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GALAXY CLUSTER ABELL 98

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The results of *B* and *V* photometry of 594 galaxies in the field of A98 cluster are presented. The plate material is obtained with the 2.6m telescope of the Byurakan Astrophysical Observatory. The galaxy distribution, luminosity function and colour distribution constructed for A98 as a whole and A98S and A98N components show that the A98N component apparently is not an individual cluster as it was suggested earlier but only a condensation of galaxies in the cluster A98 like to condensations in many other clusters.

1. *Introduction*. The galaxy cluster Abell 98 belongs to richness class 3 and distance class 5 according to Abell [1]. Its Bautz–Morgan type is II–III [2], the redshift z = 0. 1033 [3]. The optical and X–ray data show that the cluster consists of two main components with an angular separation between centers equal to about $10'$ and Bautz–Morgan classes I–II and II respectively [4]. They are designated as A98N and A98S. The redshifts of these two subclusters are 0. 1038 and 0. 1035. The component A98N is less populated than A98S which is located at the nominal cluster position. The spectra obtained by Henry et al [4] show no evidence for existence of any active galactic nuclei or QSO in the region of A98N. So the X–ray source detected at its position can be identified with the subcluster itself.

The coordinates and F–magnitudes of about 400 possible cluster galaxies have been determined by Dressler [5] and the luminosity function has been constructed. It was shown that the luminosity function is too steep at the bright end.

The magnitudes of brightest cluster galaxies in more than one colour band have been determined by Sandage [6], Schneider et al [3].

In this article the results of B and V two–colour photometry of about 600 galaxies in the region A98 brighter than $V = 20^m_{\cdot}0$ are presented. We discuss some brightness and colour properties of galaxies in both N and S components.

2. *Observations and reduction procedure.* The plates in B and V bands were obtained with the 2.6m telescope of the Byurakan Observatory of the National Academy of Sciences of Armenian Republic. ZU–21 ORWO emulsions with blue filter have been used for B band and 103aD emulsions in combination with yellow filter for V band. In every colour one plate of good quality has been elaborated. The instrumental colour system is very near to the standart B, V system. The plates were calibrated with the spot sensitometer printed on the blank parts of the plates with cluster image.

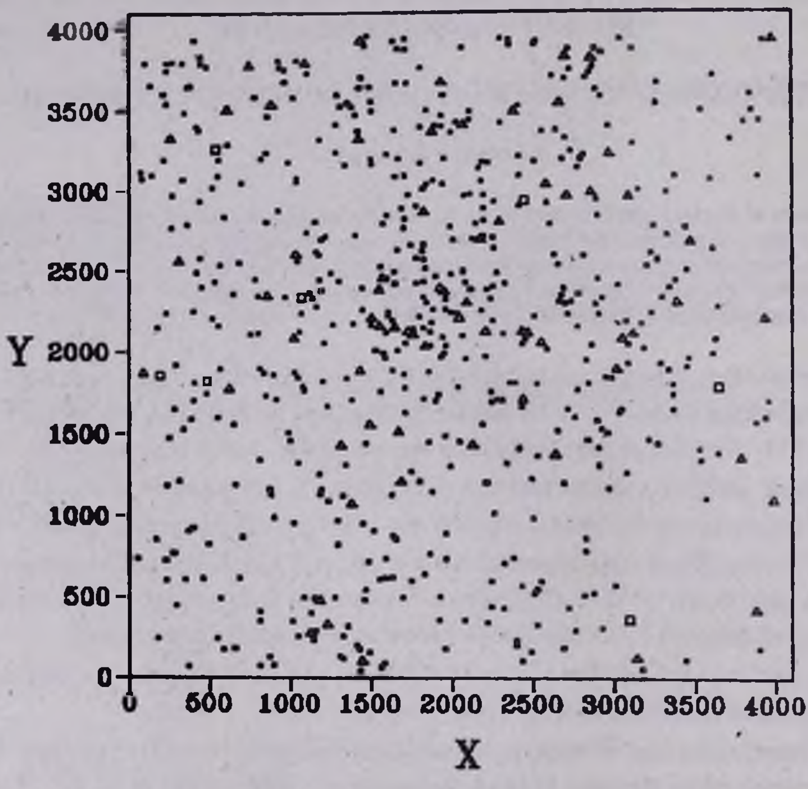

Fig.1. The galaxy cluster A98. The X and Y coordinates are in pixels.

The plates were scanned by the Rome Observatory PDS 1010G micro densitometer at Monteporzio in transparency mode. The aperture used was a square of 25 μm dimensions; 20 μm were the X and Y steps. The scanning provides a matrix of 4000 x 4000 pixels corresponding to an angular dimensions of $27' x\ 27'$. As photometrical zero points the B and V magnitudes of brightest galaxy taken from Sandage [6] were used.

The calibration method, searching algorithm and star–galaxy separation are described by Iannicola et al [7]. 594 galaxies with $V \leq 20.0$ mag have been identified in the scanned field. For all of these galaxies B and V magnitudes were obtained. The map of galaxies is given in Fig. 1. The coordinates are in pixels. The list of these galaxies is presented in Table 1.

3. *Results.*

3.1. *The luminosity function.* As it was shown by Dressler [5] the luminosity functions of many clusters nave too steep bright ends, or alternatively, the faint ends

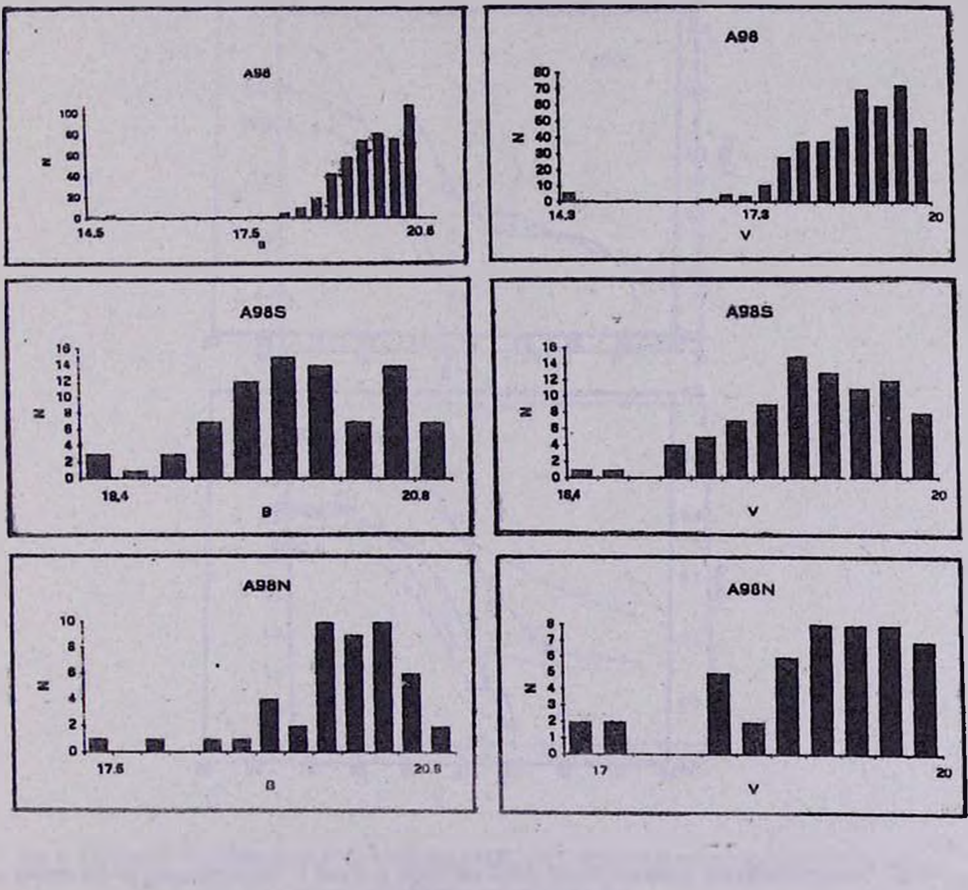

Fig.2. Differential luminosity functions of A98, A98S and A98N in B and V bands corrected for the density of field galaxies.

are rising more slowly than it would be expected from the appearance of the bright ends. This type of deviations from the proposed form show many clusters, in particulary, the cluster A98.

The differential and integral luminosity functions for both B and V bands are given in Fig. 2 and 3. Counts were corrected for field galaxies according to the data given by Oemler [8] equal to 0.22 galaxies per square arcmin up to $m = 19.2$ which corresponds to about $V = 20.0$. The galactic absorption is negligible.

The maxima in differential function extend till 20.5 and 19.7 mag in B and V respectively. There is a flat tail at the bright end of the function in both B and V. Redshifts are needed to decide if these bright galaxies which are out of central parts

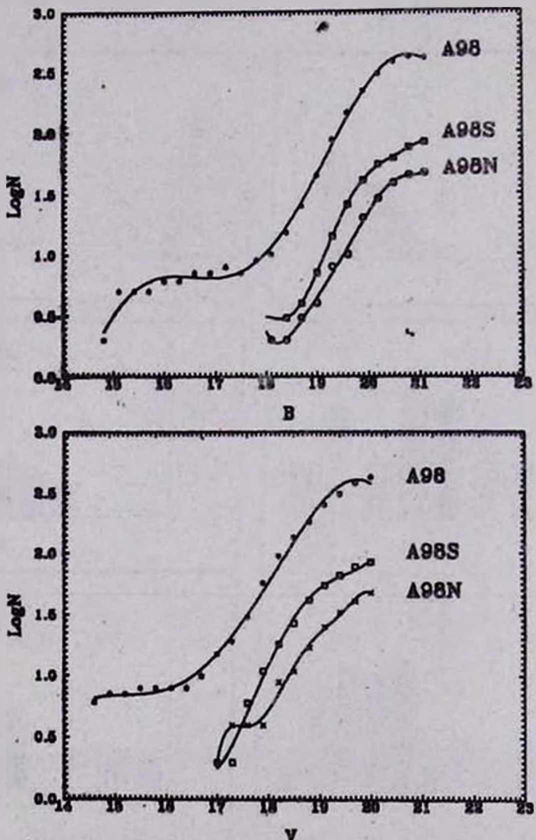

Fig.3. Integral luminosity functions of A98, A98S and A98N in B and V bands corrected for the density of field galaxies.

of the cluster, are cluster members. It is important to note that the central galaxies in A98S and A98N are of 16.3 mag in V and are much fainter than the brightest galaxy in the field.

There is no secondary maximum in differential luminosity function neither in B nor in V as it was suggested by Abell [9] for many clusters.

Consequently there is no obvious break in the integral luminosity function. According to Dressier [5] there are some deviations from Schechter's function too. For characteristic absolute magnitude M^* in F band Dressler has found -22.5 mag which corresponds to -21.7 mag in V band. In Fig.3 it corresponds to $V=17.2$ mag if we adopt $m-M=38.9$ for the cluster ($H=50$ km/s/Mpc). A simple inspection of our curves shows no changing of slope at this magnitude. To our

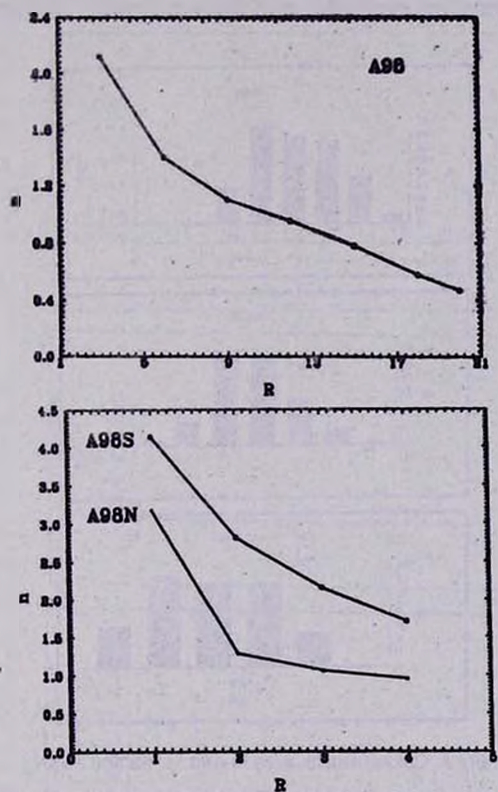

Fig.4. The galaxy distribution for A98, A98S and A98N. On Y–axis are the number of galaxies in arcmin^{-2} in the given radius R (arcmin).

impression it is true also for the luminosity function constructed by Dressler (see Fig.4 of his article).

According to Beers et al [10] the cluster has been divided into two parts by drawing an E–W line intersecting the region of X-ray and bright galaxy density minimum between subclusters. The diameter of each circle centered on the dominant galaxy of each subcluster was about 9 arcmin. On our plates around the dominant galaxy of A98N we may draw a circle of 7.7 arcmin in diameter. A circle of the same size has been drawn around the brightest galaxy in A98S. None of the considered galaxies are included simultaneously in both components. In this way the total number of galaxies brighter than $V = 20$ is 86 and 48 in A98S and A98N components respectively. Thus the S-component is about twice more populated than N-component.

Fig.2 and 3 show the luminosity functions of A98S and A98N components. The background corrections are negligible and are not applied. Besides of differences in

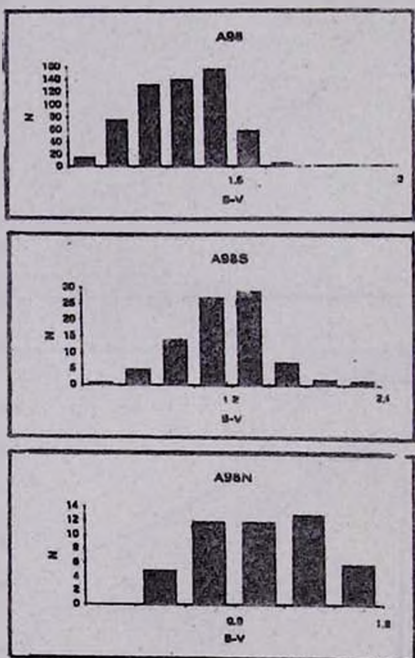

Fig.5. Colour distributions in A98, A98S and A98N.

population there are no other valuable differences between two distributions in both colours. The brightest galaxies are of the same magnitude.

3.2. *Galaxy distribution*. We have calculated the angular distances of galaxies from the centers of S and N components in arcminutes to study the azimuthally averaged distribution of galaxies. For galaxies of the cluster A98 as a whole the distances have been calculated from the nominal center of the cluster which coincides with the center of S–component. The azimuthally averaged distributions for all of three samples for galaxies brighter than $V = 20$ mag are given in Fig.4. On X–axis the distances R from corresponding centers are plotted in arcmin, while Y–axis shows the number of galaxies in arcmin averaged in a given radius. We see that the galaxy density in A98N is systematically lower than A98S. Besides at R = 2 arcmin the density in A98N drops more sharply than in A98S. The galaxy density in the cluster A98 as a whole is changing gradually without any secondary maximum which might occur due to the existence of N–component if the latter had a high galaxy density.

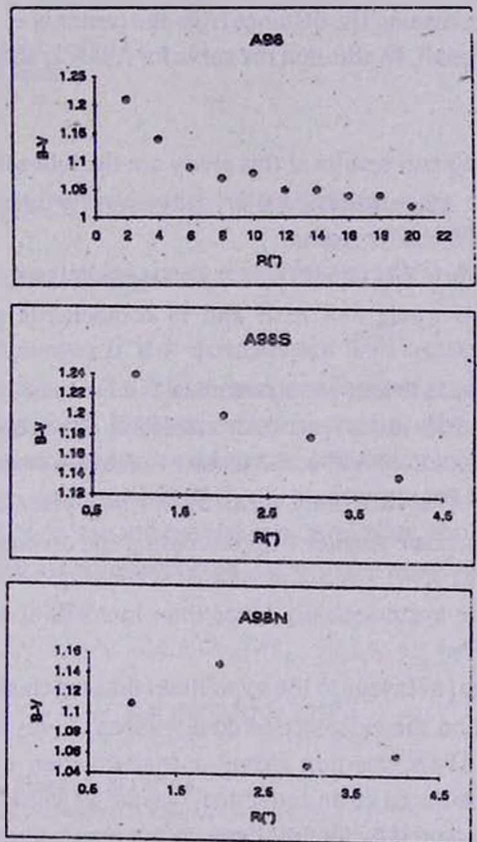

Fig.6. Dependence of B-V colour on the distance from the centers of A98, A98S and A98N. Colours are averaged in the given radius R. The upper scale of X-axis refers to A98, the lower - to A98S and A98N.

3.3. *Colour distribution*. Colour distributions in A98, A98S and A98N are given in Fig.5. The galaxies were counted in bins of width 0.3 mag. In all three cases most of galaxies are concentrated in the interval $0.6<B-V<1.5$. As the A98 and A98S centers coincides the colour distributions of both samples are similar to each other. The distribution for galaxies in A98N is more flat than the other two. The mean colour index $B-V$ for A98N is $1^m.06\pm0^m.06$, for A98S $-1^m.16\pm0^m.36$ and for A98– $1^m.06\pm0^m.14$. Galaxies in A98N are in the mean slightly more blue than in A98S. It is important to note that the cluster A98 as a whole has in the mean a smaller colour index $B-V$ than A98S which is the central condensation of A98. This kind of distribution of colours is typical for many clusters. We looked for the dependence of $B-V$ on the distance from the center of each of three samples. These relations are shown in Fig.6. In all three cases there is a well defined tendency for $B-V$ to become bluer with increasing the distance from the center of each sample though the range of variation is small. In addition the curve for A98N is sistematically lower than for A98S.

4. *Discussion*. The main results of this study are the followings.

1. B and V magnitudes of 594 automatically identified galaxies have determined in the A98 cluster region.

2. The luminosity function in both colour bands, radial and colour distributions of galaxies in A98 as a whole and in S and N components separately have been investigated.

3. The N–component is less populated than the S–component. There is a sharp increase of galaxy density to the central parts of A98N. No secondary maximum exists in the density distribution of A98 at the distance of A98N component.

4. The galaxies in A98N are in the mean by 0.1 mag bluer than in A98S. There is a trend of $B-V$ to become smaller with increasing the distance from the centers of each of three samples A98, A98S and A98N. According to these distributions the galaxies in A98N are systematically bluer than in A98S at all distances from the corresponding centers.

The main argument in favour to the hypothesis that the cluster A98 consists of two subclusters is based on the existence of double lobed X–ray emission. There is no doubt that at the A98N position exists a condensation of galaxies. May this condensation be considered as an individual cluster which is in process of merging with A98S?. To our opinion the optical data are not conclusive for such a suggestion.

First of all the cluster A98 as a whole has a galaxy density distribution, a colour distribution and a luminosity function usual for normal clusters with only one center of concentration. On the other hand the A98N component is not a rich one to be an individual cluster; in the mean the galaxies in A98N have a little lower value of $B-V$ than galaxies in A98S component. This is consistent with the fact that at the distance of A98N from the nominal center of A98 the colours of galaxies are bluer than at it's central parts. In addition if we exclude a few galaxies from the central parts of A98N the galaxy density drops significantly (Fig.4) and hardly one can recognize any cluster at it's position.

Thus the optical data give evidences to the suggestion that A98N component is only a condensation in the cluster A98 like to condensations in many other clusters. The existence of a relatively strong X–ray source at the position of A98N needs apparently another explanation than the merging process.

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СКОПЛЕНИЕ ГАЛАКТИК А98

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Представлены результаты B и V фотометрии 594 галактик в области скопления А98. Снимки получены на 2.6м телескопе Бюраканской астрофизической обсерватории. Исследование распределения галактик, функции светимости и распределения цветов как в самом скоплении А98, так и в компонентах А98S и А98N показывает, что компонент А98N, по–видимому, не является индивидуальным скоплением, как это предполагается, а только сгущением галактик в скоплении А98, подобным сгущениям во многих других скоплениях.

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Table 1

RECTANGULAR COORDINATES, MAGNITUDES AND COLOURS OF GALAXIES INTHE A98 CLUSTER FIELD

N:	X	Y	V	B–V	N:	X	Y	V	B–V
1	2	3	4	5	1	2	3	4	5
1	1437	47	18.88	1.75	26	2400	235	19.78	0.78
2	3173	61	19.53	0.81	27	1142	240	19.44	1.14
3	1561	69	19.46	0.80	28	184	245	19.80	1.40
4	368	71	19.31	0.45	29	549	247	19.72	0.03
5	812	75	19.65	0.51	30	1327	260	18.17	1.28
6	894	83	19.32	1.80	31	1047	263	19.12	0.98
7	1589	96	18.32	1.33	32	1123	288	17.97	1.52
8	2435	111	18.43	1.18	33	1156	294	18.99	1.64
9	1446	112	17.88	1.25	34	2764	299	19.89	0.40
10	3443	117	19.12	0.69	35	2926	314	19.42	0.47
11	1325	122	18.38	1.66	36	1360	325	19.39	1.22
12	3143	135	17.55	1.16	37	1230	341	16.93	1.56
13	971	132	19.07	0.96	38	2219	345	19.03	0.86
14	1309	139	19.29	0.87	39	1019	356	18.83	0.89
15	1492	160	20.03	0.75	40	812	358	18.65	0.45
16	2492	167	18.16	1.23	41	2077	363	19.25	0.51
17	586	181	19.69	0.54	42	1924	363	18.31	1.42
18	1429	179	18.97	1.17	43	3098	366	14.40	0.42
19	659	187	19.02	1.25	44	1129	405	18.78	1.04
20	2691	190	19.74	0.60	45	812	412	18.15	0.73
21	3903	189	18.10	0.15	46	2320	433	19.21	2.49
22	1956	186	19.10	0.76	47	3884	434	16.73	0.38
23	1957	187	19.01	1.43	48	2717	438	19.97	0.43
24	2400	202	18.57	0.85	49	2246	441	19.81	0.81
25	1417	206	18.89	0.89	50	295	450	19.31	1.01

Table 1 (continued)

1	2	3	4	5	1	2	3	4	5
51	1460	485	19.64	0.60	79	228	727	19.67	0.85
52	1183	489	17.69	1.28	80	57	735	19.38	0.51
53	1083	497	19.71	1.32	81	1591	736	18.16	1.33
54	1152	496	19.53	0.61	82	1967	737	19.78	1.31
55	569	494	19.21	1.39	83	2384	743	19.17	1.66
56	1276	497	18.36	1.00	84	1862	764	18.76	2.53
57	1703	500	18.76	1.47	85	279	770	18.52	0.55
58	1829	504	19.39	0.95	86	2829	783	19.05	1.06
59	2823	511	18.38	0.86	87	1293	823	18.44	1.53
60	2513	525	18.76	0.69	88	494	828	19.60	1.50
61	2879	527	19.96	0.06	89	167	855	19.60	0.70
62	2527	549	19.72	1.53	90	1656	857	18.85	1.65
63	1468	547	19.06	0.77	91	2830	865	19.39	0.87
64	2436	569	19.03	1.26	92	704	871	19.83	0.80
65	3011	576	18.89	0.71	93	1635	875	19.65	0.52
66	2242	597	20.00	1.75	94	1966	889	19.40	0.59
67	1753	598	18.20	1.30	95	373	907	18.90	2.00
68	2556	600	19.21	1.04	96	1515	906	19.72	0.70
69	1557	606	18.49	0.71	97	399	927	18.15	1.51
70	230	604	19.66	0.99	98	1455	951	19.45	0.31
71	351	608	19.54	0.93	99	1026	955	18.66	0.82
72	690	616	19.70	2.06	100	1297	967	19.93	1.31
73	459	615	19.59	1.08	101	2503	981	18.47	0.76
74	1592	619	19.16	0.45	102	900	990	19.40	1.42
75	1634	624	19.90	0.77	103	2263	1010	19.20	1.57
76	1835	642	19.90	0.82	104	1382	1078	17.71	1.52
77	2325	709	19.66	1.26	105	1235	1086	19.22	0.72
78	1485	719	18.61	1.09	106	3987	1103	17.25	0.26

Table 1 (continued)

1	2	3	4	5	1	2	3	4	5
107	3566	1107	18.02	0.47	135	3788	1360	17.89	0.64
108	1324	1119	19.52	1.08	136	2645	1376	17.95	1.42
109	1628	1126	18.21	1.41	137	3642	1380	19.74	0.10
110	1187	1128	19.78	0.42	138	3532	1405	19.63	0.39
111	881	1132	19.15	0.82	139	2420	1408	19.57	1.29
112	1876	1143	19.77	1.32	140	2912	1413	19.44	0.26
113	1194	1158	18.39	0.60	141	1320	1433	17.49	1.18
114	874	1161	19.31	1.16	142	3273	1437	19.16	1.55
115	2971	1167	19.54	0.76	143	2129	1435	17.63	1.39
116	238	1185	18.91	1.06	144	1474	1437	19.28	0.92
117	660	1191	18.01	1.40	145	1859	1442	19.97	1.12
118	2216	1202	19.09	0.36	146	2049	1449	18.19	1.21
119	2692	1203	19.36	0.93	147	1001	1457	19.12	0.58
120	1820	1208	19.29	0.98	148	3221	1462	19.64	1.29
121	314	1216	19.74	1.49	149	2843	1462	18.89	1.14
122	1689	1213	17.67	0.66	150	249	1477	19.72	0.75
123	2500	1225	18.44	1.55	151	1962	1480	19.81	0.84
124	1179	1256	19.17	0.98	152	992	1504	19.45	1.02
125	3083	1263	18.44	1.14	153	2969	1505	19.78	0.80
126	1748	1267	18.45	1.52	154	1673	1516	17.55	1.38
127	1989	1299	19.10	0.43	155	2657	1517	19.74	1.14
128	2907	1308	18.31	1.39	156	340	1529	19.49	1.37
129	1347	1310	19.49	1.46	157	2930	1529	18.41	1.01
130	2348	1315	19.56	0.87	158	2194	1551	19.49	0.68
131	1053	1323	18.25	1.57	159	658	1556	19.80	0.75
132	3543	1337	18.80	0.95	160	1496	1557	17.67	1.33
133	814	1344	19.25	1.16	161	3876	1567	18.07	1.20
134	2538	1364	19.62	1.75	162	2900	1581	19.09	0.74

Table 1 (continued)

1	2	3	4	5	1	2	3	4	5
163	390	1591	19.77	1.27	191	2246	1751	18.47	1.40
164	3933	1595	19.86	0.45	192	1909	1763	18.83	0.98
165	2766	1599	19.52	0.42	193	2780	1764	19.04	0.89
166	553	1602	18.51	0.47	194	1715	1769	19.04	0.97
167	3034	1626	19.67	0.70	195	625	1778	17.89	1.40
168	1712	1623	19.68	0.87	196	2040	1774	18.25	1.19
169	3370	1647	18.85	0.64	197	3645	1781	14.47	0.46
170	3052	1648	18.01	1.66	198	1082	1783	19.80	1.21
171	2717	1649	19.43	1.16	199	2530	1798	19.44	1.36
172	282	1652	19.15	1.28	200	3374	1801	19.74	0.31
173	3157	1656	17.86	1.19	201	2366	1804	18.96	0.86
174	2435	1664	18.84	1.27	202	2847	1802	18.22	1.18
175	1232	1666	19.48	1.72	203	2397	1806	18.89	1.48
176	2253	1691	18.16	0.76	204	408	1811	19.49	0.38
177	1904	1693	18.22	1.40	205	1205	1813	18.78	1.62
178	3956	1700	19.35	1.43	206	483	1816	14.73	0.05
179	2315	1702	19.77	0.61	207	3094	1829	18.55	1.64
180	2283	1706	19.86	0.49	208	1046	1836	19.05	1.06
181	400	1703	18.33	1.02	209	2988	1836	19.80	0.90
182	1386	1704	19.85	1.52	210	1353	1834	19.26	1.26
183	916	1711	19.50	0.64	211	2915	1843	19.57	1.13
184	1828	1711	19.47	0.17	212	194	1854	14.42	0.50
185	2443	1715	17.86	0.81	213	905	1856	18.48	1.23
186	1919	1732	19.59	1.30	214	1704	1857	18.74	0.63
187	852	1731	19.25	1.20	215	837	1867	19.64	0.60
188	3371	1738	18.63	0.58	216	1859	1871	19.76	0.93
189	485	1746	18.85	0.69	217	1027	1872	19.05	0.64
190	1564	1752	19.84	1.15	218	88	1877	17.63	1.25

Table 1 (continued)

1	2	3	4	5	1	2	3	4	5
219	1639	1879	19.50	1.03	247	2865	2043	18.24	1.09
220	1438	1884	18.00	1.17	248	3091	2046	19.80	1.08
221	3339	1891	18.92	1.36	249	1214	2052	18.76	1.45
222	811	1892	19.67	0.32	250	2557	2062	17.86	1.30
223	569	1894	18.93	1.46	251	2457	2074	18.77	1.43
224	3022	1900	17.63	1.40	252	1949	2082	19.35	1.49
225	3455	1907	19.02	0.85	253	3628	2080	19.02	1.31
226	292	1917	18.75	0.99	254	1027	2090	17.51	1.26
227	3262	1928	19.80	0.39	255	3056	2089	16.95	1.36
228	2835	1947	19.60	0.98	256	2070	2094	18.38	1.25
229	2084	1951	18.90	1.17	257	2323	2106	19.89	1.21
230	1592	1955	18.97	2.24	258	1764	2109	17.41	0.75
231	1593	1955	18.76	1.96	259	760	2108	19.43	1.25
232	3465	1960	18.82	0.41	260	809	2114	18.06	1.56
233	1933	1962	19.89	0.88	261	1601	2112	18.05	1.08
234	2215	1966	19.10	0.99	262	1871	2119	19.89	1.21
235	1954	1984	19.49	0.71	263	3124	2120	17.91	1.37
236	3615	1987	19.25	0.48	264	1061	2124	18.04	1.06
237	1593	1986	18.94	1.02	265	1733	2125	16.58	1.57
238	1533	2004	19.39	1.29	266	2473	2123	17.67	1.24
239	1669	2004	18.52	0.77	267	2215	2127	17.61	1.17
240	2595	2012	18.86	1.08	268	1763	2136	19.28	1.56
241	3187	2021	18.42	1.18	269	2441	2133	17.21	1.18
242	1869	2031	19.37	1.31	270	1826	2143	18.65	1.35
243	1964	2031	19.63	0.47	271	175	2151	19.32	0.60
244	1836	2034	17.56	1.74	272	2782	2153	18.95	1.40
245	1719	2045	18.56	1.19	273	1652	2152	17.77	1.36
246	2439	2046	19.94	0.54	274	560	2159	19.67	1.31

Table 1 (continued)

1	2	3	4	5	1	2	3	4	5
275	1560	2160	17.83	1.48	303	1964	2255	19.28	1.37
276	1506	2161	18.61	1.12	304	1170	2273	18.81	0.73
277	1296	2165	19.09	0.89	305	3644	2277	19.06	0.63
278	1875	2173	19.29	1.31	306	2892	2292	19.89	0.49
279	1396	2169	19.09	0.63	307	1845	2298	19.57	0.37
280	3174	2176	18.10	0.96	308	2705	2295	18.92	0.95
281	1635	2187	19.01	1.34	309	2671	2306	19.49	0.99
282	3082	2190	19.89	1.70	310	2096	2305	17.36	1.27
283	2256	2190	19.87	0.73	311	2747	2306	19.34	1.26
284	525	2207	19.14	1.04	312	3395	2311	17.53	1.33
285	2050	2209	17.49	1.34	313	1965	2319	18.57	1.16
286	1510	2210	16.88	1.51	314	1146	2325	19.05	0.52
287	1804	2214	19.38	0.88	315	2243	2321	18.49	1.08
288	2514	2216	19.25	0.69	316	2934	2331	19.72	1.23
289	3933	2214	17.92	1.35	317	1826	2329	18.66	1.13
290	1611	2219	19.25	1.33	318	1073	2333	15.34	0.66
291	2042	2232	18.02	1.48	319	973	2338	19.11	1.85
292	2722	2232	19.14	1.40	320	808	2339	18.64	1.49
293	1071	2237	18.97	0.83	321	3304	2336	18.89	1.25
294	230	2240	19.57	0.64	322	2683	2344	18.52	1.30
295	2908	2232	18.83	0.78	323	864	2348	17.70	1.33
296	2001	2235	18.42	0.91	324	2786	2353	19.41	1.31
297	3241	2239	19.08	0.97	325	656	2356	19.82	0.22
298	1610	2242	18.88	1.05	326	1124	2358	19.20	0.90
299	402	2249	19.99	1.39	327	1197	2375	19.51	0.53
300	2186	2249	18.66	1.67	328	1954	2371	17.62	1.52
301	1892	2253	18.25	1.41	329	2220	2377	18.05	0.81
302	1453	2255	18.70	1.53	330	2121	2379	19.61	1.99

Table 1 (continued)

1	2	3	4	5	1	2	3	4	5
331	2695	2390	18.63	0.55	359	2073	2498	19.24	1.45
332	1456	2387	19.92	1.34	360	3454	2507	19.54	0.58
333	1556	2385	17.98	1.39	361	1837	2512	18.53	1.11
334	1931	2392	17.99	1.38	362	1566	2519	19.94	1.08
335	3348	2388	18.89	1.40	363	3206	2529	19.77	1.17
336	451	2398	18.98	1.29	364	570	2536	19.06	0.94
337	2257	2397	19.79	0.27	365	2662	2534	19.87	0.64
338	1653	2414	19.40	0.85	366	690	2549	19.41	1.18
339	3030	2413	19.39	0.93	367	1046	2560	18.18	1.16
340	1781	2415	18.29	1.09	368	1834	2563	18.92	0.97
341	2335	2417	18.34	1.18	369	310	2567	18.00	1.25
342	2088	2421	19.08	0.91	370	3278	2571	19.95	2.45
343	1830	2424	19.02	0.85	371	1781	2572	18.88	1.00
344	1308	2429	18.44	0.89	372	443	2577	19.18	1.03
345	538	2431	19.02	1.61	373	2823	2592	19.67	1.18
346	1188	2440	19.08	0.95	374	2638	2599	19.57	0.63
347	790	2444	19.85	0.41	375	1181	2599	18.77	1.06
348	1605	2449	19.90	0.55	376	1041	2607	17.83	1.48
349	3386	2438	18.65	1.46	377	1171	2617	18.96	0.83
350	2904	2451	19.79	0.55	378	3233	2610	18.93	1.29
351	1579	2453	17.83	1.42	379	1818	2617	18.73	1.11
352	1906	2461	18.10	1.31	380	1670	2623	19.62	0.43
353	1999	2473	19.82	0.70	381	1668	2627	19.53	1.39
354	1257	2481	19.72	0.76	382	2266	2635	19.07	1.24
355	2281	2483	19.45	1.35	383	3610	2637	19.24	0.16
356	1650	2489	19.67	1.41	384	1749	2652	18.57	1.47
357	422	2490	18.01	1.03	385	1830	2656	18.53	1.06
358	2072	2488	19.68	0.46	386	2013	2687	18.39	1.56

Table 1 (continued)

1	2	3	4	5	1	2	3	4	5
387	1157	2691	18.30	1.09	415	927	2872	19.77	1.15
388	2130	2694	19.84	0.62	416	1694	2881	19.57	0.99
389	3477	2686	17.68	1.10	417	2202	2880	19.83	0.49
390	2182	2697	17.78	1.57	418	1784	2894	19.57	0.65
391	2258	2702	19.00	1.10	419	2422	2898	19.44	0.52
392	2202	2709	18.80	0.49	420	2594	2917	18.96	1.21
393	1226	2712	18.27	0.92	421	2265	2923	19.81	1.06
394	1409	2717	19.54	1.15	422	2453	2928	14.45	0.42
395	3336	2724	19.73	1.16	423	441	2933	19.88	0.95
396	1107	2734	19.38	0.49	424	2896	2939	18.30	1.53
397	1704	2761	20.01	1.16	425	2078	2960	19.28	1.12
398	266	2769	19.39	0.77	426	2201	2966	19.14	1.04
399	1993	2767	19.70	0.72	427	2118	2970	19.21	0.99
400	3449	2766	18.39	1.17	428	1739	2968	18.96	0.85
401	3253	2776	19.41	1.01	429	2714	2966	17.29	1.45
402	365	2785	19.20	0.57	430	3096	2965	17.46	0.11
403	2610	2787	19.73	0.76	431	271	2972	19.68	0.81
404	1578	2789	19.15	1.22	432	3326	2985	19.18	1.14
405	2151	2786	19.63	2.10	433	2863	2989	17.54	1.40
406	1159	2799	19.59	1.04	434	3155	3001	19.80	1.08
407	855	2801	19.32	0.79	435	1824	3006	19.12	1.40
408	2198	2804	18.15	1.26	436	522	3018	19.34	0.96
409	2299	2803	17.63	1.53	437	1948	3036	18.95	0.92
410	1713	2815	19.57	0.32	438	1844	3033	18.20	1.44
411	595	2833	19.43	0.36	439	2587	3040	17.60	0.88
412	1604	2837	19.19	0.59	440	699	3047	19.22	1.39
413	2901	2838	18.88	1.23	441	1043	3051	19.73	1.32
414	1831	2866	17.25	1.44	442	2188	3052	19.66	0.66

Table 1 (continued)

1	2	3	4	5	1	2	3	4	5
443	1890	3055	18.99	0.80	471	1952	3194	19.44	1.22
444	3601	3067	19.95	0.79	472	1677	3194	19.08	0.80
445	336	3070	19.43	0.72	473	825	3198	19.91	0.89
446	80	3074	19.80	0.99	474	2424	3203	18.61	0.40
447	1041	3077	19.38	0.73	475	2822	3213	19.41	0.80
448	1653	3082	18.68	1.44	476	1603	3234	18.78	1.17
449	3381	3088	19.62	0.48	477	1286	3238	19.72	0.54
450	1712	3088	19.79	0.45	478	855	3239	19.51	0.99
451	557	3093	19.42	1.12	479	2977	3231	17.59	1.08
452	2422	3088	19.60	1.29	480	2737	3241	18.29	1.26
453	3890	3086	18.66	1.32	481	543	3263	14.50	0.23
454	141	3098	19.84	0.57	482	615	3290	18.72	1.04
455	73	3119	19.44	0.18	483	3124	3289	18.51	1.35
456	2170	3135	19.26	0.87	484	1190	3316	19.72	0.86
457	2169	3135	19.17	0.95	485	3721	3318	18.92	1.52
458	2784	3139	18.76	0.47	486	2707	3324	19.12	0.68
459	1348	3155	19.38	0.70	487	1434	3328	17.00	1.55
460	2230	3165	19.83	0.81	488	260	3336	17.64	1.41
461	1513	3162	18.05	0.96	489	2532	3334	18.90	0.73
462	2516	3174	19.84	1.62	490	1995	3362	18.47	1.65
463	1807	3168	18.80	0.89	491	2564	3365	19.94	0.48
464	989	3175	18.93	0.92	492	1425	3369	18.67	0.95
465	2197	3172	18.76	0.76	493	1884	3369	17.29	1.40
466	218	3196	19.29	0.84	494	1650	3374	18.09	1.22
467	1504	3192	19.18	2.01	495	2652	3373	19.53	1.33
468	2801	3189	19.42	1.01	496	434	3380	18.66	0.89
469	2688	3191	19.84	1.02	497	1938	3397	19.12	1.33
470	563	3194	19.74	0.43	498	1811	3394	19.45	1.25

Table 1 (continued)

1	2	3	4	5	1	2	3	4	5
499	424	3406	19.18	1.10	527	2229	3544	18.11	1.65
500	2972	3397	18.18	1.20	528	2670	3547	17.90	1.16
501	1895	3406	18.24	1.26	529	1296	3569	19.55	1.05
502	1291	3412	19.25	1.64	530	1026	3579	19.70	0.76
503	2074	3413	16.50	1.44	531	2923	3577	19.49	1.63
504	2308	3419	19.69	0.52	532	780	3582	18.96	0.93
505	2030	3421	18.61	1.51	533	3844	3592	19.50	1.41
506	3803	3423	19.88	0.77	534	1950	3589	19.32	1.07
507	2113	3435	18.94	0.76	535	216	3603	19.14	0.94
508	3898	3434	18.74	0.31	536	2891	3621	19.80	1.24
509	1938	3464	19.75	1.01	537	365	3644	18.16	1.32
510	866	3464	19.84	1.26	538	1435	3638	19.25	0.59
511	1408	3469	18.70	0.86	539	1495	3643	18.62	1.50
512	344	3488	19.73	0.72	540	386	3653	19.94	0.37
513	2111	3490	20.00	0.37	541	129	3654	19.59	1.16
514	3850	3495	19.97	1.57	542	3263	3663	19.92	0.78
515	1508	3493	18.48	1.26	543	1660	3664	19.79	0.62
516	2388	3494	17.23	1.57	544	1724	3666	18.19	1.02
517	3540	3496	19.48	0.73	545	969	3674	19.14	0.80
518	1847	3500	18.05	1.20	546	1940	3676	16.90	1.55
519	612	3511	17.82	1.44	547	2700	3689	19.67	1.45
520	1385	3522	19.91	0.85	548	2824	3694	20.03	1.07
521	1315	3523	19.08	1.23	549	1444	3700	19.42	0.73
522	2417	3521	19.64	0.44	550	2625	3705	19.54	0.87
523	3265	3539	19.13	1.65	551	3613	3710	19.66	0.44
524	889	3542	17.78	2.92	552	2851	3728	19.85	1.20
525	1359	3544	18.48	0.74	553	1112	3728	18.75	1.02
526	1502	3549	19.75	1.37	554	230	3746	19.03	1.29

Table 1 (continued)

1	2	3	4	5	1	2	3	4	5
555	968	3749	19.47	0.01	575	1716	3872	19.72	0.69
556	2729	3746	19.18	1.40	576	2727	3872	19.96	0.82
557	1811	3759	19.10	1.10	577	2883	3874	19.91	0.47
558	933	3764	19.90	0.96	578	3118	3875	19.51	0.83
559	486	3771	18.73	0.79	579	2066	3882	19.06	1.26
560	2871	3762	18.47	0.95	580	1667	3878	19.02	0.94
561	747	3782	17.76	1.50	581	2362	3896	19.58	1.17
562	445	3788	18.25	0.85	582	1467	3899	19.68	1.01
563	230	3793	18.90	0.69	583	2515	3904	18.80	1.16
564	100	3794	19.52	1.51	584	2522	3921	19.34	1.40
565	268	3797	18.23	1.26	585	3921	3928	18.92	1.48
566	1099	3799	17.96	0.92	586	1643	3927	19.75	1.54
567	3331	3792	18.73	0.85	587	406	3937	19.80	0.39
568	927	3806	19.45	1.40	588	2361	3930	18.76	1.63
569	1041	3806	19.56	0.65	589	1441	3935	17.95	1.39
570	438	3832	19.51	0.55	590	3043	3933	19.10	1.21
571	2863	3821	18.00	0.98	591	1712	3941	19.17	1.52
572	2705	3831	17.70	1.41	592	2310	3942	19.62	0.78
573	2705	3832	17.83	1.54	593	3978	3941	16.15	0.29
574	2935	3852	19.06	1.13	594	1481	3957	19.02	0.94