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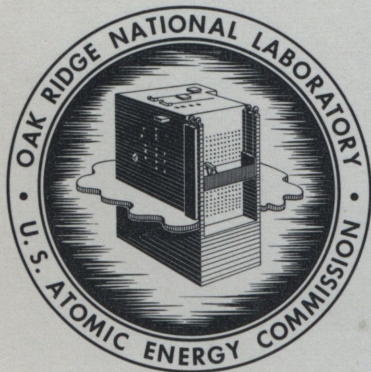
Section 2.3

SMOOTHED THERMOCOUPLE TABLES OF
EXTENDED SIGNIFICANCE (°C)

Volume 2

Section 2.3 Chromel-Alumel Thermocouples

R. K. Adams
E. G. Davisson



OAK RIDGE NATIONAL LABORATORY

operated by

UNION CARBIDE CORPORATION

for the

U.S. ATOMIC ENERGY COMMISSION

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INSTRUMENTATION AND CONTROLS DIVISION

SMOOTHED THERMOCOUPLE TABLES OF EXTENDED SIGNIFICANCE (°C)

R. K. Adams and E. G. Davisson

Volume 2

SECTION 2.3 CHROMEL-ALUMEL THERMOCOUPLES

MARCH 1965

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee
operated by
UNION CARBIDE CORPORATION
for the
U. S. ATOMIC ENERGY COMMISSION

SMOOTHED THERMOCOUPLE TABLES OF EXTENDED SIGNIFICANCE (°C)

R. K. Adams E. G. Davisson

Volume 2

SECTION 2.3 CHROMEL-ALUMEL THERMOCOUPLES

This section contains tables of emf (in absolute millivolts) vs temperature (in degrees Celsius on the International Temperature Scale of 1948) for Chromel-Alumel thermocouples. The values in these tables, derived from those given in National Bureau of Standards Circular 561, Table 6,¹ are computed to more significant digits, that is, to the nearest 0.001 μV . The techniques of computation are described in Vol. 1 of this report.

Figure 1, a plot of the difference in microvolts between the values in the smoothed table and those in the original table vs temperature, illustrates how the values in the smoothed table compare with those in the original table.

In Table 3 a smoothed emf value is tabulated in absolute millivolts for every degree Celsius in the range of the table.

In Table 3A the first two columns contain the same information as given in Table 3. To the right of these two columns is a difference table of the millivolt values in column 2. The difference table is expressed in thousandths of microvolts and contains orders 0 through 5. This difference table gives a convenient tabulation of differences for those engaged in temperature difference work.

Although these tables are expressed to the nearest 0.001 μV , which is roughly equivalent to 0.00002°C, this in no way implies that temperature measurements to this accuracy are possible. The user of these tables is reminded of the accuracy tolerances on thermocouples published by the American Society for Testing and Materials² and the Instrument Society of America,³ which state limits of error equivalent to about $\pm 2.2^\circ\text{C}$ from 0 to 277°C, $\pm 0.75\%$ of reading from 277 to 1260°C for "standard" materials, and one-half these limits for "special" materials. Individual calibration of Chromel-Alumel thermocouples in the ORNL Standards Laboratory can improve their accuracy to better than $\pm 0.5^\circ\text{C}$ in the range of -200 to 1100°C, and the reproducibility will be better than $\pm 0.25^\circ\text{C}$.

After a thermocouple has been used in the field to measure temperature, the reproducibility of the characteristic calibration curve for that thermocouple, previously standardized in the ORNL Standards Laboratory, depends on such factors as the temperatures to which the thermocouple had been exposed, the length of exposure to elevated or depressed temperatures, and the conditions of exposure.⁴

¹H. Shenker *et al.*, "Reference Tables for Thermocouples," *Nat. Bur. Std. (U.S.) Circ. 561*, GPO, Washington, 1955.

²"Temperature Electromotive Force (EMF) Tables for Thermocouples, ASTM E 230-63," *Am. Soc. Testing Mater., ASTM Std. 1964*, Pt. 30, pp. 646-704; see Table XIII, p. 700.

³"Thermocouples and Thermocouple Extension Wires - Terminology, Limits of Error, and Wire Sizes," *Recommended Practice RP 1.3*, Instrument Society of America, Pittsburgh, Pa., 1959.

⁴"Temperature Electromotive Force (EMF) Tables for Thermocouples, ASTM E 230-63," *Am. Soc. Testing Mater., ASTM Std. 1964*, Pt. 30, pp. 646-704; see Note 3 to Table XIII, p. 700.

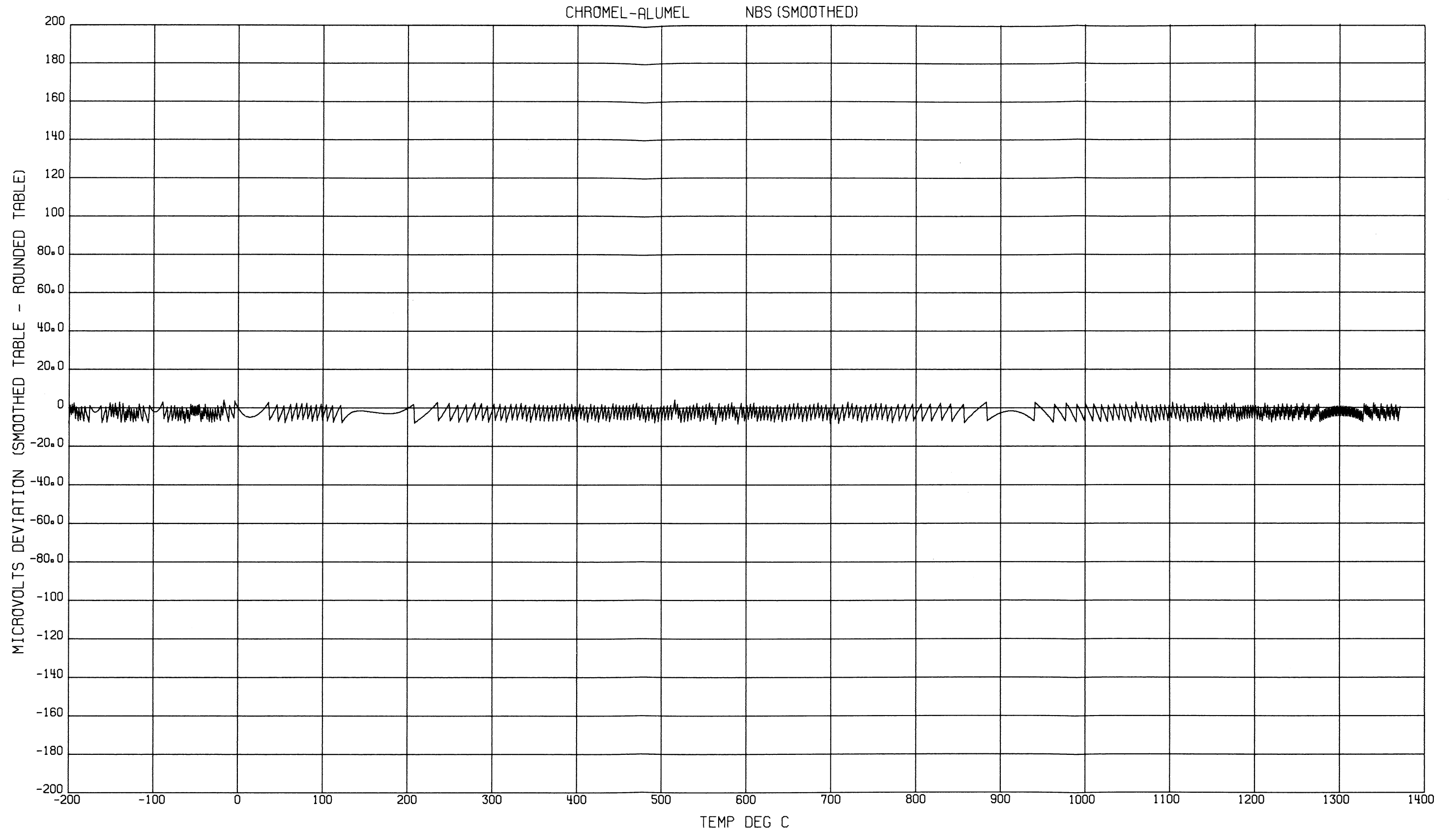


Fig. 1. Deviation of Original Table from Smoothed Table.

CHROMEL-ALUMEL NBS(SMOOTHED)
TABLE NO. 3

TEMP=DEG C (INT,1948)
VOLTAGE=MILLIVOLT ABSOLUTE

TEMP	0	1	2	3	4	5	6	7	8	9
	MILLIVOLTS									
-200	-5.758145									
-190	-5.603265	-5.619532	-5.635628	-5.651551	-5.667300	-5.682876	-5.698279	-5.713507	-5.728561	-5.743441
-180	-5.431166	-5.449142	-5.466949	-5.484585	-5.502052	-5.519348	-5.536474	-5.553429	-5.570212	-5.586824
-170	-5.242156	-5.261810	-5.281297	-5.300618	-5.319771	-5.338757	-5.357575	-5.376225	-5.394708	-5.413021
-160	-5.036507	-5.057813	-5.078955	-5.099933	-5.120747	-5.141396	-5.161879	-5.182197	-5.202350	-5.222336
-150	-4.814547	-4.837461	-4.860218	-4.882816	-4.905255	-4.927534	-4.949652	-4.971609	-4.993404	-5.015037
-140	-4.576973	-4.601401	-4.625684	-4.649820	-4.673808	-4.697646	-4.721333	-4.744868	-4.768249	-4.791476
-130	-4.325010	-4.350813	-4.376484	-4.402024	-4.427429	-4.452699	-4.477833	-4.502829	-4.527685	-4.552400
-120	-4.059966	-4.087035	-4.113979	-4.140799	-4.167494	-4.194063	-4.220507	-4.246824	-4.273014	-4.299077
-110	-3.782389	-3.810717	-3.838916	-3.866988	-3.894933	-3.922752	-3.950444	-3.978012	-4.005455	-4.032772
-100	-3.491909	-3.521556	-3.551069	-3.580447	-3.609692	-3.638804	-3.667783	-3.696631	-3.725347	-3.753933
-90	-3.188067	-3.219047	-3.249897	-3.280616	-3.311202	-3.341656	-3.371975	-3.402161	-3.432211	-3.462128
-80	-2.871403	-2.903606	-2.935694	-2.967667	-2.999520	-3.031254	-3.062867	-3.094356	-3.125720	-3.156957
-70	-2.543456	-2.576710	-2.609866	-2.642923	-2.675879	-2.708732	-2.741481	-2.774124	-2.806660	-2.839087
-60	-2.205761	-2.239939	-2.274028	-2.308028	-2.341937	-2.375756	-2.409483	-2.443117	-2.476658	-2.510105
-50	-1.859192	-1.894236	-1.929195	-1.964068	-1.998856	-2.033557	-2.068172	-2.102700	-2.137142	-2.171495
-40	-1.504127	-1.540008	-1.575806	-1.611522	-1.647155	-1.682704	-1.718170	-1.753552	-1.788850	-1.824063
-30	-1.140804	-1.177506	-1.214126	-1.250664	-1.287119	-1.323492	-1.359783	-1.395992	-1.432119	-1.468164
-20	-.769126	-.806681	-.844149	-.881530	-.918824	-.956033	-.993156	-1.030194	-1.067148	-1.104017
-10	-.388746	-.427176	-.465520	-.503778	-.541949	-.580032	-.618027	-.655934	-.693752	-.731483
0	0	-.039214	-.078357	-.117429	-.156425	-.195346	-.234188	-.272951	-.311632	-.350231

+ 0	0	.039282	.078630	.118041	.157513	.197043	.236630	.276271	.315963	.355705
10	.395495	.435329	.475207	.515127	.555087	.595085	.635121	.675193	.715301	.755442
20	.795618	.835826	.876067	.916341	.956647	.996985	1.037356	1.077758	1.118194	1.158661
30	1.199162	1.239695	1.280262	1.320862	1.361496	1.402163	1.442863	1.483597	1.524365	1.565166
40	1.606000	1.646867	1.687767	1.728699	1.769663	1.810659	1.851686	1.892744	1.933831	1.974948
50	2.016093	2.057266	2.098467	2.139693	2.180946	2.222223	2.263525	2.304850	2.346198	2.387568
60	2.428961	2.470374	2.511808	2.553262	2.594736	2.636230	2.677742	2.719272	2.760820	2.802386
70	2.843969	2.885569	2.927185	2.968816	3.010463	3.052125	3.093800	3.135489	3.177190	3.218902
80	3.260626	3.302359	3.344100	3.385849	3.427604	3.469364	3.511128	3.552894	3.594660	3.636425
90	3.678188	3.719946	3.761699	3.803443	3.845178	3.886901	3.928611	3.970304	4.011980	4.053636
100	4.095271	4.136881	4.178465	4.220022	4.261548	4.303042	4.344503	4.385927	4.427315	4.468663
110	4.509971	4.551236	4.592459	4.633636	4.674768	4.715854	4.756892	4.797882	4.838823	4.879716
120	4.920560	4.961355	5.002101	5.042799	5.083449	5.124051	5.164608	5.205118	5.245585	5.286009
130	5.326392	5.366735	5.407040	5.447308	5.487543	5.527745	5.567917	5.608061	5.648179	5.688272
140	5.728344	5.768396	5.808429	5.848447	5.888450	5.928440	5.968419	6.008389	6.048351	6.088306
150	6.128256	6.168201	6.208143	6.248083	6.288021	6.327959	6.367896	6.407834	6.447772	6.487711
160	6.527652	6.567594	6.607537	6.647482	6.687429	6.727378	6.767329	6.807282	6.847237	6.887195
170	6.927155	6.967118	7.007084	7.047054	7.087028	7.127006	7.166990	7.206980	7.246977	7.286980
180	7.326992	7.367012	7.407042	7.447082	7.487132	7.527194	7.567268	7.607354	7.647453	7.687565
190	7.727691	7.767830	7.807982	7.848148	7.888328	7.928520	7.968726	8.008945	8.049176	8.089419

CHROMEL-ALUMEL NBS(SMOOTHED)
TABLE NO. 3

TEMP=DEG C (INT.1948)
VOLTAGE=MILLIVOLT ABSOLUTE

TEMP	0	1	2	3	4	5	6	7	8	9
	MILLIVOLTS									
200	8.129673	8.169938	8.210214	8.250499	8.290792	8.331094	8.371403	8.411718	8.452039	8.492365
210	8.532696	8.573030	8.613368	8.653708	8.694052	8.734398	8.774747	8.815099	8.855454	8.895813
220	8.936176	8.976544	9.016918	9.057299	9.097686	9.138082	9.178488	9.218904	9.259331	9.299771
230	9.340225	9.380693	9.421177	9.461677	9.502195	9.542730	9.583285	9.623858	9.664451	9.705065
240	9.745698	9.786353	9.827028	9.867723	9.908440	9.949177	9.989934	10.030711	10.071507	10.112322
250	10.153155	10.194006	10.234874	10.275757	10.316655	10.357568	10.398495	10.439434	10.480386	10.521349
260	10.562323	10.603307	10.644302	10.685306	10.726319	10.767341	10.808372	10.849412	10.890460	10.931517
270	10.972583	11.013657	11.054739	11.095831	11.136931	11.178041	11.219160	11.260288	11.301427	11.342575
280	11.383734	11.424903	11.466083	11.507273	11.548473	11.589685	11.630908	11.672141	11.713386	11.754641
290	11.795908	11.837186	11.878475	11.919775	11.961085	12.002407	12.043739	12.085081	12.126434	12.167798
300	12.209171	12.250555	12.291948	12.333352	12.374766	12.416190	12.457624	12.499068	12.540522	12.581987
310	12.623462	12.664948	12.706444	12.747951	12.789469	12.830999	12.872539	12.914091	12.955655	12.997231
320	13.038818	13.080418	13.122030	13.163655	13.205292	13.246942	13.288604	13.330280	13.371968	13.413669
330	13.455382	13.497108	13.538846	13.580596	13.622358	13.664132	13.705918	13.747715	13.789522	13.831340
340	13.873168	13.915006	13.956854	13.998710	14.040575	14.082448	14.124328	14.166217	14.208112	14.250014
350	14.291923	14.333838	14.375759	14.417686	14.459618	14.501555	14.543498	14.585445	14.627398	14.669355
360	14.711317	14.753283	14.795255	14.837231	14.879212	14.921198	14.963189	15.005185	15.047187	15.089194
370	15.131208	15.173227	15.215254	15.257286	15.299326	15.341374	15.383428	15.425491	15.467561	15.509640
380	15.551727	15.593823	15.635927	15.678040	15.720163	15.762294	15.804434	15.846584	15.888742	15.930910
390	15.973086	16.015271	16.057464	16.099666	16.141876	16.184094	16.226320	16.268553	16.310793	16.353040
400	16.395294	16.437554	16.479819	16.522090	16.564365	16.606645	16.648929	16.691217	16.733507	16.775801
410	16.818097	16.860395	16.902694	16.944995	16.987297	17.029600	17.071904	17.114208	17.156512	17.198816
420	17.241120	17.283425	17.325729	17.368033	17.410338	17.452642	17.494947	17.537252	17.579558	17.621865
430	17.664173	17.706482	17.748794	17.791107	17.833423	17.875742	17.918065	17.960392	18.002723	18.045059
440	18.087401	18.129749	18.172104	18.214467	18.256838	18.299218	18.341607	18.384007	18.426417	18.468838
450	18.511270	18.553715	18.596172	18.638642	18.681125	18.723622	18.766133	18.808657	18.851195	18.893747
460	18.936313	18.978893	19.021487	19.064094	19.106714	19.149347	19.191992	19.234649	19.277317	19.319995
470	19.362682	19.405378	19.448082	19.490792	19.533509	19.576230	19.618954	19.661681	19.704410	19.747138
480	19.789867	19.832593	19.875317	19.918037	19.960753	20.003463	20.046168	20.088866	20.131557	20.174241
490	20.216917	20.259585	20.302244	20.344895	20.387537	20.430171	20.472797	20.515414	20.558024	20.600626
500	20.643221	20.685809	20.728391	20.770968	20.813539	20.856107	20.898671	20.941232	20.983791	21.026348
510	21.068905	21.111461	21.154018	21.196576	21.239136	21.281698	21.324263	21.366830	21.409401	21.451975
520	21.494553	21.537136	21.579722	21.622312	21.664907	21.707506	21.750109	21.792716	21.835328	21.877944
530	21.920564	21.963188	22.005816	22.048449	22.091085	22.133725	22.176368	22.219016	22.261667	22.304321
540	22.346978	22.389638	22.432301	22.474967	22.517636	22.560307	22.602981	22.645656	22.688334	22.731014
550	22.773696	22.816380	22.859066	22.901754	22.944444	22.987135	23.029828	23.072522	23.115218	23.157915
560	23.200614	23.243313	23.286014	23.328717	23.371417	23.414119	23.456822	23.499525	23.542228	23.584931
570	23.627633	23.670336	23.713038	23.755740	23.798441	23.841142	23.883843	23.926543	23.969243	24.011943
580	24.054642	24.097341	24.140040	24.182738	24.225436	24.268135	24.310832	24.353530	24.396227	24.438924
590	24.481620	24.524316	24.567011	24.609706	24.652400	24.695093	24.737785	24.780476	24.823166	24.865853

CHROMEL-ALUMEL NBS(SMOOTHED)
TABLE NO. 3

TEMP=DEG C (INT,1948)
VOLTAGE=MILLIVOLT ABSOLUTE

TEMP	0	1	2	3	4	5	6	7	8	9
	MILLIVOLTS									
600	24.908539	24.951222	24.993903	25.036581	25.079255	25.121925	25.164591	25.207252	25.249907	25.292555
610	25.335197	25.377831	25.420457	25.463074	25.505681	25.548278	25.590864	25.633438	25.675999	25.718548
620	25.761082	25.803603	25.846108	25.888598	25.931072	25.973530	26.015972	26.058396	26.100803	26.143193
630	26.185566	26.227920	26.270257	26.312577	26.354879	26.397164	26.439432	26.481684	26.523919	26.566139
640	26.608344	26.650534	26.692710	26.734873	26.777024	26.819162	26.861290	26.903407	26.945515	26.987614
650	27.029706	27.071790	27.113869	27.155943	27.198012	27.240077	27.282140	27.324201	27.366260	27.408319
660	27.450378	27.492437	27.534497	27.576559	27.618624	27.660690	27.702760	27.744832	27.786908	27.828987
670	27.871069	27.913156	27.955246	27.997340	28.039438	28.081538	28.123643	28.165750	28.207860	28.249972
680	28.292086	28.334202	28.376318	28.418435	28.460552	28.502668	28.544783	28.586897	28.629007	28.671115
690	28.713219	28.755318	28.797413	28.839502	28.881585	28.923662	28.965732	29.007795	29.049850	29.091897
700	29.133936	29.175966	29.217988	29.260002	29.302006	29.344002	29.385988	29.427966	29.469935	29.511896
710	29.553848	29.595792	29.637727	29.679655	29.721575	29.763488	29.805394	29.847293	29.889186	29.931072
720	29.972953	30.014828	30.056698	30.098562	30.140422	30.182277	30.224128	30.265974	30.307815	30.349652
730	30.391484	30.433313	30.475137	30.516956	30.558771	30.600581	30.642387	30.684187	30.725983	30.767773
740	30.809558	30.851338	30.893111	30.934879	30.976641	31.018396	31.060144	31.101885	31.143620	31.185346
750	31.227065	31.268776	31.310478	31.352171	31.393855	31.435529	31.477194	31.518848	31.560491	31.602123
760	31.643744	31.685352	31.726949	31.768532	31.810103	31.851659	31.893202	31.934731	31.976245	32.017743
770	32.059227	32.100694	32.142145	32.183580	32.224998	32.266400	32.307784	32.349151	32.390500	32.431833
780	32.473148	32.514446	32.555727	32.596991	32.638238	32.679468	32.720681	32.761878	32.803059	32.844225
790	32.885375	32.926510	32.967630	33.008735	33.049827	33.090906	33.131971	33.173023	33.214063	33.255091
800	33.296108	33.337113	33.378108	33.419093	33.460069	33.501035	33.541993	33.582943	33.623886	33.664821
810	33.705750	33.746672	33.787588	33.828498	33.869403	33.910302	33.951197	33.992088	34.032974	34.073856
820	34.114733	34.155607	34.196477	34.237343	34.278206	34.319065	34.359920	34.400772	34.441619	34.482462
830	34.523301	34.564135	34.604963	34.645785	34.686601	34.727410	34.768212	34.809005	34.849790	34.890565
840	34.931329	34.972083	35.012825	35.053555	35.094271	35.134975	35.175664	35.216339	35.256999	35.297645
850	35.338275	35.378891	35.419492	35.460079	35.500650	35.541207	35.581750	35.622279	35.662795	35.703297
860	35.743787	35.784264	35.824730	35.865185	35.905629	35.946064	35.986490	36.026907	36.067317	36.107720
870	36.148116	36.188507	36.228892	36.269273	36.309650	36.350022	36.390391	36.430756	36.471117	36.511474
880	36.551828	36.592177	36.632522	36.672862	36.713196	36.753524	36.793846	36.834161	36.874468	36.914766
890	36.955055	36.995335	37.035605	37.075864	37.116113	37.156350	37.196576	37.236789	37.276991	37.317180
900	37.357356	37.397520	37.437670	37.477806	37.517928	37.558036	37.598130	37.638209	37.678274	37.718324
910	37.758359	37.798379	37.838385	37.878375	37.918351	37.958312	37.998258	38.038190	38.078108	38.118011
920	38.157900	38.197776	38.237637	38.277485	38.317318	38.357135	38.396948	38.436737	38.476516	38.516281
930	38.556033	38.595771	38.635497	38.675209	38.714908	38.754595	38.794269	38.833932	38.873583	38.913222
940	38.952851	38.992469	39.032078	39.071676	39.111265	39.150845	39.190416	39.229979	39.269533	39.309078
950	39.348615	39.388143	39.427662	39.467173	39.506675	39.546168	39.585652	39.625127	39.664592	39.704048
960	39.743494	39.782930	39.822355	39.861771	39.901176	39.940570	39.979954	40.019327	40.058689	40.098040
970	40.137379	40.176707	40.216023	40.255327	40.294619	40.333899	40.373168	40.412424	40.451668	40.490901
980	40.530122	40.569332	40.608530	40.647718	40.686894	40.726059	40.765214	40.804359	40.843493	40.882618
990	40.921732	40.960837	40.999932	41.039018	41.078095	41.117161	41.156218	41.195266	41.234304	41.273331

CHROMEL-ALUMEL NBS(SMOOTHED)
TABLE NO. 3

TEMP=DEG C (INT.1948)
VOLTAGE=MILLIVOLT ABSOLUTE

TEMP	0	1	2	3	4	5	6	7	8	9
	MILLIVOLTS									
1000	41.312349	41.351356	41.390354	41.429340	41.468317	41.507282	41.546236	41.585179	41.624110	41.663030
1010	41.701938	41.740835	41.779719	41.818592	41.857452	41.896300	41.935136	41.973958	42.012768	42.051566
1020	42.090350	42.129122	42.167880	42.206626	42.245360	42.284080	42.322788	42.361484	42.400168	42.438840
1030	42.477500	42.516149	42.554787	42.593413	42.632029	42.670634	42.709230	42.747815	42.786392	42.824959
1040	42.863517	42.902067	42.940609	42.979143	43.017668	43.056186	43.094697	43.133200	43.171696	43.210185
1050	43.248666	43.287141	43.325608	43.364069	43.402521	43.440967	43.479404	43.517834	43.556256	43.594670
1060	43.633075	43.671471	43.709858	43.748235	43.786603	43.824959	43.863305	43.901639	43.939961	43.978272
1070	44.016569	44.054854	44.093125	44.131383	44.169626	44.207855	44.246070	44.284271	44.322456	44.360627
1080	44.398783	44.436924	44.475051	44.513163	44.551260	44.589343	44.627413	44.665468	44.703510	44.741539
1090	44.779555	44.817558	44.855550	44.893529	44.931497	44.969453	45.007398	45.045333	45.083258	45.121172
1100	45.159076	45.196970	45.234854	45.272729	45.310594	45.348450	45.386295	45.424131	45.461957	45.499772
1110	45.537577	45.575371	45.613154	45.650925	45.688685	45.726432	45.764167	45.801888	45.839597	45.877292
1120	45.914972	45.952639	45.990291	46.027928	46.065549	46.103155	46.140746	46.178321	46.215879	46.253422
1130	46.290949	46.328459	46.365954	46.403432	46.440895	46.478341	46.515772	46.553187	46.590587	46.627971
1140	46.665341	46.702696	46.740037	46.777363	46.814675	46.851974	46.889259	46.926531	46.963790	47.001036
1150	47.038270	47.075491	47.112700	47.149896	47.187080	47.224253	47.261413	47.298561	47.335698	47.372823
1160	47.409936	47.447037	47.484127	47.521205	47.558271	47.595326	47.632369	47.669401	47.706420	47.743429
1170	47.780425	47.817409	47.854382	47.891342	47.928291	47.965227	48.002151	48.039063	48.075963	48.112850
1180	48.149724	48.186586	48.223435	48.260271	48.297094	48.333905	48.370702	48.407485	48.444256	48.481012
1190	48.517755	48.554484	48.591199	48.627899	48.664585	48.701255	48.737911	48.774551	48.811175	48.847784
1200	48.884376	48.920951	48.957510	48.994052	49.030577	49.067084	49.103573	49.140045	49.176498	49.212934
1210	49.249351	49.285749	49.322129	49.358491	49.394834	49.431158	49.467463	49.503750	49.540018	49.576267
1220	49.612498	49.648710	49.684904	49.721080	49.757238	49.793378	49.829501	49.865607	49.901696	49.937769
1230	49.973826	50.009867	50.045892	50.081903	50.117898	50.153880	50.189847	50.225801	50.261741	50.297668
1240	50.333583	50.369484	50.405373	50.441250	50.477115	50.512967	50.548807	50.584636	50.620452	50.656256
1250	50.692048	50.727828	50.763595	50.799349	50.835089	50.870817	50.906530	50.942229	50.977914	51.013583
1260	51.049237	51.084875	51.120496	51.156100	51.191687	51.227255	51.262805	51.298336	51.333848	51.369341
1270	51.404813	51.440266	51.475698	51.511110	51.546502	51.581873	51.617225	51.652556	51.687867	51.723159
1280	51.758431	51.793684	51.828919	51.864136	51.899336	51.934519	51.969687	52.004839	52.039976	52.075100
1290	52.110210	52.145308	52.180395	52.215470	52.250535	52.285590	52.320636	52.355673	52.390702	52.425724
1300	52.460737	52.495743	52.530742	52.565733	52.600718	52.635695	52.670666	52.705628	52.740583	52.775530
1310	52.810469	52.845398	52.880319	52.915230	52.950131	52.985021	53.019899	53.054766	53.089621	53.124463
1320	53.159291	53.194106	53.228906	53.263691	53.298461	53.333215	53.367953	53.402674	53.437378	53.472066
1330	53.506736	53.541388	53.576022	53.610639	53.645237	53.679817	53.714378	53.748921	53.783444	53.817949
1340	53.852434	53.886990	53.921534	53.956072	53.990597	54.025115	54.059625	54.094127	54.128621	54.163100
1350	54.196180	54.230438	54.264673	54.298885	54.333074	54.367240	54.401381	54.435499	54.469593	54.503662
1360	54.537706	54.571726	54.605719	54.639687	54.673629	54.707545	54.741434	54.775297	54.809132	54.842939
1370	54.876719	54.910471								

TABLE 3A

CHROMEL-ALUMEL NBS(SMOOTHED)

TEMP	MV	DIFFERENCE ORDER					
		0 TH	1 ST	2 ND	3 RD	4 TH	5 TH
-200	-5.758145	-5758145					
-199	-5.743441	-5743441	14704				
-198	-5.728561	-5728561	14880	176			
-197	-5.713507	-5713507	15054	174	=2		
-196	-5.698279	-5698279	15228	174	0	2	=1
-195	-5.682876	-5682876	15403	175	1		=4
-194	-5.667300	-5667300	15576	173	=2	=3	5
-193	-5.651551	-5651551	15749	173	0	2	=1
-192	-5.635628	-5635628	15923	174	1		=3
-191	-5.619532	-5619532	16096	173	=1	=2	1
-190	-5.603265	-5603265	16267	171	=2	=1	6
-189	-5.586824	-5586824	16441	174	3	5	=11
-188	-5.570212	-5570212	16612	174	=3	=6	9
-187	-5.553429	-5553429	16783	171	0	3	=2
-186	-5.536474	-5536474	16955	171	1		=3
-185	-5.519348	-5519348	17126	172	=1	=2	2
-184	-5.502052	-5502052	17296	171	=1	0	2
-183	-5.484585	-5484585	17467	170	=1	2	=5
-182	-5.466949	-5466949	17636	169	1		=5
-181	-5.449142	-5449142	17807	169	=2	4	7
-180	-5.431166	-5431166	17976	169	2		=8
-179	-5.413021	-5413021	18145	171	=2	=4	6
-178	-5.394708	-5394708	18313	168	=2	=4	6
-177	-5.376225	-5376225	18483	167	=2	=4	7
-176	-5.357575	-5357575	18650	168	1		=5
-175	-5.338757	-5338757	18818	168	0	=1	0
-174	-5.319771	-5319771	18986	168	=1	=1	3
-173	-5.300618	-5300618	19153	167	=1	2	
-172	-5.281297	-5281297	19321	168	=2	=3	=5
-171	-5.261810	-5261810	19487	166	2		8
-170	-5.242156	-5242156	19654	167	0	3	9
-169	-5.222336	-5222336	19820	166	=3	4	9
-168	-5.202350	-5202350	19986	166	1		=5
-167	-5.182197	-5182197	20153	167	=2	=3	6
-166	-5.161879	-5161879	20318	165	0	2	=1
-165	-5.141396	-5141396	20483	165	1		=3
			20649	166	=1	=2	2

164	-5.120747	-5120747	20814	165	0	1
163	-5.099933	-5099933	20978	164	0	1
162	-5.078955	-5078955	21142	164	0	0
161	-5.057813	-5057813	21306	164	0	1
160	-5.036507	-5036507	21470	164	1	1
159	-5.015037	-5015037	21633	163	1	1
158	-4.993404	-4993404	21795	162	0	2
157	-4.971609	-4971609	21957	162	1	2
156	-4.949652	-4949652	22118	161	0	2
155	-4.927534	-4927534	22279	161	1	1
154	-4.905255	-4905255	22439	160	1	1
153	-4.882816	-4882816	22598	159	0	3
152	-4.860218	-4860218	22757	159	2	4
151	-4.837461	-4837461	22914	157	0	3
150	-4.814547	-4814547	23071	157	1	0
149	-4.791476	-4791476	23227	156	2	3
148	-4.768249	-4768249	23381	154	0	4
147	-4.744868	-4744868	23535	154	2	3
146	-4.721333	-4721333	23687	152	1	1
145	-4.697646	-4697646	23838	151	1	1
144	-4.673808	-4673808	23988	150	2	2
143	-4.649820	-4649820	24136	148	1	2
142	-4.625684	-4625684	24283	147	2	3
141	-4.601401	-4601401	24428	145	0	5
140	-4.576973	-4576973	24573	145	3	5
139	-4.552400	-4552400	24715	142	1	2
138	-4.527685	-4527685	24856	141	1	1
137	-4.502829	-4502829	24996	140	2	1
136	-4.477833	-4477833	25134	138	2	1
135	-4.452699	-4452699	25270	136	1	0
134	-4.427429	-4427429	25405	135	0	5
133	-4.402024	-4402024	25540	133	4	9
132	-4.376484	-4376484	25671	131	1	8
131	-4.350813	-4350813	25803	132	2	5
130	-4.325010	-4325010	25933	130	0	5
129	-4.299077	-4299077	26063	130	3	6
128	-4.273014	-4273014	26190	127	0	3
127	-4.246824	-4246824	26317	127	0	2
126	-4.220507	-4220507	26444	127	2	5
125	-4.194063	-4194063	26569	125	1	5
124	-4.167494	-4167494		126	2	

-123	-4,140799	-4140799	26695	125	=1	0	2
-122	-4,113979	-4113979	26820	124	=1	2	2
-121	-4,087035	-4087035	26944	125	1		=3
-120	-4,059966	-4059966	27069	125	0	=1	=1
-119	-4,032772	-4032772	27194	125	=2	=2	7
-118	-4,005455	-4005455	27317	123	3	5	=9
-117	-3,978012	-3978012	27443	126	=1	=4	4
-116	-3,950444	-3950444	27568	125	=1	0	4
-115	-3,922752	-3922752	27692	124	3	4	=8
-114	-3,894933	-3894933	27819	127	=1	=4	6
-113	-3,866988	-3866988	27945	126	1	2	=3
-112	-3,838916	-3838916	28072	127	0	=1	3
-111	-3,810717	-3810717	28199	127	2	2	=5
-110	-3,782389	-3782389	28328	129	=1	=3	8
-109	-3,753933	-3753933	28456	128	2	3	=5
-108	-3,725347	-3725347	28586	130	0	=2	4
-107	-3,696631	-3696631	28716	130	2	2	=5
-106	-3,667783	-3667783	28848	132	=1	=3	6
-105	-3,638804	-3638804	28979	131	2	3	=5
-104	-3,609692	-3609692	29112	133	0	=2	2
-103	-3,580447	-3580447	29245	133	0	0	2
-102	-3,551069	-3551069	29378	133	2	2	=5
-101	-3,521556	-3521556	29513	135	=1	=3	4
-100	-3,491909	-3491909	29647	134	0	1	1
-99	-3,462128	-3462128	29781	134	2	2	=7
-98	-3,432211	-3432211	29917	136	=3	=5	11
-97	-3,402161	-3402161	30050	133	3	6	=12
-96	-3,371975	-3371975	30186	136	=3	=6	11
-95	-3,341656	-3341656	30319	133	=3	5	=10
-94	-3,311202	-3311202	30454	135	2	=5	9
-93	-3,280616	-3280616	30586	135	=3	4	=7
-92	-3,249897	-3249897	30719	132	1	=3	4
-91	-3,219047	-3219047	30850	131	=2		4
-90	-3,188067	-3188067	30980	131	=1	1	0
-89	-3,156957	-3156957	31110	130	0		=4
-88	-3,125720	-3125720	31237	130	=3	=3	6
-87	-3,094356	-3094356	31364	127	0	3	=5
-86	-3,062867	-3062867	31489	127	=2	=2	3
-85	-3,031254	-3031254	31613	125	=1		=3
-84	-2,999520	-2999520	31734	124	=3	=2	3
				121	=2	1	2
				119		3	

-83	-2,967667	-2967667	31853	120	1	=6	=9
-82	-2,935694	-2935694	31973	119	=5	=5	11
-81	-2,903606	-2903606	32088	115	0	=5	=7
-80	-2,871403	-2871403	32203	115	=2	=2	2
-79	-2,839087	-2839087	32316	113	=2	0	0
-78	-2,806660	-2806660	32427	111	=2	0	0
-77	-2,774124	-2774124	32536	109	=2	0	1
-76	-2,741481	-2741481	32643	107	=1	1	=2
-75	-2,708732	-2708732	32749	106	=2	=1	2
-74	-2,675879	-2675879	32853	104	=1	1	=2
-73	-2,642923	-2642923	32956	103	=2	=1	1
-72	-2,609866	-2609866	33057	101	=2	0	1
-71	-2,576710	-2576710	33156	99	=1	1	=1
-70	-2,543456	-2543456	33254	98	=1	0	0
-69	-2,510105	-2510105	33351	97	=1	0	=1
-68	-2,476658	-2476658	33447	96	=2	=1	2
-67	-2,443117	-2443117	33541	94	=1	1	0
-66	-2,409483	-2409483	33634	93	0	1	=2
-65	-2,375756	-2375756	33727	93	=1	=1	0
-64	-2,341937	-2341937	33819	92	=2	=1	4
-63	-2,308028	-2308028	33909	90	1	3	=6
-62	-2,274028	-2274028	34000	91	=2	=3	5
-61	-2,239939	-2239939	34089	89	0	2	=3
-60	-2,205761	-2205761	34178	89	=1	=1	1
-59	-2,171495	-2171495	34266	88	=1	0	3
-58	-2,137142	-2137142	34353	87	2	3	=8
-57	-2,102700	-2102700	34442	89	=3	=5	9
-56	-2,068172	-2068172	34528	86	1	4	=6
-55	-2,033557	-2033557	34615	87	=1	=2	4
-54	-1,998856	-1998856	34701	86	1	2	=5
-53	-1,964068	-1964068	34788	87	=2	=3	6
-52	-1,929195	-1929195	34873	85	1	3	=5
-51	-1,894236	-1894236	34959	86	=1	=2	3
-50	-1,859192	-1859192	35044	85	0	1	=2
-49	-1,824063	-1824063	35129	85	=1	=1	3
-48	-1,788850	-1788850	35213	84	1	2	=4
-47	-1,753552	-1753552	35298	85	=1	=2	3
-46	-1,718170	-1718170	35382	84	0	1	=2
-45	-1,682704	-1682704	35466	84	=1	2	3
-44	-1,647155	-1647155	35549	83	1	2	=4
-43	-1,611522	-1611522	35633	84	=1	=2	2
				83		0	

-42	-1,575806	-1575806	35716	82	=1	2	2
-41	-1,540008	-1540008	35798	83		=2	=4
-40	-1,504127	-1504127	35881	82	=1		3
-39	-1,468164	-1468164	35963	82	0	0	=1
-38	-1,432119	-1432119	36045	82	0	0	0
-37	-1,395992	-1395992	36127	82	0	0	0
-36	-1,359783	-1359783	36209	82	0	0	0
-35	-1,323492	-1323492	36291	82	0	0	0
-34	-1,287119	-1287119	36373	82	0		1
-33	-1,250664	-1250664	36455	83		=2	=3
-32	-1,214126	-1214126	36538	82	=1		3
-31	-1,177506	-1177506	36620	82	0		2
-30	-1,140804	-1140804	36702	82	3	3	=9
-29	-1,104017	-1104017	36787	85	=3	=6	12
-28	-1,067148	-1067148	36869	82	3	6	=10
-27	-1,030194	-1030194	36954	85	=1	=4	6
-26	-.993156	-993156	37038	84		2	=2
-25	-.956033	-956033	37123	85		0	=2
-24	-.918824	-918824	37209	86	=1	=2	5
-23	-.881530	-881530	37294	85	2	3	=5
-22	-.844149	-844149	37381	87	0	=2	2
-21	-.806681	-806681	37468	87	0	0	1
-20	-.769126	-769126	37555	87			=2
-19	-.731483	-731483	37643	88	0	=1	0
-18	-.693752	-693752	37731	88	=1	=1	4
-17	-.655934	-655934	37818	87	2	3	=6
-16	-.618027	-618027	37907	89	=1	=3	4
-15	-.580032	-580032	37995	88	0		=1
-14	-.541949	-541949	38083	88	0	0	=1
-13	-.503778	-503778	38171	88	=1	=1	1
-12	-.465520	-465520	38258	87	=1	0	1
-11	-.427176	-427176	38344	86	0		=2
-10	-.388746	-388746	38430	86	=1	=1	1
-9	-.350231	-350231	38515	85	=1	0	=1
-8	-.311632	-311632	38599	84	=2	=1	3
-7	-.272951	-272951	38681	82	0	2	=5
-6	-.234188	-234188	38763	82	=3	=3	6
-5	-.195346	-195346	38842	79	0	3	=7
-4	-.156425	-156425	38921	79	=4	=4	9
-3	-.117429	-117429	38996	75		5	=11
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-2	.078357	.78357		71		5	
-1	.039214	.39214	39143	71	0	-3	-8
0	0	0	39214	68	-3		4
1	.039282	.39282	39282	66	-2	-1	-2
2	.078630	.78630	39348	63	-3		2
3	.118041	118041	39411	61	-2	-1	-2
4	.157513	157513	39472	58	-3	2	3
5	.197043	197043	39530	57	-1	-2	-4
6	.236630	236630	39587	54	-3	0	2
7	.276271	276271	39641	51	-3	2	2
8	.315963	315963	39692	50	-1	-1	-3
9	.355705	355705	39742	48	-2	-2	-1
10	.395495	395495	39790	44	-4	-2	6
11	.435329	435329	39834	44	0	4	-6
12	.475207	475207	39878	44	-2	-2	2
13	.515127	515127	39920	42	-2	0	0
14	.555087	555087	39960	40	-2	0	2
15	.595085	595085	39998	38	0	2	-4
16	.635121	635121	40036	38	-2	-2	4
17	.675193	675193	40072	36	0	2	-5
18	.715301	715301	40108	36	-3	-3	8
19	.755442	755442	40141	33	2	5	-10
20	.795618	795618	40176	35	-3	-5	9
21	.835826	835826	40208	32	1	4	-5
22	.876067	876067	40241	33	0	-1	0
23	.916341	916341	40274	33	-1	-1	2
24	.956647	956647	40306	32	0		0
25	.996985	996985	40338	32	1		-4
26	1.037356	1037356	40371	33	-2	-3	8
27	1.077758	1077758	40402	31	3	5	-11
28	1.118194	1118194	40436	34	-3	-6	12
29	1.158661	1158661	40467	31	3	6	-11
30	1.199162	1199162	40501	34	-2	-5	9
31	1.239695	1239695	40533	32	2	4	-7
32	1.280262	1280262	40567	34	-1	-3	5
33	1.320862	1320862	40600	33	1	2	-4
34	1.361496	1361496	40634	34	-1	-2	3
35	1.402163	1402163	40667	33	0		0
36	1.442863	1442863	40700	33	1		-2
37	1.483597	1483597	40734	34	0	-1	0
38	1.524365	1524365	40768	33	-1	-1	2

39	1.565166	1565166	40801	33	0	0	=1
40	1.606000	1606000	40834	33	0	0	0
41	1.646867	1646867	40867	33	0	0	=1
42	1.687767	1687767	40900	32	=1	=1	2
43	1.728699	1728699	40932	32	0	0	=1
44	1.769663	1769663	40964	32	0	0	=1
45	1.810659	1810659	40996	31	=1	=1	2
46	1.851686	1851686	41027	31	0	0	=3
47	1.892744	1892744	41058	29	=2	=2	5
48	1.933831	1933831	41087	29	1	3	=6
49	1.974948	1974948	41117	30	=2	=3	5
50	2.016093	2016093	41145	28	0	2	=2
51	2.057266	2057266	41173	28	0	0	=3
52	2.098467	2098467	41201	28	=3	=3	8
53	2.139693	2139693	41226	25	2	5	=10
54	2.180946	2180946	41253	27	=3	=5	9
55	2.222223	2222223	41277	24	1	4	=7
56	2.263525	2263525	41302	25	=2	=3	5
57	2.304850	2304850	41325	23	0	2	=3
58	2.346198	2346198	41348	23	=1	=1	3
59	2.387568	2387568	41370	22	1	2	=6
60	2.428961	2428961	41393	23	=3	=4	8
61	2.470374	2470374	41413	20	1	4	=6
62	2.511808	2511808	41434	21	=1	=2	3
63	2.553262	2553262	41454	20	0	1	=1
64	2.594736	2594736	41474	20	0	0	=2
65	2.636230	2636230	41494	20	=2	=2	4
66	2.677742	2677742	41512	18	0	2	=2
67	2.719272	2719272	41530	18	0	0	0
68	2.760820	2760820	41548	18	0	0	=1
69	2.802386	2802386	41566	17	=1	=1	2
70	2.843969	2843969	41583	17	0	0	=2
71	2.885569	2885569	41600	17	=1	=1	1
72	2.927185	2927185	41616	16	=1	0	2
73	2.968816	2968816	41631	15	1	2	=4
74	3.010463	3010463	41647	16	=1	=2	1
75	3.052125	3052125	41662	15	=2	=1	4
76	3.093800	3093800	41675	13	1	3	=6
77	3.135489	3135489	41689	14	=2	=3	4
78	3.177190	3177190	41701	12	=1	1	1
			41712	11	1	2	=6

79	3.218902	3218902	41724	12	-3	-4	6
80	3.260626	3260626	41733	9	=1	2	=1
81	3.302359	3302359	41741	8	0	1	=3
82	3.344100	3344100	41749	8	=2	=2	3
83	3.385849	3385849	41755	6	=1	1	=1
84	3.427604	3427604	41760	5	=1	0	=1
85	3.469364	3469364	41764	4	=2	=1	1
86	3.511128	3511128	41766	2	=2	0	1
87	3.552894	3552894	41766	0	=1	1	=1
88	3.594660	3594660	41765	-1	=1	0	=2
89	3.636425	3636425	41763	-2	=3	=2	5
90	3.678188	3678188	41758	-5	0	3	=7
91	3.719946	3719946	41753	-5	=4	=4	8
92	3.761699	3761699	41744	-9	0	4	=7
93	3.803443	3803443	41735	-9	=3	=3	5
94	3.845178	3845178	41723	-12	=1	2	=5
95	3.886901	3886901	41710	-13	=4	=3	7
96	3.928611	3928611	41693	-17	0	4	=7
97	3.970304	3970304	41676	-17	=3	=3	5
98	4.011980	4011980	41656	-20	=1	2	=5
99	4.053636	4053636	41635	-21	=4	=3	6
100	4.095271	4095271	41610	-25	=1	3	=3
101	4.136881	4136881	41584	-26	=1	0	=3
102	4.178465	4178465	41557	-27	=4	=3	6
103	4.220022	4220022	41526	-31	=1	3	=3
104	4.261548	4261548	41494	-32	=1	0	=3
105	4.303042	4303042	41461	-33	=4	=3	8
106	4.344503	4344503	41424	-37	1	3	=10
107	4.385927	4385927	41388	-38	=4	=3	9
108	4.427315	4427315	41348	-40	0	4	=7
109	4.468663	4468663	41308	-40	=3	=3	7
110	4.509971	4509971	41265	-43	1	4	=9
111	4.551236	4551236	41223	-42	=4	=3	10
112	4.592459	4592459	41177	-44	1	3	=7
113	4.633636	4633636	41132	-45	=1	=2	1
114	4.674768	4674768	41086	-46	=2	=1	3
115	4.715854	4715854	41038	-48	0	2	=3
116	4.756892	4756892	40990	-48	=1	=1	3
117	4.797882	4797882	40941	-49	1	2	=4
118	4.838823	4838823	40893	-48	=1	=2	3
119	4.879716	4879716		-49		1	

120	4,920560	4920560	40844	-49	0	0	=1
121	4,961355	4961355	40795	-49	0	1	1
122	5,002101	5002101	40746	-48	1	=1	=2
123	5,042799	5042799	40698	-48	0	0	1
124	5,083449	5083449	40650	-48	0	3	3
125	5,124051	5124051	40602	-48	3	3	=8
126	5,164608	5164608	40557	-45	=2	=5	11
127	5,205118	5205118	40510	-47	4	6	=10
128	5,245585	5245585	40467	-43	0	=4	6
129	5,286009	5286009	40424	-43	2	2	=3
130	5,326392	5326392	40383	-41	1	=1	2
131	5,366735	5366735	40343	-40	2	1	=2
132	5,407040	5407040	40305	-38	1	=1	4
133	5,447308	5447308	40305	-37	1	3	4
134	5,487543	5487543	40268	-33	4	3	=7
135	5,527745	5527745	40235	-33	0	=4	7
136	5,567917	5567917	40202	-33	3	3	=4
137	5,608061	5608061	40172	-30	2	=1	1
138	5,648179	5648179	40144	-28	2	0	=1
139	5,688272	5688272	40118	-26	1	=1	4
140	5,728344	5728344	40093	-25	1	3	4
141	5,768396	5768396	40072	-21	4	=3	=6
142	5,808429	5808429	40052	-20	1	0	3
143	5,848447	5848447	40033	-19	1	3	3
144	5,888450	5888450	40033	-15	4	3	=7
145	5,928440	5928440	40018	-15	0	=4	6
146	5,968419	5968419	40003	-15	2	2	=2
147	6,008389	6008389	39990	-13	2	0	0
148	6,048351	6048351	39979	-11	2	0	=1
149	6,088306	6088306	39970	-9	1	=1	1
150	6,128256	6128256	39962	-8	1	0	1
151	6,168201	6168201	39955	-7	2	1	=3
152	6,208143	6208143	39950	-5	0	=2	4
153	6,248083	6248083	39945	-5	2	2	=3
154	6,288021	6288021	39942	-3	1	=1	0
155	6,327959	6327959	39940	-2	0	=1	3
156	6,367896	6367896	39938	-2	2	2	=5
157	6,407834	6407834	39938	0	2	=3	6
158	6,447772	6447772	39938	=1	=1	3	6
159	6,487711	6487711	39937	=1	2	3	=6
160	6,527652	6527652	39938	0	=1	=3	5
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			39942		0		0
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			39943		1		=2
162	6.607537	6607537		2		=1	
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163	6.647482	6647482		2		0	
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164	6.687429	6687429		2		0	
			39949		0		0
165	6.727378	6727378		2		0	
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166	6.767329	6767329		2		0	
			39953		0		1
167	6.807282	6807282		2		1	
			39955		1		-3
168	6.847237	6847237		3		-2	
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169	6.887195	6887195		2		2	
			39960		1		=3
170	6.927155	6927155		3		-1	
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171	6.967118	6967118		3		1	
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172	7.007084	7007084		4		=1	
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173	7.047054	7047054		4		0	
			39974		0		2
174	7.087028	7087028		4		2	
			39978		2		-4
175	7.127006	7127006		6		-2	
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176	7.166990	7166990		6		1	
			39990		1		-3
177	7.206980	7206980		7		-2	
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178	7.246977	7246977		6		4	
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179	7.286980	7286980		9		-4	
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180	7.326992	7326992		8		3	
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181	7.367012	7367012		10		-2	
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182	7.407042	7407042		10		0	
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183	7.447082	7447082		10		2	
			40050		2		=4
184	7.487132	7487132		12		-2	
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185	7.527194	7527194		12		0	
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186	7.567268	7567268		12		1	
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187	7.607354	7607354		13		-1	
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188	7.647453	7647453		13		1	
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189	7.687565	7687565		14		=2	
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190	7.727691	7727691		13		1	
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191	7.767830	7767830		13		1	
			40152		1		=2
192	7.807982	7807982		14		-1	
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193	7.848148	7848148		14		=2	
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194	7.888328	7888328		12		4	
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195	7.928520	7928520		14		=3	
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196	7.968726	7968726		13		0	
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197	8.008945	8008945		12		1	
			40231		0		-2
198	8.049176	8049176		12		-1	
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199	8.089419	8089419		11		1	
			40254		0		-1
200	8.129673	8129673		11		0	
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201	8.169938	8169938		11		-2	

202	8.210214	8210214	40276	9	=2	1	3
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203	8.250499	8250499	40293	8	1	2	=5
204	8.290792	8290792	40302	9		=3	4
205	8.331094	8331094	40309	7	=2	1	0
206	8.371403	8371403	40315	6	0	1	=2
207	8.411718	8411718	40321	6	=1	=1	2
208	8.452039	8452039	40326	5	0	1	=3
209	8.492365	8492365	40331	5	=2	=2	5
210	8.532696	8532696	40334	3	1	3	=6
211	8.573030	8573030	40338	4		=3	7
212	8.613368	8613368	40340	2	2	4	=8
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214	8.694052	8694052	40346	2	1	3	=4
215	8.734398	8734398	40349	3	0	=1	1
216	8.774747	8774747	40352	3	0	0	1
217	8.815099	8815099	40355	3	1	1	=2
218	8.855454	8855454	40359	4	0	=1	2
219	8.895813	8895813	40363	4	1	1	=1
220	8.936176	8936176	40368	5	1	0	0
221	8.976544	8976544	40374	6	1	0	=2
222	9.016918	9016918	40381	7	=1	=2	6
223	9.057299	9057299	40387	6	3	4	=6
224	9.097686	9097686	40396	9	1	=2	1
225	9.138082	9138082	40406	10	0	=1	2
226	9.178488	9178488	40416	10	1	1	0
227	9.218904	9218904	40427	11	2	1	=2
228	9.259331	9259331	40440	13	1	=1	0
229	9.299771	9299771	40454	14	0	=1	3
230	9.340225	9340225	40468	14	2	2	=4
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232	9.421177	9421177	40500	16	2	2	=5
233	9.461677	9461677	40518	18	=1	=3	7
234	9.502195	9502195	40535	17	3	4	=9
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236	9.583285	9583285	40573	18	2	4	=5
237	9.623858	9623858	40593	20	1	=1	=2
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239	9.705065	9705065	40633	19	3	5	=10
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241	9.786353	9786353	40675	20	0	2	0

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243	9.867723	9867723		22		=4	
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244	9.908440	9908440		20		2	
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245	9.949177	9949177		20		0	
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246	9.989934	9989934		20		=1	
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247	10.030711	10030711		19		1	
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248	10.071507	10071507		19		=1	
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249	10.112322	10112322		18		1	
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250	10.153155	10153155		18		=1	
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252	10.234874	10234874		15		2	
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253	10.275757	10275757		15		0	
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254	10.316655	10316655		15		=1	
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255	10.357568	10357568		14		=1	
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256	10.398495	10398495		12		3	
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258	10.480386	10480386		11		2	
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259	10.521349	10521349		11		=1	
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260	10.562323	10562323		10		2	
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261	10.603307	10603307		11		=3	
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262	10.644302	10644302		9		2	
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263	10.685306	10685306		9		0	
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264	10.726319	10726319		9		0	
			41022		0		0
265	10.767341	10767341		9		0	
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266	10.808372	10808372		9		=1	
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267	10.849412	10849412		8		2	
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268	10.890460	10890460		9		=1	
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270	10.972583	10972583		8		1	
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271	11.013657	11013657		8		2	
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272	11.054739	11054739		10		=4	
			41092		=2		8
273	11.095831	11095831		8		4	
			41100		2		=7
274	11.136931	11136931		10		=3	
			41110		=1		4
275	11.178041	11178041		9		1	
			41119		0		1
276	11.219160	11219160		9		2	
			41128		2		=6
277	11.260288	11260288		11		=4	
			41139		=2		8
278	11.301427	11301427		9		4	
			41148		2		-7
279	11.342575	11342575		11		=3	
			41159		=1		5
280	11.383734	11383734		10		2	
			41169		1		=4
281	11.424903	11424903		11		=2	
			41180		=1		3
282	11.466083	11466083		10		1	

283	11.507273	11507273	41190	10	0	2	1
284	11.548473	11548473	41200	12	2	=3	=5
285	11.589685	11589685	41212	11	=1	0	3
286	11.630908	11630908	41223	10	=1	3	3
287	11.672141	11672141	41233	12	2	=4	=7
288	11.713386	11713386	41245	10	=2	4	8
289	11.754641	11754641	41255	12	2	=3	=7
290	11.795908	11795908	41267	11	=1	1	4
291	11.837186	11837186	41278	11	0	0	=1
292	11.878475	11878475	41289	11	0	=1	=1
293	11.919775	11919775	41300	10	=1	3	4
294	11.961085	11961085	41310	12	2	=4	=7
295	12.002407	12002407	41322	10	=2	2	6
296	12.043739	12043739	41332	10	0	1	=1
297	12.085081	12085081	41342	11	1	=1	=2
298	12.126434	12126434	41353	11	0	=1	=1
299	12.167798	12167798	41364	9	=2	4	6
300	12.209171	12209171	41373	11	2	=4	=8
301	12.250555	12250555	41384	9	=2	4	8
302	12.291948	12291948	41393	11	2	=3	=7
303	12.333352	12333352	41404	10	=1	1	4
304	12.374766	12374766	41414	10	0	0	=1
305	12.416190	12416190	41424	10	0	0	0
306	12.457624	12457624	41434	10	0	0	0
307	12.499068	12499068	41444	10	0	0	1
308	12.540522	12540522	41454	11	1	=2	=3
309	12.581987	12581987	41465	10	=1	2	4
310	12.623462	12623462	41475	11	1	2	=4
311	12.664948	12664948	41486	10	=1	2	4
312	12.706444	12706444	41496	11	1	=1	=3
313	12.747951	12747951	41507	11	0	1	2
314	12.789469	12789469	41518	12	1	=3	=4
315	12.830999	12830999	41530	10	=2	4	7
316	12.872539	12872539	41540	12	2	=2	=6
317	12.914091	12914091	41552	12	0	0	2
318	12.955655	12955655	41564	12	0	=1	=1
319	12.997231	12997231	41576	11	=1	3	4
320	13.038818	13038818	41587	11	2	3	=6
321	13.080418	13080418	41600	13	=1	2	5
322	13.122030	13122030	41612	12	1	=2	=4
323	13.163655	13163655	41625	13	=1	2	4

324	13,205292	13205292	41637	13	1	-2	=4
325	13,246942	13246942	41650	12	=1	3	5
326	13,288604	13288604	41662	14	2	-4	=7
327	13,330280	13330280	41676	12	=2	3	7
328	13,371968	13371968	41688	13	1	-2	=5
329	13,413669	13413669	41701	12	=1	2	4
330	13,455382	13455382	41713	13	1	-2	=4
331	13,497108	13497108	41726	12	=1	1	3
332	13,538846	13538846	41738	12	0	0	=1
333	13,580596	13580596	41750	12	0	0	0
334	13,622358	13622358	41762	12	0	0	0
335	13,664132	13664132	41774	12	0	=1	=1
336	13,705918	13705918	41786	11	=1	0	1
337	13,747715	13747715	41797	10	-1	2	2
338	13,789522	13789522	41807	11	1	=2	=4
339	13,831340	13831340	41818	10	-1	1	3
340	13,873168	13873168	41828	10	0	0	=1
341	13,915006	13915006	41838	10	0	-2	=2
342	13,956854	13956854	41848	8	=2	3	5
343	13,998710	13998710	41856	9	1	-2	=5
344	14,040575	14040575	41865	8	=1	0	2
345	14,082448	14082448	41873	7	=1	3	3
346	14,124328	14124328	41880	9	2	-5	-8
347	14,166217	14166217	41889	8	=3	4	9
348	14,208112	14208112	41895	6	1	4	=5
349	14,250014	14250014	41902	7	0	=1	0
350	14,291923	14291923	41909	6	=1	1	2
351	14,333838	14333838	41915	6	0	0	=1
352	14,375759	14375759	41921	6	0	-1	=1
353	14,417686	14417686	41927	5	=1	1	2
354	14,459618	14459618	41932	5	0	1	0
355	14,501555	14501555	41937	6	1	-3	-4
356	14,543498	14543498	41943	4	=2	4	7
357	14,585445	14585445	41947	4	2	4	=8
358	14,627398	14627398	41953	6	=2	-4	7
359	14,669355	14669355	41957	4	1	3	-5
360	14,711317	14711317	41962	5	=1	-2	5
361	14,753283	14753283	41966	4	2	3	=7
362	14,795255	14795255	41972	6	=2	-4	7
363	14,837231	14837231	41976	4	1	3	=4
			41981	5	0	-1	1

364	14.879212	14879212	41986	5	0	0	0
365	14.921198	14921198	41991	5	0	0	1
366	14.963189	14963189	41996	5	1	1	=3
367	15.005185	15005185	42002	6	=1	=2	5
368	15.047187	15047187	42007	5	2	3	=7
369	15.089194	15089194	42014	7	=2	=4	9
370	15.131208	15131208	42019	5	3	5	=11
371	15.173227	15173227	42027	8	=3	=6	12
372	15.215254	15215254	42032	5	3	6	=9
373	15.257286	15257286	42040	8	0	=3	1
374	15.299326	15299326	42048	8	=2	=2	7
375	15.341374	15341374	42054	6	3	5	=10
376	15.383428	15383428	42063	9	=2	=5	9
377	15.425491	15425491	42070	7	2	4	=7
378	15.467561	15467561	42079	9	=1	=3	5
379	15.509640	15509640	42087	8	1	2	=4
380	15.551727	15551727	42096	9	=1	=2	4
381	15.593823	15593823	42104	8	1	2	=2
382	15.635927	15635927	42113	9	1	0	=3
383	15.678040	15678040	42123	10	=2	=3	6
384	15.720163	15720163	42131	8	1	3	=3
385	15.762294	15762294	42140	9	1	0	=3
386	15.804434	15804434	42150	10	=2	=3	7
387	15.846584	15846584	42158	8	2	4	=8
388	15.888742	15888742	42168	10	=2	=4	7
389	15.930910	15930910	42176	8	1	3	=5
390	15.973086	15973086	42185	9	=1	=2	4
391	16.015271	16015271	42193	8	1	2	=4
392	16.057464	16057464	42202	9	=1	=2	3
393	16.099666	16099666	42210	8	0	1	=1
394	16.141876	16141876	42218	8	0	0	=1
395	16.184094	16184094	42226	8	=1	=1	2
396	16.226320	16226320	42233	7	0	1	=1
397	16.268553	16268553	42240	7	0	0	0
398	16.310793	16310793	42247	7	0	0	=1
399	16.353040	16353040	42254	7	=1	=1	1
400	16.395294	16395294	42260	6	=1	0	2
401	16.437554	16437554	42265	5	1	2	=5
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403	16.522090	16522090	42275	4	1	3	=5
404	16.564365	16564365		5		=2	

405	16.606645	16606645	42280	4	=1		3
406	16.648929	16648929	42284	4	0		=3
407	16.691217	16691217	42288	2	=2		6
408	16.733507	16733507	42290	4	2		=8
409	16.775801	16775801	42294	2	=2		6
410	16.818097	16818097	42296	2	0		=3
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412	16.902694	16902694	42299	2			=4
413	16.944995	16944995	42301	2	=1		3
414	16.987297	16987297	42302	1	0		=1
415	17.029600	17029600	42303	1	0		=1
416	17.071904	17071904	42304	0	=1		2
417	17.114208	17114208	42304	0	0		-1
418	17.156512	17156512	42304	0	0		0
419	17.198816	17198816	42304	0	0		1
420	17.241120	17241120	42304	0			=4
421	17.283425	17283425	42305	-1	=2		6
422	17.325729	17325729	42304	0			=3
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425	17.452642	17452642	42304	1	2		=7
426	17.494947	17494947	42305	0	=1		5
427	17.537252	17537252	42305	0			=3
428	17.579558	17579558	42306	1	0		1
429	17.621865	17621865	42307	1	0		0
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431	17.706482	17706482	42309	3	2		=6
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436	17.918065	17918065	42323	4	0		1
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438	18.002723	18002723	42331	5			=1
439	18.045059	18045059	42336	6			=1
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441	18.129749	18129749	42348	7			=1
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444	18.256838	18256838	42371	9			=2
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446	18,341607	18341607	42389	1	2	-3	=5
447	18,384007	18384007	42400	10	=1	2	5
448	18,426417	18426417	42410	1	1	=1	=3
449	18,468838	18468838	42421	11	0	2	3
450	18,511270	18511270	42432	13	2	=3	=5
451	18,553715	18553715	42445	12	=1	=3	5
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454	18,681125	18681125	42483	14	1	1	=2
455	18,723622	18723622	42497	14	0	=1	0
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457	18,808657	18808657	42524	14	1	2	=3
458	18,851195	18851195	42538	14	0	=1	1
459	18,893747	18893747	42552	14	0	0	0
460	18,936313	18936313	42566	14	0	0	0
461	18,978893	18978893	42580	14	0	0	=1
462	19,021487	19021487	42594	13	=1	=1	2
463	19,064094	19064094	42607	13	0	1	=1
464	19,106714	19106714	42620	13	0	0	=1
465	19,149347	19149347	42633	12	=1	=1	2
466	19,191992	19191992	42645	12	0	1	=2
467	19,234649	19234649	42657	11	=1	=1	1
468	19,277317	19277317	42668	10	=1	0	0
469	19,319995	19319995	42678	9	=1	1	1
470	19,362682	19362682	42687	9	0	1	=2
471	19,405378	19405378	42696	8	=1	=1	0
472	19,448082	19448082	42704	6	=2	-1	4
473	19,490792	19490792	42710	6	1	3	-7
474	19,533509	19533509	42717	7	=3	-4	6
475	19,576230	19576230	42721	4	=1	2	=1
476	19,618954	19618954	42724	3	0	1	=2
477	19,661681	19661681	42727	3	=1	=1	=1
478	19,704410	19704410	42729	2	=1	=2	=1
479	19,747138	19747138	42729	-1	=3	5	7
480	19,789867	19789867	42728	1	2	=6	=11
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482	19,875317	19875317	42726	-3	1	5	=8
483	19,918037	19918037	42724	-2	=2	=3	5
484	19,960753	19960753	42724	-4	=2	2	5
485	20,003463	20003463	42720	-4	0	=2	=4
486	20,046168	20046168	42716	-6	=2	3	5
			42710	-6	1	3	=6
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487	20.088866	20088866	42698	-7	0	0	-2
488	20.131557	20131557	42691	-7	0	-1	-1
489	20.174241	20174241	42684	-8	-1	1	2
490	20.216917	20216917	42676	-8	0	-1	-2
491	20.259585	20259585	42668	-9	-1	2	3
492	20.302244	20302244	42659	-8	1	-2	-4
493	20.344895	20344895	42651	-9	-1	2	4
494	20.387537	20387537	42642	-8	1	-1	-3
495	20.430171	20430171	42634	-8	0	-1	0
496	20.472797	20472797	42626	-9	-1	3	4
497	20.515414	20515414	42617	-7	2	-3	-6
498	20.558024	20558024	42610	-8	-1	2	5
499	20.600626	20600626	42602	-7	1	-1	-3
500	20.643221	20643221	42595	-7	0	1	2
501	20.685809	20685809	42588	-6	1	0	-1
502	20.728391	20728391	42582	-5	1	0	-2
503	20.770968	20770968	42577	-6	-1	-2	6
504	20.813539	20813539	42571	-3	3	4	-8
505	20.856107	20856107	42568	-3	-1	-4	6
506	20.898671	20898671	42564	-4	1	2	-2
507	20.941232	20941232	42561	-3	1	0	-1
508	20.983791	20983791	42559	-2	0	-1	3
509	21.026348	21026348	42557	-2	2	2	-5
510	21.068905	21068905	42557	0	-1	-3	6
511	21.111461	21111461	42556	-1	2	3	-5
512	21.154018	21154018	42557	1	0	-2	3
513	21.196576	21196576	42558	1	1	1	-2
514	21.239136	21239136	42560	2	0	-1	2
515	21.281698	21281698	42562	2	1	1	-3
516	21.324263	21324263	42565	3	-1	-2	5
517	21.366830	21366830	42567	2	2	3	-6
518	21.409401	21409401	42571	4	-1	-3	5
519	21.451975	21451975	42574	3	1	2	-2
520	21.494553	21494553	42578	4	1	0	-3
521	21.537136	21537136	42583	5	-2	-3	6
522	21.579722	21579722	42586	3	1	3	-3
523	21.622312	21622312	42586	4	1	0	-3
524	21.664907	21664907	42590	5	1	-2	2
525	21.707506	21707506	42595	4	-1	1	3
526	21.750109	21750109	42599	4	0	0	-1
527	21.792716	21792716	42603	4	0	1	1
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			42612		=1		3
528	21,835328	21835328	42616	4	0	1	=1
529	21,877944	21877944	42620	4	0	0	0
530	21,920564	21920564	42624	4	0	0	1
531	21,963188	21963188	42628	4	1	1	=4
532	22,005816	22005816	42633	5	=2	=3	6
533	22,048449	22048449	42636	3	1	3	=5
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535	22,133725	22133725	42643	3	2	3	=7
536	22,176368	22176368	42648	5	=2	=4	6
537	22,219016	22219016	42651	3	0	2	=2
538	22,261667	22261667	42654	3	0	0	0
539	22,304321	22304321	42657	3	0	0	0
540	22,346978	22346978	42660	3	0	0	0
541	22,389638	22389638	42663	3	0	0	0
542	22,432301	22432301	42666	3	0	0	=1
543	22,474967	22474967	42669	3	0	0	=1
544	22,517636	22517636	42671	2	=1	2	3
545	22,560307	22560307	42674	3	1	=3	=5
546	22,602981	22602981	42677	1	=2	4	7
547	22,645656	22645656	42678	3	2	=3	=7
548	22,688334	22688334	42680	2	=1	1	4
549	22,731014	22731014	42682	2	0	0	=1
550	22,773696	22773696	42684	2	0	0	0
551	22,816380	22816380	42686	2	0	0	0
552	22,859066	22859066	42688	2	0	0	0
553	22,901754	22901754	42688	2	0	0	=1
554	22,944444	22944444	42690	2	=1	=1	3
555	22,987135	22987135	42691	1	1	2	=4
556	23,029828	23029828	42693	2	1	=2	4
557	23,072522	23072522	42694	1	=1	2	=4
558	23,115218	23115218	42696	2	1	-2	4
559	23,157915	23157915	42697	1	1	2	=5
560	23,200614	23200614	42699	2	=2	=3	7
561	23,243313	23243313	42699	0	2	4	=8
562	23,286014	23286014	42701	2	2	-4	=6
563	23,328715	23328715	42701	0	=2	3	7
564	23,371417	23371417	42701	1	1	-2	=5
565	23,414119	23414119	42702	0	=1	2	4
566	23,456822	23456822	42702	1	1	2	=4
567	23,499525	23499525	42703	1	=1	-2	3
568	23,542228	23542228	42703	0	0	1	=1
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569	23,584931	23584931	42703	=1	=1	3	4
570	23,627633	23627633	42702	-1	2	-4	-7
571	23,670336	23670336	42703	=1	=2	3	7
572	23,713038	23713038	42702	0	1	-2	=5
573	23,755740	23755740	42702	=1	=1	2	4
574	23,798441	23798441	42701	0	1	-1	=3
575	23,841142	23841142	42701	0	0	-1	0
576	23,883843	23883843	42701	-1	=1	2	3
577	23,926543	23926543	42700	0	1	=1	=3
578	23,969243	23969243	42700	0	0	=1	0
579	24,011943	24011943	42700	-1	=1	2	3
580	24,054642	24054642	42699	0	1	=1	=3
581	24,097341	24097341	42699	0	0	=1	0
582	24,140040	24140040	42699	=1	=1	2	3
583	24,182738	24182738	42698	0	1	0	=2
584	24,225436	24225436	42698	0	1	0	=4
585	24,268135	24268135	42699	-2	=3	6	10
586	24,310832	24310832	42697	1	3	=5	-11
587	24,353530	24353530	42698	=1	=2	3	8
588	24,396227	24396227	42697	=1	1	3	=5
589	24,438924	24438924	42697	0	=1	=2	4
590	24,481620	24481620	42696	=1	1	2	-4
591	24,524316	24524316	42696	0	=1	=2	4
592	24,567011	24567011	42695	=1	1	2	=4
593	24,609706	24609706	42695	0	=1	=2	3
594	24,652400	24652400	42694	-1	0	1	=1
595	24,695093	24695093	42693	-1	0	0	0
596	24,737785	24737785	42692	-1	0	0	0
597	24,780476	24780476	42691	-1	0	0	=2
598	24,823166	24823166	42690	=1	-2	-2	6
599	24,865853	24865853	42687	-3	2	4	=8
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603	25,036581	25036581	42681	-3	=1	0	1
604	25,079255	25079255	42678	-4	0	1	-1
605	25,121925	25121925	42674	-4	0	0	-1
606	25,164591	25164591	42670	-4	0	-1	1
607	25,207252	25207252	42666	-5	=1	0	0
608	25,249907	25249907	42661	-6	=1	0	2
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613	25,463074	25463074	42617	=9	=1	0	1
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615	25,548278	25548278	42597	=10	=1	=1	1
616	25,590864	25590864	42586	=11	=1	0	0
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618	25,675999	25675999	42561	=13	1	2	=6
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620	25,761082	25761082	42534	=15	2	5	=10
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622	25,846108	25846108	42505	=16	1	4	=6
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624	25,931072	25931072	42474	=18	0	1	=1
625	25,973530	25973530	42458	=16	0	0	=2
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633	26,312577	26312577	42337	=17	0	=2	1
634	26,354879	26354879	42320	=17	=1	=1	3
635	26,397164	26397164	42302	=18	1	2	=3
636	26,439432	26439432	42285	=17	0	=1	2
637	26,481684	26481684	42268	=17	1	1	=3
638	26,523919	26523919	42252	=16	=1	=2	5
639	26,566139	26566139	42235	=17	2	3	=5
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644	26,777024	26777024	42163	=13	1	0	=2
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646	26,861290	26861290	42138	=13	3	4	=8
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648	26,945515	26945515	42117	=11	2	3	=5
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653	27,155943	27155943	42074	-5	0	1	1
654	27,198012	27198012	42069	-4	1	1	0
655	27,240077	27240077	42065	-2	2	-2	-3
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657	27,324201	27324201	42061	-2	0	2	2
658	27,366260	27366260	42059	0	2	-2	-4
659	27,408319	27408319	42059	0	0	0	2
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663	27,576559	27576559	42062	3	1	0	-3
664	27,618624	27618624	42065	1	-2	-3	8
665	27,660690	27660690	42066	4	3	5	-10
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668	27,786908	27786908	42076	4	-1	-3	4
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672	27,955246	27955246	42090	3	1	3	-4
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679	28,249972	28249972	42110	2	-1	1	-1
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682	28,376318	28376318	42116	0	-2	3	-5
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688	28,629007	28629007	42114	-1	-3	-3	-9
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691	28,755318	28755318	42104	-5	-1	2	-5
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