25
4	−772	787	22
5	−82	0	147 W
6	262	283	25
7	−39	115	47
8	113	165	30
9	162	147	39
10	−418	420	17
*** 11 13 L ***			
−8	−646	629	21
−7	−222	281	35
−6	607	597	21
−5	104	231	50
−4	−426	357	40
−3	13	0	279 W
−2	−110	240	59
−1	−232	284	53
0	549	546	20
1	160	43	201
2	−687	703	22
3	−178	90	83
4	538	560	19
5	−23	66	89
6	−249	243	27
7	110	0	111 W
8	−228	228	22
*** 13 13 L ***			
−5	19	0	259 W
−4	196	17	756
−3	−88	0	249 W
−2	120	0	261 W
−1	241	126	105
0	−526	558	18
1	−221	241	28
2	611	625	19
3	131	169	32
4	−409	449	17
*** 0 14 L ***			
0	−1037	1060	26
1	−39	0	147 W
2	912	904	23
3	92	0	150 W
4	−234	213	35
5	48	76	95
6	−379	381	23
7	−84	65	104
8	744	758	21
9	13	108	56
10	−727	732	21
11	−46	0	124 W
12	406	414	17
*** 2 14 L ***			
−12	−499	484	20
−11	−79	150	36
−10	847	828	21
−9	62	118	56
−8	−688	694	20
−7	12	88	75
−6	353	375	21
−5	17	0	131 W
−4	400	420	20
−3	35	94	66
−2	−792	809	22
−1	−139	90	69
0	1126	1102	24
1	7	0	191 W
2	−551	550	24
3	28	186	39
4	147	183	45
5	−10	0	164 W
6	617	601	23
7	111	145	48
8	−784	787	23
9	−67	62	104
10	750	740	21
11	−28	0	122 W
12	−321	294	22
*** 4 14 L ***			
−12	525	527	18
−11	23	0	114 W
−10	−739	724	20
−9	−74	0	132 W
−8	602	612	19
−7	0	0	123 W
−6	−93	187	30
−5	99	110	57
−4	−518	518	20
−3	−45	104	50
−2	967	967	24
−1	60	149	36
0	−971	976	22
1	−79	84	122
2	628	628	23
3	−95	42	194
4	97	149	49
5	87	0	171 W
6	−528	554	19
7	−40	0	135 W
8	765	761	22
9	66	83	72
*** 4 14 L ***			
10	−591	567	20
11	11	74	66
*** 6 14 L ***			
−11	−41	0	119 W
−10	750	748	20
−9	−13	0	123 W
−8	−479	472	20
−7	−18	49	122
−6	81	143	40
−5	−95	122	51
−4	610	608	21
−3	120	188	30
−2	−830	858	22
−1	−17	126	45
0	867	875	21
1	−25	26	386
2	−294	287	34
3	32	0	154 W
4	−138	139	57
5	−154	129	55
6	742	788	21
7	72	136	47
8	−682	657	21
9	14	0	113 W
10	566	539	20
11	−12	0	88 W
*** 8 14 L ***			
−10	−639	669	19
−9	34	276	22
−8	324	323	23
−7	−85	206	23
−6	149	201	28
−5	58	153	31
−4	−627	659	20
−3	−109	62	109
−2	886	890	23
−1	56	188	31
0	−723	732	19
1	84	42	204
2	255	251	34
3	−99	111	67
4	269	294	26
5	70	71	91
6	−581	597	19
7	−104	0	135 W
8	647	656	19
9	−21	0	102 W
*** 10 14 L ***			
−8	−248	0	219 W
−7	108	0	220 W
−6	−182	167	75
−5	−125	0	269 W
−4	639	572	30
−3	27	0	292 W
−2	−674	628	29
−1	−32	0	301 W
0	579	581	20
1	−68	38	208
2	−36	0	153 W
3	146	153	44
*** 10 14 L ***			
4	−335	338	25
5	−97	0	123 W
6	651	651	19
7	20	0	101 W
*** 12 14 L ***			
−4	−636	580	25
−3	−61	168	71
−2	651	654	24
−1	−58	83	131
0	−413	456	16
1	67	99	58
2	18	0	127 W
3	−114	112	51
4	347	358	20
*** 1 15 L ***			
−11	44	0	120 W
−10	63	131	41
−9	33	0	131 W
−8	359	359	24
−7	−45	123	49
−6	−797	785	23
−5	107	0	151 W
−4	864	873	22
−3	−133	155	40
−2	−552	576	22
−1	−38	0	126 W
0	−138	170	30
1	41	0	208 W
2	580	574	23
3	−138	208	37
4	−924	912	24
5	161	161	50
6	724	709	22
7	−164	138	54
8	−279	250	34
9	−7	0	139 W
10	−230	217	29
11	−45	0	117 W
*** 3 15 L ***			
−11	−32	0	105 W
−10	−31	175	28
−9	−30	19	322
−8	−551	547	20
−7	184	172	40
−6	772	746	21
−5	−77	108	60
−4	−817	840	22
−3	205	234	27
−2	387	364	25
−1	−68	103	58
0	195	221	26
1	−12	230	36
2	−766	773	24
3	105	146	53
4	807	820	24
5	−66	88	85
6	−653	652	22
7	130	180	35
8	151	146	46
9	−9	134	40
*** 3 15 L ***			
10	306	286	23
*** 5 15 L ***			
−10	−114	63	94
−9	−50	0	112 W
−8	525	547	19
−7	−93	0	139 W
−6	−862	894	22
−5	132	0	146 W
−4	635	644	20
−3	−61	36	172
−2	−260	250	31
−1	47	112	58
0	−339	354	21
1	29	159	55
2	740	738	24
3	−188	224	36
4	−839	835	24
5	135	265	24
6	454	468	21
7	−137	152	41
8	−66	163	33
9	67	0	120 W
10	−360	381	18
*** 7 15 L ***			
−9	−44	0	109 W
−8	−603	583	19
−7	101	141	43
−6	717	712	20
−5	−144	108	59
−4	−626	611	20
−3	212	244	51
−2	38	0	327 W
−1	10	0	343 W
0	392	401	24
1	55	161	48
2	−738	761	24
3	114	166	42
4	699	704	22
5	−119	137	47
6	−390	398	20
7	98	106	50
8	−103	134	37
*** 9 15 L ***			
−7	−108	0	252 W
−6	−664	583	26
−5	71	131	79
−4	403	430	28
−3	−133	186	64
−2	−20	184	64
−1	43	167	74
0	−526	565	19
1	94	0	178 W
2	664	683	21
3	−121	74	97
4	−587	604	20
5	145	99	67
6	249	254	24
*** 11 15 L ***			
−3	133	129	72
−2	−143	247	39
−1	−54	158	60
0	445	452	18
1	20	0	129 W
2	−659	700	20
3	163	199	26
*** 0 16 L ***			
0	−802	801	24
1	297	305	28
2	610	582	22
3	−176	146	52
4	−85	0	161 W
5	−19	0	151 W
6	−260	283	22
7	179	185	40
8	683	680	21
9	−242	173	47
*** 2 16 L ***			
−9	−227	251	25
−8	−544	541	19
−7	172	166	39
−6	206	164	46
−5	−1	0	137 W
−4	359	341	23
−3	−184	174	43
−2	−690	698	22
−1	303	320	26
0	784	796	20
1	−281	301	35
2	−608	653	23
3	147	59	176
4	21	73	116
5	32	135	53
6	397	411	23
7	−198	179	41
8	−568	551	20
9	237	260	25
*** 4 16 L ***			
−9	239	239	24
−8	507	461	21
−7	−135	125	49
−6	−88	0	130 W
−5	−20	135	38
−4	−311	328	22
−3	191	178	41
−2	786	816	21
−1	−307	293	28
0	−628	644	18
1	269	322	32
2	402	448	24
3	−126	60	146
4	91	0	170 W
5	−54	0	160 W
6	−504	508	19
7	189	122	60
8	661	671	19
9	−237	274	21
*** 6 16 L ***			
−8	−325	342	20
−7	142	162	35
−6	−61	133	41
−5	54	100	60
−4	463	475	20
−3	−195	182	38
−2	−723	722	21
−1	280	278	26
0	689	678	19
1	−254	286	36
2	−263	320	26
3	97	140	52
4	−177	228	29
5	75	114	57
6	440	428	21
7	−195	167	38
*** 8 16 L ***			
−6	179	196	31
−5	−51	0	121 W
−4	−452	459	18
−3	216	197	36
−2	656	655	19
−1	−269	278	26
0	−459	470	17
1	211	182	52
2	189	207	39
3	−92	135	49
4	343	350	24
5	−90	133	42
*** 10 16 L ***			
−1	260	0	270 W
0	388	363	22
*** 1 17 L ***			
−8	244	211	32
−7	−346	374	20
−6	−557	524	22
−5	414	410	21
−4	582	571	20
−3	−333	281	33
−2	−386	386	24
−1	187	215	33
0	−101	127	49
1	164	163	62
2	397	395	26
3	−343	329	29
4	−633	601	21
5	382	374	25
6	484	442	24
7	−207	224	29
*** 3 17 L ***			
−7	238	257	24
−6	539	483	21
−5	−453	461	20
−4	−548	568	20
−3	237	255	28
−2	242	224	32
−1	−67	160	37
0	144	0	132 W
*** 3 17 L ***			
1	−207	177	61
2	−544	608	21
3	387	350	30
4	554	573	20
5	−427	388	24
6	−440	462	18
7	215	233	26
*** 5 17 L ***			
−6	−607	610	18
−5	382	409	19
−4	429	390	23
−3	−325	272	30
−2	−154	178	38
−1	34	0	141 W
0	−264	301	21
1	224	177	61
2	507	490	25
3	−303	250	39
4	−578	588	20
5	365	345	25
6	289	302	23
*** 7 17 L ***			
−4	−410	387	21
−3	166	189	31
−2	6	135	40
−1	−39	135	42
0	317	304	21
1	−310	347	25
2	−526	525	23
3	352	367	22
*** 0 18 L ***			
0	−456	467	25
1	458	499	20
2	424	415	24
3	−307	235	38
4	−100	26	280
5	−72	159	40
*** 2 18 L ***			
−5	4	0	128 W
−4	197	179	43
−3	−296	301	24
−2	−357	362	23
−1	527	524	20
0	515	512	18
1	−431	428	28
2	−208	202	44
3	199	87	98
4	56	0	151 W
*** 4 18 L ***			
−3	332	347	21
−2	462	446	21
−1	−467	466	20
0	−439	444	18
1	436	419	27
2	257	313	27
3	−133	146	51

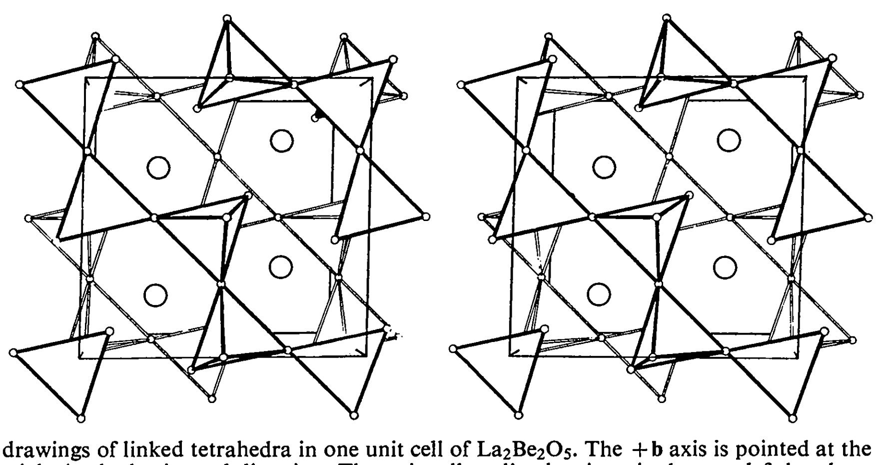

Fig. 2. Stereoscopic drawings of linked tetrahedra in one unit cell of $La_2Be_2O_5$. The $+\mathbf{b}$ axis is pointed at the viewer, and the $+\mathbf{a}$ axis points to the right in the horizontal direction. The unit-cell outline has its raised upper left-hand corner at $x=0$, $y=1{\cdot}0$, $z=0$. For clarity, beryllium atoms have been omitted from the tetrahedra and only the lanthanum atoms near $y=\frac{1}{2}$ are shown. Atoms are drawn as spheres of arbitrary radius; the largest are La, the smallest O.

Atomic position and thermal vibration parameters from the final least-squares cycle are listed in Table 1. A comparison of observed and computed $|F|$ values is given in Table 2. A final difference Fourier synthesis with all atoms removed showed no positive or negative peak containing more than 0·5 electron. The largest excursions on this map were associated with the subtracted lanthanum atom.

Description of the structure

The *ORFFE* program of Busing, Martin & Levy (1964) was used with the parameters of Table 1 to compute interatomic distances and angles. A selection of the more important of these appears in Table 3. Several drawings of the structure were prepared with the *ORTEP* program written by Johnson (1965).

Table 3. *Interatomic distances and angles in* $La_2Be_2O_5$

Distances		Standard deviation
Be–O(1)	1·602 Å	0·004 Å
Be–O(2)	1·637	0·004
Be–O(3)	1·661	0·003
Be–O(4)	1·678	0·004
La–O(1)	2·415	0·002
La–O(3)	2·426	0·002
La–O(1)	2·480	0·002
La–O(4)	$2·502_3$	$0·002_2$
La–O(2)	$2·556_3$	$0·000_4$
La–O(1)	2·719	0·002
La–O(2)	$2·755_5$	$0·000_3$
La–O(3)	2·903	0·002
La–O(4)	$2·971_4$	$0·000_3$
La–O(1)	2·999	0·002

Angles		Standard deviation
O(1)–Be–O(4)	113·4°	0·2
O(1)–Be–O(3)	111·8	0·2
O(1)–Be–O(2)	117·4	0·2
O(2)–Be–O(4)	105·1	0·2
O(2)–Be–O(3)	102·9	0·2
O(3)–Be–O(4)	105·0	0·2

From the results listed in Table 3, we see at once that the beryllium–oxygen coordination polyhedron in $La_2Be_2O_5$ closely approximates a regular tetrahedron with interatomic distances comparable to those found in BeO (Smith, Newkirk & Kahn, 1964) and chrysoberyl, Al_2BeO_4 (Farrell, Fang & Newnham, 1963). Further consideration shows that each beryllium–oxygen tetrahedron shares three of its four corners with three other beryllium–oxygen tetrahedra. The linked tetrahedra form a space-filling framework* that is an important feature of the structure.

To describe the inter-tetrahedral linkages, we note that each tetrahedron is oriented so that three of its Be–O vectors are roughly parallel to the unit-cell axes. The oxygen atoms at the ends of these vectors are the ones shared with adjacent tetrahedra. In an idealized representation, we may neglect the departures of the monoclinic angle and of the O–Be–O angles from 90° and replace each tetrahedron by three orthogonal vectors based at the central beryllium atom and directed along the idealized bonds to the shared oxygen atoms. The result of doing this is shown in Fig. 1.

Depending on the direction of view, one may reconstruct the three-dimensional pattern by considering strings of corner-sharing tetrahedra to be extended through the structure, repeated by axial translations into two-dimensional arrays, and cross-linked by corner-sharing with tetrahedra in adjacent related arrays. Viewed in the **a** direction, one may see strings with a 'squarewave' appearance (Fig. 1) resembling those found in petalite, $LiAlSi_4O_{10}$ (Liebau, 1961*c*), extending in [001] directions. Arrays on 200 planes are formed by the **b** lattice repetition and arrays on adjacent 200 planes are related by the *C*-centering operation. Viewed in the **c** direction, one may see strings resembling those found in diopside, $CaMg(SiO_3)_2$ (Warren & Bragg, 1928), extending in [110] or [$\bar{1}$10] directions. Arrays on 002 planes are formed by the **a** (or **b**) lattice repetition and arrays on adjacent 002 planes are related by the two-fold axes half-way between them. Viewed in the **b** direction, one may see (Fig. 2) strings that are a variation of those found in wollastonite, $CaSiO_3$ (Mamedov & Belov, 1956), extending in [101] directions. Arrays on 020 planes are formed by the **c** (or **a**) lattice repetition and arrays on adjacent 020 planes are related by the *c*-glide operation.

The consequence of this linking together of tetrahedral strings is the formation of cube-like cages of tetrahedra whose outline is easily seen in Figs. 1 and 2. We note that six edges of a cage follow Be–O–Be bonds while the remaining six are only suggested by opposed tetrahedra faces. Each cage provides a location for a lanthanum atom, but the lanthanum–oxygen coordination polyhedron is rather irregular with five close La–O contacts, two longer contacts, and three still longer contacts in which interactions must be relatively weak (see Table 3). A detailed view of such a lanthanum atom environment is given in Fig. 3.

A few additional points are noteworthy. As shown in Fig. 3, the thermal motion ellipsoids of the oxygen atoms have principal axes normal and parallel to Be–O bonds – a further evidence of the structural importance of the tetrahedral framework. The thermal vibration of the O(4) atom is unusual in that it is large and directed along the line of two long (2·97 Å) contacts with lanthanum atoms. One might imagine that this reflects a static displacement of the O(4) atom favored by the resultant shortening of one of the 2·97 Å lanthanum contacts. Such a displacement would also produce a nonlinear Be–O–Be sequence which might be energetically favored, in analogy with the behavior of corner-sharing (SiO_4) tetrahedra (Liebau, 1961*d*). To

* We used the word 'framework' for want of a better term. It does not conform to the framework concept used in silicate structures since only three of the four corners of each tetrahedron are shared. The name 'interrupted framework' might be a more correct description.

this point, note that the Be–O(3)–Be angle is 163·5 ± 0·3°, but that the Be–O(2)–Be angle is required to be 180° and the thermal vibration parameters of the O(2) atom do not appear abnormal. We did not test structure models in which either the center of symmetry was removed or a pair of partial atoms replaced the O(4) atom.

Finally, the Be–O(1) bond is significantly shorter than the other three beryllium–oxygen bonds, and O(1) is the oxygen atom not shared with an adjacent tetrahedron.* A similar reduction in bond length with decreasing degree of oxygen association between tetrahedra has been reported in structures containing connected PO_4, SiO_4 and BO_4 tetrahedra (de Decker, 1941; Grund, 1954; Prewitt & Shannon, 1967, respectively).

* All oxygen atoms have four lanthanum atom near neighbors at distances from 2·415 to 2·999 Å.

Discussion

Beryllium oxide (Smith, Newkirk & Kahn, 1964), Al_2BeO_4 (Bragg & Brown, 1926), and Cr_2BeO_4 (Weir & Van Valkenburg, 1960) have structures which are described in terms of close-packed layers of oxygen atoms with small metal atoms regularly occupying certain interstitial sites. The structure of beryl, $Be_3Al_2Si_6O_{18}$, is usually classified as a ring silicate in which beryllium atoms act as an inter-ring link while preserving their tetrahedral environment (Bragg & West, 1926). Phenakite, Be_2SiO_4, has a three-dimensional arrangement of corner-sharing (BeO_4) and (SiO_4) tetrahedra in which each oxygen atom is bonded to two beryllium atoms and one silicon atom (Bragg & Zachariasen, 1930).

In $La_2Be_2O_5$, we see a structure that must be described as a three-dimensional framework formed exclusively of linked (BeO_4) tetrahedra. Although close contacts occur between oxygen atoms of a given BeO_4 tetrahedron, there are no extensive parts of this framework in which the oxygen or oxygen–lanthanum atom arrangement is close-packed. The structure of $La_2Be_2O_5$ may in this sense be compared with silicate structures; some associations with known silicate string configurations were made in the preceding section.

Silicates of general formula $A_2Si_2O_5$ are known and structures for compounds with A = Li, Na, and (0·25 Li, 0·25 Al, 0·5 vacancy) have been reported (Liebau, 1961*a,b,c*; Grund, 1954). In all studied to date, the silicate tetrahedra combine into sheets with A cations lying between the sheets. Structures of alkali titanates of general formula $A_2Ti_2O_5$ have also been given (Barblan, 1943; Andersson & Wadsley, 1961). Here too, sheet-like combinations of TiO_4 tetrahedra* are found. The structures of V_2O_5* and the stable orthorhombic forms of P_2O_5 contain corner-sharing XO_4 tetrahedra; V_2O_5* (Ketelaar, 1936) and the so-called third form of P_2O_5 (MacGillavry, de Decker & Nyland, 1949) have sheet-like configurations, but the second form of P_2O_5 has a three-dimensional framework with spirals of PO_4 tetrahedra about 2_1 screw axes (de Decker, 1941).

The BeO_4 tetrahedra in $La_2Be_2O_5$ do not join to form sheets, perhaps because of the high surface charge that a sheet of net composition Be_2O_5 would have. Rather, they form a unique three-dimensional framework of corner-sharing tetrahedra with cage-like sites for the large lanthanum cations. The second form of P_2O_5 is the only other example of an X_2O_5 framework, but the motifs are not alike and the effect of charge neutralization is absent in P_2O_5.

It is important to contrast the $La_2Be_2O_5$ structure with the metastable $Ca_{12}Be_{17}O_{29}$ and Y_2BeO_4 structures (Harris & Yakel, 1966, 1967). In the latter, linear or

* The situation is complicated in these structures owing to the approach of a fifth oxygen atom to the XO_4 tetrahedra to give trigonal bipyramidal coordination (see also Byström, Wilhelmi & Brotzen, 1950).

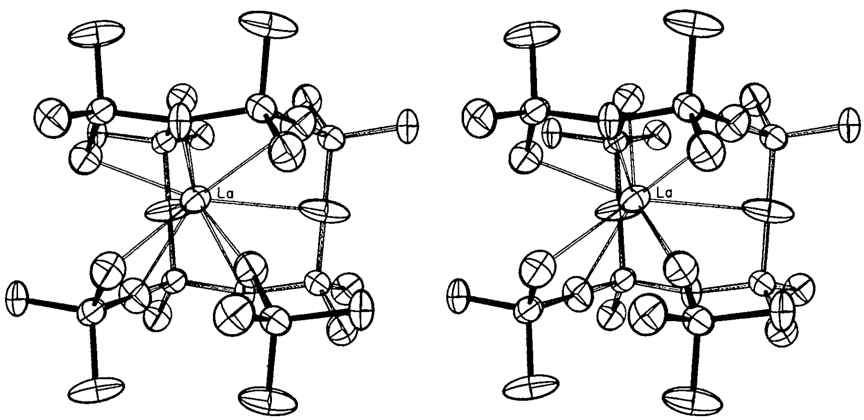

Fig. 3. Stereoscopic drawings of the lanthanum atom environment in $La_2Be_2O_5$. The unit-cell origin is half-way between the O(4) atoms (elongated ellipsoids) at the left of the drawing. The +**b** axis is vertical and directed upward in the drawing plane. The +**c** axis emerges up and to the right from the paper at an angle of 25° to the drawing plane, and the +**a** axis emerges behind the paper in a right-handed relation to **b** and **c**. Atoms are represented by thermal displacement ellipsoids including 99·9% probability (4 × r.m.s. displacement). Bounding and principal ellipses only are shown for lanthanum and beryllium atoms; forward principal axes are added for oxygen atoms. Thin bonds between lanthanum and oxygen atoms indicate important short contacts.

planar groupings of relatively normal calcium–oxygen and yttrium–oxygen coordination polyhedra were found, but beryllium atoms were not normally coordinated. Oxygen environments about beryllium atoms ranging from tetrahedral to trigonal were reported in $Ca_{12}Be_{17}O_{29}$ and trigonal environments exclusively were reported in Y_2BeO_4. The principle underlying both structures seems to be the maintenance of normal heavy cation–oxygen coordination, albeit in a metastable phase, with beryllium atoms fitting in where best they can. The situation is reversed in $La_2Be_2O_5$. Here the principle underlying the structure seems to be the maintenance of a framework of normal BeO_4 tetrahedra with lanthanum atoms fitting in where best they can.

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