Supplementary materials

Article

Prediction of molecular weight of petroleum fluids by empirical correlations and artificial neuron networks

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Table S1. 430 data points for boiling point, specific gravity, and molecular weight of petroleum fluids, and individual hydrocarbons to be used for nonlinear regression modeling

Nr	Petroleum fluid and individual component	Reference	SG	TBP (K)	MW, g/mol
1	TOPS (C5/C6)	[9]	0,631	306	76
2	naphtha	[9]	0,714	372	99
3	naphtha	[9]	0,721	365	96
4	naphtha	[9]	0,729	373	100
5	naphtha	[9]	0,679	329	82
6	naphtha	[9]	0,709	356	92
7	naphtha	[9]	0,683	332	83
8	naphtha	[9]	0,726	373	99
9	naphtha	[9]	0,721	365	96
10	naphtha	[9]	0,683	332	83
11	naphtha	[9]	0,689	338	85
12	naphtha	[9]	0,691	346	88
13	naphtha	[9]	0,697	346	89
14	naphtha	[9]	0,742	385	105
15	naphtha	[9]	0,712	363	97
16	kerosene	[9]	0,820	492	161
17	kerosene	[9]	0,816	488	160
18	light gas oil	[9]	0,832	550	204
19	light gas oil	[9]	0,849	602	244
20	light gas oil	[9]	0,833	539	192
21	heavy gas oil	[9]	0,856	594	242
22	heavy gas oil	[9]	0,857	575	221
23	heavy gas oil	[9]	0,858	601	242
24	heavy gas oil	[9]	0,862	632	277
25	heavy gas oil	[9]	0,858	592	229
26	heavy gas oil	[9]	0,865	589	231
27	extra heavy gas oil	[9]	0,864	641	288
28	extra heavy gas oil	[9]	0,866	644	291
29	extra heavy gas oil	[9]	0,879	619	264
30	extra heavy gas oil	[9]	0,877	635	277
31	extra heavy gas oil	[9]	0,885	638	279
32	hydrotreated VGO	[9]	0,870	669	326
33	hydrocracked VGO	[9]	0,845	704	388
34	short residue	[9]	0,971	890	720
35	short residue	[9]	0,961	854	617
36	short residue	[9]	1,017	898	726
37	short residue	[9]	1,080	990	1106
38	short residue	[9]	1,060	973	1020
39	n-decane (C10H22)	[9]	0,734	447	142

40	n-eicosane (C20H42)	[9]	0,792	617	282
41	C30H62	[9]	0,813	723	423
42	C40H82	[9]	0,824	798	563
43	C60H122	[9]	0,835	894	844
44	C100H202	[9]	0,844	988	1405
45	C120H242	[9]	0,846	1012	1685
46	cyclopentane	[9]	0,751	322	70
47	methylcyclohexane	[9]	0,774	374	98
48	n-dodecylcyclohexane	[9]	0,826	601	253
49	n-eicosylcyclohexane (C26H52)	[9]	0,836	696	365
50	1-methyldecaline	[9]	0,868	481	152
51	toluene (C7H8)	[9]	0,872	384	92
52	n-butylbenzene	[9]	0,864	457	134
53	C30-alkylbenzene	[9]	0,859	732	415
54	C40-alkylbenzene	[9]	0,859	804	555
55	C60-alkylbenzene	[9]	0,858	895	836
56	C16H22-tetraline	[9]	0,993	598	214
57	C12H16-alkylindan	[9]	0,927	519	160
58	diphenylethane	[9]	0,989	554	182
59	2-methylnaphthalene	[9]	1,010	514	142
60	C4-naphthalene	[9]	0,981	579	198
61	trihexylnaphthalene (C28H44)	[9]	0,915	733	381
62	1-methyl-7-phenanthrene (C18H18)	[9]	1,088	667	234
63	octadecahydrochrysene (C18H30)	[9]	0,985	626	246
64	n-hexadecane (C16H34)	[9]	0,777	560	226
65	1-hexadecene (C16H32)	[9]	0,785	558	224
66	visbroken naphtha	[9]	0,705	367	95
67	n-pentane	[9]	0,632	309	72
68	benzene	[9]	0,884	353	78
69	phenantrene	[9]	1,176	612	178
70	coronene	[9]	1,379	798	300
71		[27]	0,658	328	78
72		[27]	0,662	326	79
73		[27]	0,657	328	80
74		[27]	0,670	331	81
75		[27]	0,672	336	82
76		[27]	0,665	331	82
77		[27]	0,675	335	83
78		[27]	0,694	352	88
79		[27]	0,703	364	92
80		[27]	0,711	366	93
81		[27]	0,696	365	93
82		[27]	0,709	367	94

83		[27]	0,708	367	94
84		[27]	0,713	370	96
85		[27]	0,716	373	97
86		[27]	0,714	382	100
87		[27]	0,727	383	101
88		[27]	0,724	387	102
89		[27]	0,723	383	102
90		[27]	0,721	387	103
91		[27]	0,730	387	104
92		[27]	0,727	394	106
93		[27]	0,739	385	107
94		[27]	0,735	390	108
95		[27]	0,746	406	114
96		[27]	0,747	397	115
97		[27]	0,740	400	121
98		[27]	0,868	437	122
99		[27]	0,777	412	131
100		[27]	0,762	434	142
101		[27]	0,971	519	154
102		[27]	0,961	497	155
103		[27]	0,980	594	156
104		[27]	0,969	518	156
105		[27]	0,681	532	166
106		[27]	0,973	518	168
107		[27]	0,973	519	161
108		[27]	0,955	518	167
109		[27]	0,936	509	171
110		[27]	0,966	538	186
111		[27]	0,972	535	187
112		[27]	0,848	553	214
113		[27]	0,663	335	82
114		[27]	0,694	363	92
115		[27]	0,700	370	95
116		[27]	0,706	377	97
117		[27]	0,711	382	100
118		[27]	0,728	373	101
119		[27]	0,720	374	101
120		[27]	0,721	377	102
121		[27]	0,726	380	104
122		[27]	0,744	385	106
123		[27]	0,738	386	107
124		[27]	0,742	388	107
125		[27]	0,737	389	109

126		[27]	0,748	389	109
127		[27]	0,736	390	110
128		[27]	0,753	400	114
129		[27]	0,755	400	114
130		[27]	0,747	403	116
131		[27]	0,743	401	115
132		[27]	0,750	406	117
133		[27]	0,756	407	118
134		[27]	0,756	420	126
135		[27]	0,767	426	126
136		[27]	0,772	420	127
137		[27]	0,773	421	127
138		[27]	0,768	420	127
139		[27]	0,774	425	129
140		[27]	0,777	426	130
141		[27]	0,767	429	130
142		[27]	0,771	426	130
143		[27]	0,769	432	133
144		[27]	0,776	431	133
145		[27]	0,779	432	133
146		[27]	0,780	438	137
147		[27]	0,790	469	153
148		[27]	0,789	463	154
149		[27]	0,796	469	157
150		[27]	0,797	473	160
151		[27]	0,803	469	161
152		[27]	0,800	480	165
153		[27]	0,806	480	166
154		[27]	0,803	487	170
155	jet naphtha	[28]	0,805	434	144
156	low-boiling naphtha	[28]	0,740	400	120
157	high-boiling naphtha	[28]	0,762	434	142
158	kerosine	[28]	0,808	480	162
159	fuel oil	[28]	0,862	559	228
160	gas oil	[28]	0,848	553	214
161		[29]	0,947	494	144
162		[29]	0,950	514	161
163		[29]	0,955	541	176
164		[29]	0,982	567	196
165		[29]	0,990	598	213
166		[29]	1,022	623	234
167		[29]	1,069	647	250
168		[29]	1,046	667	262

169		[29]	0,963	547	191
170		[29]	0,972	575	208
171		[29]	0,985	600	220
172		[29]	0,999	626	240
173		[29]	1,026	664	267
174		[29]	1,047	699	304
175		[29]	1,066	723	343
176		[29]	1,082	738	334
177		[29]	0,907	518	175
178		[29]	0,924	544	194
179		[29]	0,940	570	211
180		[29]	0,953	596	234
181		[29]	0,968	619	254
182		[29]	0,979	651	279
183		[29]	0,972	571	202
184		[29]	0,978	595	224
185		[29]	0,987	622	244
186		[29]	1,015	647	257
187		[29]	1,025	666	263
188		[29]	1,044	693	312
189		[23]	1,032	742	342
190		[23]	1,008	750	373
191		[23]	1,022	765	398
192		[23]	1,022	783	471
193		[23]	1,022	808	490
194		[23]	0,907	742	355
195		[23]	0,906	750	390
196		[23]	0,916	765	420
197		[23]	0,920	783	451
198		[23]	0,921	808	473
199		[23]	0,923	942	785
200		[23]	0,918	950	933
201		[23]	0,920	965	1066
202		[23]	0,916	983	1114
203		[23]	0,919	1008	1286
204		[23]	1,013	888	721
205		[23]	1,013	893	726
206		[23]	1,013	890	723
207		[23]	1,013	895	728
208		[23]	0,925	892	723
209		[23]	0,924	886	720
210		[23]	0,925	900	714
211		[30]	0,903	698	346

212		[30]	0,919	731	382
213		[30]	0,896	724	385
214		[30]	0,932	744	415
215		[30]	0,905	739	423
216		[30]	0,913	718	366
217		[30]	0,922	711	358
218		[30]	0,897	631	283
219		[30]	0,871	744	438
220		[30]	1,003	738	382
221		[31]	0,655	342	86
222	n-Hexane	[31]	0,684	372	100
223	n-Heptane	[31]	0,718	424	128
224	n-Nonane	[31]	0,749	489	170
225	n-Dodecane	[31]	0,756	507	184
226	n-Tridecane	[31]	0,763	527	198
227	n-Tetradecane	[31]	0,776	543	210
228	n-Pentadecane	[31]	0,773	560	226
229	n-Hexadecane	[31]	0,785	575	238
230	n-Heptadecane	[31]	0,777	590	255
231	n-Octadecane	[31]	0,786	603	269
232	n-Nonadecane	[31]	0,867	409	106
233	Ethylbenzene	[31]	0,862	432	120
234	Propylbenzene	[31]	0,860	456	134
235	Butylbenzene	[31]	0,864	412	106
236	m-Xylene	[31]	0,857	513	176
237	Heptylbenzene	[31]	1,025	491	128
238	Naphthalene	[31]	1,020	518	142
239	1-Methylnaphthalene	[31]	0,937	639	254
240	Nonylnaphthalene	[32]	0,640	303	70
241	pentene	[32]	0,674	337	84
242	hexene	[32]	0,697	367	98
243	heptene	[32]	0,714	394	112
244	octene	[32]	0,982	388	79
245	pyridine	[32]	1,020	457	93
246	aniline	[32]	1,170	527	117
247	indole	[32]	1,090	510	129
248	quinoline	[32]	0,854	658	302
249	hexadecylbenzene	[32]	0,854	646	289
250	pentadecylbenzene	[32]	0,855	632	275
251	tetradecylbenzene	[32]	0,815	404	144
252	Pyrolysis naphtha	[33]	0,894	535	224
253	AGO	[33]	0,970	702	386
254	VGO	[33]	0,925	826	618

255	HVGO	[33]	0,860	736	378
256		[34]	0,868	748	405
257		[34]	0,925	736	414
258		[34]	0,877	698	367
259		[34]	0,898	728	407
260		[34]	0,801	700	426
261	Daqing VGO	[35]	0,863	655	283
262	Daqing CGO	[35]	0,910	666	308
263	Daguang CGO	[35]	0,930	735	494
264	Aramco	[36]	0,903	736	432
265	Montmirail	[36]	0,941	718	368
266	Nigeria	[36]	0,953	693	306
267	CGO-4	[37]	1,059	733	348
268	FCCS-6	[37]	0,982	656	335
269	Kern River AR	[38]	0,991	714	420
270	Kern River AR	[38]	1,004	748	470
271	Kern River AR	[38]	1,007	786	525
272	Kern River AR	[38]	1,014	824	595
273	Kern River AR	[38]	1,021	861	680
274	Kern River AR	[38]	1,024	899	755
275	Kern River AR	[38]	1,024	944	875
276	Kern River AR	[38]	0,969	643	330
277	Arabian Heavy AR	[38]	0,979	702	400
278	Arabian Heavy AR	[38]	0,979	748	470
279	Arabian Heavy AR	[38]	0,979	786	550
280	Arabian Heavy AR	[38]	0,988	825	610
281	Arabian Heavy AR	[38]	1,004	866	705
282	Arabian Heavy AR	[38]	1,011	896	785
283	Arabian Heavy AR	[38]	1,014	946	955
284	Arabian Heavy AR	[38]	0,954	623	305
285	Arabian Heavy AR	[38]	0,960	698	410
286	Maya AR	[38]	0,985	749	480
287	Maya AR	[38]	0,991	795	550
288	Maya AR	[38]	0,998	824	620
289	Maya AR	[38]	1,004	862	675
290	Maya AR	[38]	1,011	890	760
291	Maya AR	[38]	1,014	925	825
292	Maya AR	[38]	1,014	981	935
293	Maya AR	[38]	0,988	647	315
294	Maya AR	[38]	0,988	707	385
295	Boscan AR	[38]	0,988	748	450
296	Boscan AR	[38]	0,998	789	515
297	Boscan AR	[38]	0,994	825	590

298	Boscan AR	[38]	1,014	836	600
299	Boscan AR	[38]	1,017	876	690
300		[38]	1,024	934	840
301		[38]	1,038	968	925
302		[38]	0,931	655	335
303		[38]	0,954	709	430
304		[38]	0,972	787	540
305		[38]	0,991	860	675
306		[38]	1,011	920	875
307		[39]	0,913	656	313
308		[39]	0,927	696	348
309		[39]	0,930	726	380
310		[39]	0,938	746	410
311		[40]	0,795	509	197
312		[40]	0,785	465	149
313		[39]	0,865	561	206
314		[41]	0,921	695	402
315		[41]	0,877	635	276
316		[41]	0,899	569	228
317		[41]	0,906	690	354
318		[41]	0,905	626	272
319		[41]	0,884	616	271
320		[41]	0,884	643	250
321		[41]	0,904	634	281
322		[41]	0,905	639	320
323		[41]	0,945	634	332
324		[41]	0,906	642	295
325		[41]	0,957	621	278
326		[41]	0,909	651	325
327		[41]	0,964	704	366
328		[41]	0,892	638	298
329		[22]	0,686	337	84
330		[22]	0,723	365	96
331		[22]	0,746	390	107
332		[22]	0,765	415	121
333		[22]	0,779	439	134
334		[22]	0,790	460	147
335		[22]	0,801	481	161
336		[22]	0,812	500	175
337		[22]	0,823	520	180
338		[22]	0,833	539	206
339		[22]	0,840	556	222
340		[22]	0,848	573	237

341		[22]	0,853	586	251
342		[22]	0,858	598	263
343		[22]	0,883	611	275
344		[22]	0,868	624	291
345		[22]	0,873	636	305
346		[22]	0,878	648	318
347		[22]	0,882	659	331
348		[22]	0,886	670	345
349		[22]	0,890	681	359
350		[22]	0,894	691	374
351		[22]	0,897	701	388
352		[22]	0,900	709	402
353		[22]	0,903	719	416
354		[22]	0,907	728	430
355		[22]	0,910	736	444
356		[22]	0,913	745	458
357		[22]	0,915	753	472
358		[22]	0,918	760	486
359		[22]	0,920	768	500
360		[22]	0,923	773	514
361		[22]	0,925	781	528
362		[22]	0,929	788	542
363		[22]	0,929	795	558
364		[22]	0,931	801	570
365		[22]	0,932	807	584
366		[22]	0,934	813	598
367		[22]	0,936	820	612
368		[22]	0,938	826	626
369		[42]	1,527	811	403
370		[42]	1,483	826	417
371		[42]	1,451	828	431
372		[42]	1,420	844	445
373		[42]	1,285	865	543
374		[42]	1,173	911	683
375		[42]	0,911	811	501
376		[42]	0,941	824	550
377		[42]	0,875	744	387
378		[42]	1,049	747	400
379	Dist. Data of CO-B-A1_0	[1]	0,902	582	236
380	Dist. Data of CO-B-A1_1	[1]	0,925	594	258
381	Dist. Data of CO-B-A1_2	[1]	0,946	619	301
382	Dist. Data of CO-B-A1_3	[1]	0,961	643	329
383	Dist. Data of CO-B-A1_4	[1]	0,970	668	380

384	Dist. Data of CO-B-A1_5	[1]	0,981	703	398
385	Dist. Data of CO-B-A1_6	[1]	0,993	727	475
386	Dist. Data of CO-B-A1_7	[1]	0,998	762	516
387	Dist. Data of MX-HO-A1_0	[1]	0,863	582	207
388	Dist. Data of MX-HO-A1_1	[1]	0,903	594	265
389	Dist. Data of MX-HO-A1_2	[1]	0,921	619	285
390	Dist. Data of MX-HO-A1_3	[1]	0,933	643	325
391	Dist. Data of MX-HO-A1_4	[1]	0,944	668	346
392	Dist. Data of MX-HO-A1_5	[1]	0,955	703	408
393	Dist. Data of MX-HO-A1_6	[1]	0,968	727	436
394	Dist. Data of MX-HO-A1_7	[1]	0,971	762	468
395	Dist. Data of CO-B-B1_0	[1]	0,916	582	234
396	Dist. Data of CO-B-B1_1	[1]	0,900	594	281
397	Dist. Data of CO-B-B1_2	[1]	0,902	619	306
398	Dist. Data of CO-B-B1_3	[1]	0,900	643	350
399	Dist. Data of CO-B-B1_4	[1]	0,895	668	388
400	Dist. Data of CO-B-B1_5	[1]	0,879	703	432
401	Dist. Data of CO-B-B1_6	[1]	0,867	727	447
402	Dist. Data of CO-B-B1_7	[1]	0,984	762	476
403	Dist. Data of US-OH-A1_0	[1]	0,871	582	227
404	Dist. Data of US-OH-A1_1	[1]	0,903	594	261
405	Dist. Data of US-OH-A1_2	[1]	0,920	619	295
406	Dist. Data of US-OH-A1_3	[1]	0,928	643	337
407	Dist. Data of US-OH-A1_4	[1]	0,938	668	372
408	Dist. Data of US-OH-A1_5	[1]	0,950	703	411
409	Dist. Data of US-OH-A1_6	[1]	0,960	727	485
410	Dist. Data of US-OH-A1_7	[1]	0,963	762	493
411	Dist. Data of WC-B-D1_0	[1]	0,951	582	225
412	Dist. Data of WC-B-D1_1	[1]	0,972	594	259
413	Dist. Data of WC-B-D1_2	[1]	0,986	619	287
414	Dist. Data of WC-B-D1_3	[1]	0,959	643	323
415	Dist. Data of WC-B-D1_4	[1]	0,986	668	372
416	Dist. Data of WC-B-D1_5	[1]	1,008	703	451
417	Dist. Data of WC-B-D1_6	[1]	0,951	727	463
418	Dist. Data of WC-B-D1_7	[1]	0,977	762	546
419	Dist. Data of RO-HO-A1_0	[1]	0,997	582	232
420	Dist. Data of RO-HO-A1_1	[1]	1,177	594	259
421	Dist. Data of RO-HO-A1_2	[1]	1,101	619	289
422	Dist. Data of RO-HO-A1_3	[1]	0,905	643	340
423	Dist. Data of RO-HO-A1_4	[1]	0,912	668	378
424	Dist. Data of RO-HO-A1_5	[1]	0,922	703	399
425	Dist. Data of RO-HO-A1_6	[1]	0,971	727	442
426	Dist. Data of RO-HO-A1_7	[1]	0,986	762	499

427	WC-B-B1	[2]	1,002	810	559
428	WC-B-D1	[2]	0,997	800	585
429	CO-B-A1	[2]	1,006	860	604
430	MX-HO-A1	[2]	0,978	840	653

Table S2. 430 data points for boiling point, specific gravity, Kw-factor, and TBP distillation characteristics and logarithm of molecular weight of petroleum fluids, and individual hydrocarbons to be used for ANN modeling.

	ANN inlet									ANN outlet LN(MW)
Nr	SG	Tb, K	T5	T10	T30	T50	T70	T90	Kw	
1	0,631	306	211	236	285	301	314	345	12,99	4,33
2	0,714	372	306	318	351	370	386	408	12,26	4,60
3	0,721	365	302	312	344	362	378	400	12,07	4,56
4	0,729	373	311	322	352	371	387	408	12,01	4,61
5	0,679	329	256	269	308	325	339	364	12,37	4,41
6	0,709	356	291	302	335	353	368	391	12,16	4,52
7	0,683	332	261	273	311	328	342	367	12,34	4,42
8	0,726	373	311	321	352	371	387	408	12,05	4,60
9	0,721	365	302	312	344	362	378	400	12,07	4,56
10	0,683	332	261	273	311	328	342	367	12,34	4,42
11	0,689	338	268	280	317	334	349	373	12,31	4,44
12	0,691	346	276	288	325	343	357	382	12,35	4,48
13	0,697	346	278	290	325	343	357	381	12,26	4,49
14	0,742	385	325	335	364	383	400	420	11,93	4,65
15	0,712	363	298	309	342	360	376	398	12,19	4,57
16	0,820	492	427	446	471	494	517	537	11,71	5,08
17	0,816	488	424	443	467	490	513	533	11,74	5,08
18	0,832	550	479	504	530	554	580	602	11,97	5,32
19	0,849	602	522	554	582	608	637	661	12,10	5,50
20	0,833	539	468	493	519	543	568	590	11,88	5,26
21	0,856	594	511	544	574	600	629	654	11,94	5,49
22	0,857	575	493	524	555	580	608	633	11,80	5,40
23	0,858	601	517	551	581	607	636	662	11,97	5,49
24	0,862	632	544	581	612	639	670	697	12,10	5,62
25	0,858	592	509	541	572	598	626	652	11,91	5,43
26	0,865	589	502	536	569	595	623	650	11,79	5,44
27	0,864	641	551	589	621	649	680	707	12,14	5,66
28	0,866	644	552	592	624	652	683	711	12,13	5,67
29	0,879	619	520	561	599	626	656	686	11,79	5,58
30	0,877	635	537	578	615	642	673	703	11,93	5,62
31	0,885	638	533	577	618	646	677	709	11,84	5,63
32	0,870	669	574	616	649	678	711	739	12,23	5,79
33	0,845	704	622	661	684	714	749	772	12,81	5,96
34	0,971	890	510	738	870	907	952	1045	12,05	6,58
35	0,961	854	548	720	834	870	913	993	12,02	6,42
36	1,017	898	587	661	878	915	961	1111	11,54	6,59

37	1,080	990	1146	563	971	1011	1062	1358	11,22	7,01
38	1,060	973	984	612	954	993	1043	1285	11,37	6,93
39	0,734	447	378	396	426	447	468	490	12,66	4,96
40	0,792	617	548	577	597	624	654	673	13,07	5,64
41	0,813	723	650	687	703	734	770	789	13,42	6,05
42	0,824	798	722	765	778	811	852	871	13,69	6,33
43	0,835	894	815	865	874	911	957	977	14,04	6,74
44	0,844	988	905	962	969	1008	1059	1080	14,36	7,25
45	0,846	1012	928	987	993	1033	1086	1106	14,44	7,43
46	0,751	322	272	274	301	318	331	349	11,10	4,25
47	0,774	374	320	327	353	372	388	406	11,32	4,58
48	0,826	601	529	558	581	607	636	657	12,43	5,53
49	0,836	696	618	655	676	706	740	762	12,90	5,90
50	0,868	481	401	426	460	483	505	530	10,98	5,02
51	0,872	384	315	329	363	382	399	422	10,14	4,52
52	0,864	457	382	403	436	458	479	503	10,84	4,90
53	0,859	732	641	685	712	743	779	806	12,76	6,03
54	0,859	804	711	760	784	818	858	884	13,17	6,32
55	0,858	895	802	856	875	912	958	983	13,66	6,73
56	0,993	598	213	451	578	604	633	718	10,32	5,37
57	0,927	519	379	437	499	522	547	589	10,54	5,08
58	0,989	554	143	418	534	558	585	663	10,10	5,20
59	1,010	514	310	364	493	517	541	628	9,65	4,96
60	0,981	579	222	448	559	584	612	687	10,34	5,29
61	0,915	733	581	653	713	744	781	826	11,99	5,94
62	1,088	667	804	347	647	676	708	929	9,77	5,46
63	0,985	626	191	484	606	633	664	746	10,57	5,51
64	0,777	560	492	517	540	565	591	611	12,90	5,42
65	0,785	558	491	516	538	563	589	609	12,76	5,41
66	0,705	367	299	312	346	364	380	404	12,35	4,55
67	0,632	309	214	239	288	304	317	348	13,02	4,28
68	0,884	353	283	296	332	350	365	389	9,72	4,36
69	1,176	612	1190	109	592	619	648	1093	8,78	5,18
70	1,379	798	889	939	778	811	852	785	8,18	5,70
71	0,658	328	245	263	307	324	337	365	12,74	4,36
72	0,662	326	246	263	305	322	336	363	12,65	4,37
73	0,657	328	244	263	307	324	337	366	12,76	4,38
74	0,670	331	254	269	310	327	341	368	12,56	4,39
75	0,672	336	259	274	315	333	347	373	12,60	4,41
76	0,665	331	251	268	310	327	341	368	12,66	4,41
77	0,675	335	260	274	314	332	346	371	12,52	4,42

78	0,694	352	282	295	331	349	364	388	12,39	4,48
79	0,703	364	295	308	343	362	377	401	12,37	4,52
80	0,711	366	300	312	345	364	379	402	12,24	4,53
81	0,696	365	294	308	344	363	378	403	12,49	4,53
82	0,709	367	300	312	346	365	381	403	12,29	4,54
83	0,708	367	300	312	346	365	381	403	12,30	4,54
84	0,713	370	304	316	349	368	384	406	12,25	4,56
85	0,716	373	308	320	352	371	387	409	12,23	4,57
86	0,714	382	315	328	361	380	397	419	12,36	4,61
87	0,727	383	320	331	362	381	398	419	12,15	4,62
88	0,724	387	322	334	366	385	402	424	12,25	4,62
89	0,723	383	319	331	362	381	398	420	12,22	4,62
90	0,721	387	321	334	366	385	402	425	12,31	4,63
91	0,730	387	324	336	366	385	402	424	12,15	4,64
92	0,727	394	329	342	373	393	410	432	12,27	4,66
93	0,739	385	325	335	364	383	400	421	11,98	4,67
94	0,735	390	328	340	369	389	406	427	12,10	4,68
95	0,746	406	345	357	385	405	423	443	12,07	4,74
96	0,747	397	337	348	376	396	413	433	11,97	4,74
97	0,740	400	338	350	379	399	416	437	12,12	4,79
98	0,868	437	363	382	416	437	457	481	10,64	4,80
99	0,777	412	354	366	391	411	430	448	11,64	4,88
100	0,762	434	373	387	414	434	454	474	12,08	4,96
101	0,971	519	260	405	499	523	547	610	10,07	5,04
102	0,961	497	288	394	476	499	522	577	10,03	5,04
103	0,980	594	236	462	573	600	628	704	10,43	5,05
104	0,969	518	267	406	498	521	546	607	10,08	5,05
105	0,681	532	427	466	511	535	560	593	14,48	5,11
106	0,973	518	246	402	497	521	545	609	10,04	5,12
107	0,973	519	247	403	498	522	546	610	10,04	5,08
108	0,955	518	319	417	497	521	545	600	10,23	5,12
109	0,936	509	356	422	488	511	535	580	10,37	5,14
110	0,966	538	294	426	518	542	568	629	10,24	5,23
111	0,972	535	266	419	515	539	564	629	10,17	5,23
112	0,848	553	476	504	532	557	583	607	11,78	5,37
113	0,663	335	253	271	314	332	346	373	12,75	4,41
114	0,694	363	291	305	342	361	376	401	12,51	4,52
115	0,700	370	299	314	349	368	384	408	12,48	4,55
116	0,706	377	308	322	356	375	391	415	12,45	4,57
117	0,711	382	314	328	361	380	397	420	12,42	4,61
118	0,728	373	311	322	352	371	387	408	12,03	4,62

119	0,720	374	310	321	353	372	388	410	12,18	4,62
120	0,721	377	313	324	356	375	391	413	12,19	4,62
121	0,726	380	317	328	359	378	395	416	12,14	4,64
122	0,744	385	326	336	364	383	400	420	11,90	4,66
123	0,738	386	325	336	365	384	401	422	12,00	4,67
124	0,742	388	328	339	367	386	403	424	11,96	4,67
125	0,737	389	328	339	368	388	405	425	12,06	4,69
126	0,748	389	330	340	368	388	405	424	11,87	4,69
127	0,736	390	328	340	369	389	406	426	12,08	4,70
128	0,753	400	340	352	379	399	416	436	11,91	4,74
129	0,755	400	341	352	379	399	417	436	11,87	4,74
130	0,747	403	342	354	382	402	420	440	12,03	4,75
131	0,743	401	340	352	380	400	418	438	12,08	4,74
132	0,750	406	346	358	385	405	423	443	12,01	4,76
133	0,756	407	348	359	386	406	424	444	11,93	4,77
134	0,756	420	359	372	399	420	438	458	12,06	4,84
135	0,767	426	366	379	405	426	445	464	11,94	4,84
136	0,772	420	361	374	399	420	438	458	11,80	4,84
137	0,773	421	362	375	400	421	440	459	11,80	4,84
138	0,768	420	361	373	399	420	438	458	11,87	4,84
139	0,774	425	366	379	404	425	444	463	11,82	4,86
140	0,777	426	367	380	405	426	445	464	11,79	4,87
141	0,767	429	369	382	408	428	448	467	11,96	4,87
142	0,771	426	367	380	405	426	445	464	11,87	4,87
143	0,769	432	372	385	411	432	451	470	11,96	4,89
144	0,776	431	372	385	410	431	450	470	11,84	4,89
145	0,779	432	373	386	411	432	452	471	11,81	4,89
146	0,780	438	379	392	417	438	458	477	11,85	4,92
147	0,790	469	408	424	449	470	492	511	11,97	5,03
148	0,789	463	402	418	443	464	485	505	11,93	5,04
149	0,796	469	408	424	449	470	492	511	11,88	5,06
150	0,797	473	411	428	453	475	496	516	11,89	5,08
151	0,803	469	407	424	449	470	492	511	11,77	5,08
152	0,800	480	418	435	460	482	504	523	11,91	5,11
153	0,806	480	417	435	460	482	504	524	11,82	5,11
154	0,803	487	424	442	466	489	512	531	11,93	5,14
155	0,805	434	375	388	413	434	453	472	11,44	4,97
156	0,740	400	338	350	379	399	416	437	12,12	4,79
157	0,762	434	373	387	414	434	454	474	12,08	4,96
158	0,808	480	417	435	459	481	504	523	11,78	5,09
159	0,862	559	476	507	539	564	591	616	11,63	5,43

160	0,848	553	476	504	532	557	583	607	11,78	5,37
161	0,947	494	322	401	473	496	519	568	10,15	4,97
162	0,950	514	330	417	493	516	541	592	10,26	5,08
163	0,955	541	337	439	521	545	571	627	10,39	5,17
164	0,982	567	201	437	547	572	599	673	10,25	5,28
165	0,990	598	159	455	578	604	633	716	10,35	5,36
166	1,022	623	448	434	603	630	660	776	10,17	5,45
167	1,069	647	693	373	626	654	686	867	9,84	5,52
168	1,046	667	607	428	647	675	708	860	10,16	5,57
169	0,963	547	312	437	527	551	577	638	10,33	5,25
170	0,972	575	289	454	555	580	608	676	10,41	5,34
171	0,985	600	179	462	580	606	635	714	10,42	5,40
172	0,999	626	292	467	606	633	663	757	10,41	5,48
173	1,026	664	501	459	644	672	705	831	10,34	5,59
174	1,047	699	639	451	679	709	744	903	10,31	5,72
175	1,066	723	761	428	703	733	769	964	10,24	5,84
176	1,082	738	860	403	718	749	785	1015	10,16	5,81
177	0,907	518	404	447	498	521	546	581	10,77	5,17
178	0,924	544	403	462	523	548	574	616	10,74	5,27
179	0,940	570	394	476	549	575	602	653	10,72	5,35
180	0,953	596	381	490	576	602	631	689	10,74	5,45
181	0,968	619	336	496	599	626	656	726	10,71	5,54
182	0,979	651	280	513	631	659	691	771	10,77	5,63
183	0,972	571	286	450	551	577	604	672	10,39	5,31
184	0,978	595	256	465	575	601	629	704	10,46	5,41
185	0,987	622	122	478	602	629	659	743	10,52	5,50
186	1,015	647	423	463	627	655	687	798	10,37	5,55
187	1,025	666	495	463	646	674	707	832	10,36	5,57
188	1,044	693	620	451	673	703	737	891	10,31	5,74
189	1,032	742	593	510	722	754	791	937	10,67	5,83
190	1,008	750	426	557	730	762	799	917	10,97	5,92
191	1,022	765	544	546	745	777	816	953	10,89	5,99
192	1,022	783	556	560	763	796	835	975	10,97	6,15
193	1,022	808	572	580	788	822	863	1006	11,09	6,19
194	0,907	742	602	668	722	754	791	833	12,14	5,87
195	0,906	750	610	677	730	762	799	841	12,20	5,97
196	0,916	765	607	683	745	777	816	863	12,14	6,04
197	0,920	783	616	698	763	796	835	885	12,19	6,11
198	0,921	808	635	721	788	822	863	914	12,30	6,16
199	0,923	942	754	853	923	961	1009	1064	12,93	6,67
200	0,918	950	772	866	931	969	1018	1070	13,02	6,84

201	0,920	965	782	879	946	985	1034	1088	13,07	6,97
202	0,916	983	807	902	964	1003	1054	1106	13,20	7,02
203	0,919	1008	825	924	989	1029	1081	1135	13,28	7,16
204	1,013	888	539	662	869	905	950	1092	11,54	6,58
205	1,013	893	542	666	873	910	955	1098	11,56	6,59
206	1,013	890	540	663	870	906	952	1094	11,55	6,58
207	1,013	895	543	667	875	912	957	1100	11,57	6,59
208	0,925	892	703	801	873	909	955	1010	12,66	6,58
209	0,924	886	700	796	867	903	948	1003	12,65	6,58
210	0,925	900	710	809	881	917	963	1019	12,70	6,57
211	0,903	698	568	627	678	708	743	782	11,95	5,85
212	0,919	731	571	647	711	742	778	826	11,92	5,94
213	0,896	724	600	658	704	735	771	808	12,19	5,95
214	0,932	744	557	649	724	755	792	847	11,83	6,03
215	0,905	739	602	667	719	751	787	829	12,15	6,05
216	0,913	718	570	639	698	729	764	809	11,92	5,90
217	0,922	711	549	626	691	721	756	805	11,78	5,88
218	0,897	631	514	564	611	638	669	705	11,64	5,65
219	0,871	744	644	692	724	755	792	822	12,65	6,08
220	1,003	738	370	555	718	749	786	897	10,96	5,94
221	0,655	342	254	276	321	339	353	383	12,99	4,46
222	0,684	372	293	311	351	369	385	412	12,79	4,61
223	0,718	424	353	370	403	424	443	466	12,74	4,85
224	0,749	489	421	442	469	491	514	536	12,80	5,14
225	0,756	507	439	461	487	510	534	555	12,82	5,22
226	0,763	527	459	482	506	530	555	576	12,88	5,29
227	0,776	543	476	500	523	547	573	593	12,78	5,35
228	0,773	560	492	517	540	565	591	612	12,97	5,42
229	0,785	575	508	533	555	580	608	628	12,88	5,47
230	0,777	590	521	549	570	596	624	644	13,14	5,54
231	0,786	603	534	563	583	609	639	658	13,08	5,59
232	0,867	409	338	355	388	408	426	450	10,42	4,67
233	0,862	432	361	379	411	432	452	475	10,67	4,79
234	0,860	456	383	404	436	457	478	502	10,89	4,90
235	0,864	412	342	358	391	411	430	453	10,48	4,67
236	0,857	513	436	461	493	516	540	564	11,37	5,17
237	1,025	491	366	329	471	493	516	612	9,36	4,85
238	1,020	518	364	355	497	521	545	641	9,57	4,96
239	0,937	639	457	544	619	647	678	731	11,18	5,54
240	0,640	303	216	236	282	298	310	340	12,76	4,25
241	0,674	337	260	275	316	333	347	373	12,55	4,43

242	0,697	367	295	310	346	364	380	404	12,49	4,59
243	0,714	394	325	340	373	393	410	433	12,49	4,72
244	0,982	388	131	285	367	386	403	458	9,04	4,37
245	1,020	457	319	309	437	458	479	565	9,19	4,53
246	1,170	527	980	106	507	531	555	916	8,40	4,76
247	1,090	510	615	254	490	513	537	711	8,92	4,86
248	0,854	658	573	610	638	666	699	724	12,39	5,71
249	0,854	646	562	598	626	654	686	711	12,31	5,66
250	0,855	632	548	583	612	639	670	695	12,21	5,61
251	0,815	404	347	358	383	403	421	440	11,04	4,97
252	0,894	535	432	470	515	539	564	596	11,05	5,41
253	0,970	702	386	569	682	712	747	824	11,15	5,96
254	0,925	826	643	735	806	840	882	935	12,34	6,43
255	0,860	736	645	689	716	747	784	810	12,78	5,93
256	0,868	748	650	698	728	760	797	826	12,72	6,00
257	0,925	736	564	647	716	747	784	835	11,87	6,03
258	0,877	698	595	642	678	708	742	773	12,30	5,91
259	0,898	728	602	661	708	739	775	813	12,19	6,01
260	0,801	700	629	664	680	710	745	764	13,48	6,05
261	0,863	655	565	604	635	663	695	722	12,25	5,65
262	0,910	666	529	590	646	675	707	749	11,67	5,73
263	0,930	735	553	642	715	746	783	836	11,80	6,20
264	0,903	736	602	665	716	747	784	824	12,17	6,07
265	0,941	718	512	615	698	728	764	823	11,58	5,91
266	0,953	693	455	580	673	703	737	802	11,30	5,72
267	1,059	733	737	450	713	744	781	967	10,35	5,85
268	0,982	656	257	515	636	665	697	780	10,77	5,81
269	0,991	714	165	552	694	724	759	856	10,97	6,04
270	1,004	748	387	562	728	760	797	911	11,00	6,15
271	1,007	786	435	588	766	799	838	960	11,14	6,26
272	1,014	824	516	607	804	838	880	1015	11,25	6,39
273	1,021	861	595	625	842	877	921	1070	11,34	6,52
274	1,024	899	647	647	879	916	962	1121	11,46	6,63
275	1,024	944	675	683	924	963	1011	1177	11,65	6,77
276	0,969	643	347	516	622	650	682	754	10,83	5,80
277	0,979	702	319	558	682	712	747	831	11,05	5,99
278	0,979	748	350	599	728	760	797	885	11,29	6,15
279	0,979	786	376	633	766	799	838	930	11,47	6,31
280	0,988	825	265	654	806	840	882	986	11,55	6,41
281	1,004	866	428	661	847	882	926	1054	11,55	6,56
282	1,011	896	518	673	876	913	959	1098	11,60	6,67

283	1,014	946	578	707	927	965	1013	1164	11,78	6,86
284	0,954	623	397	514	603	630	660	722	10,89	5,72
285	0,960	698	430	576	678	707	742	812	11,24	6,02
286	0,985	749	273	592	729	761	798	892	11,22	6,17
287	0,991	795	39	622	776	809	849	954	11,37	6,31
288	0,998	824	317	637	805	839	880	995	11,43	6,43
289	1,004	862	426	657	842	878	922	1048	11,53	6,51
290	1,011	890	516	668	871	907	953	1092	11,58	6,63
291	1,014	925	568	691	906	944	991	1139	11,69	6,72
292	1,014	981	594	737	962	1002	1052	1207	11,92	6,84
293	0,988	647	114	499	627	655	687	773	10,65	5,75
294	0,988	707	170	551	687	717	752	845	10,97	5,95
295	0,988	748	204	586	728	760	797	894	11,18	6,11
296	0,998	789	313	607	769	802	842	953	11,27	6,24
297	0,994	825	241	643	806	840	882	993	11,48	6,38
298	1,014	836	522	617	816	851	893	1030	11,30	6,40
299	1,017	876	575	644	857	893	937	1084	11,44	6,54
300	1,024	934	670	676	915	953	1001	1166	11,61	6,73
301	1,038	968	809	669	949	988	1038	1232	11,59	6,83
302	0,931	655	483	564	635	663	695	746	11,35	5,81
303	0,954	709	462	593	689	719	754	821	11,37	6,06
304	0,972	787	428	643	767	800	840	926	11,55	6,29
305	0,991	860	185	678	840	876	919	1030	11,67	6,51
306	1,011	920	529	693	901	938	985	1128	11,71	6,77
307	0,913	656	515	578	636	664	696	739	11,57	5,75
308	0,927	696	527	607	676	706	740	790	11,63	5,85
309	0,930	726	545	633	706	737	773	826	11,75	5,94
310	0,938	746	544	645	726	758	795	853	11,77	6,02
311	0,795	509	445	466	489	512	536	556	12,22	5,28
312	0,785	465	404	420	445	466	488	507	12,01	5,00
313	0,865	561	476	508	541	566	593	619	11,61	5,33
314	0,921	695	537	611	675	704	738	785	11,70	6,00
315	0,877	635	537	578	615	643	674	704	11,93	5,62
316	0,899	569	457	502	549	574	601	636	11,22	5,43
317	0,906	690	556	617	670	700	734	774	11,87	5,87
318	0,905	626	501	554	606	633	663	702	11,50	5,61
319	0,884	616	513	555	595	622	652	684	11,71	5,60
320	0,884	643	538	583	623	651	682	714	11,88	5,52
321	0,904	634	509	563	614	642	673	711	11,56	5,64
322	0,905	639	512	567	619	647	678	716	11,58	5,77
323	0,945	634	433	532	614	641	672	729	11,06	5,81

324	0,906	642	513	569	622	650	681	720	11,58	5,69
325	0,957	621	386	509	600	628	658	720	10,84	5,63
326	0,909	651	517	576	631	659	691	731	11,59	5,78
327	0,964	704	418	578	684	714	749	822	11,23	5,90
328	0,892	638	525	574	618	646	677	711	11,74	5,70
329	0,686	337	266	279	316	333	348	372	12,35	4,43
330	0,723	365	303	313	344	363	378	400	12,03	4,56
331	0,746	390	330	341	369	388	405	425	11,92	4,67
332	0,765	415	356	368	395	415	433	453	11,87	4,80
333	0,779	439	379	393	418	439	459	478	11,87	4,90
334	0,790	460	399	415	440	461	482	502	11,89	4,99
335	0,801	481	419	437	461	483	505	525	11,91	5,08
336	0,812	500	436	456	480	503	526	546	11,90	5,16
337	0,823	520	452	474	499	523	547	568	11,89	5,19
338	0,833	539	469	493	519	543	569	590	11,89	5,33
339	0,840	556	483	510	536	561	587	610	11,92	5,40
340	0,848	573	495	525	553	578	606	629	11,92	5,47
341	0,853	586	506	537	566	592	620	645	11,94	5,53
342	0,858	598	514	548	578	604	633	658	11,95	5,57
343	0,883	611	510	551	591	618	647	678	11,69	5,62
344	0,868	624	533	571	604	631	662	689	11,98	5,67
345	0,873	636	541	581	616	644	675	704	11,99	5,72
346	0,878	648	548	591	628	656	688	718	11,99	5,76
347	0,882	659	555	600	639	668	700	731	12,01	5,80
348	0,886	670	561	609	650	679	712	745	12,02	5,84
349	0,890	681	567	618	661	690	724	758	12,03	5,88
350	0,894	691	572	626	671	700	735	770	12,03	5,92
351	0,897	701	578	634	681	711	745	783	12,05	5,96
352	0,900	709	582	640	689	719	755	793	12,06	6,00
353	0,903	719	586	648	699	729	765	805	12,07	6,03
354	0,907	728	589	654	708	738	775	816	12,07	6,06
355	0,910	736	592	660	717	748	784	828	12,07	6,10
356	0,913	745	595	666	725	756	793	838	12,08	6,13
357	0,915	753	598	672	733	764	802	848	12,10	6,16
358	0,918	760	599	677	740	772	810	858	12,09	6,19
359	0,920	768	603	683	748	780	818	867	12,11	6,21
360	0,923	773	601	686	753	786	824	875	12,10	6,24
361	0,925	781	605	692	762	794	834	886	12,12	6,27
362	0,929	788	602	695	768	801	841	895	12,10	6,30
363	0,929	795	608	702	776	809	849	904	12,13	6,32
364	0,931	801	608	705	781	814	855	911	12,14	6,35

365	0,932	807	611	710	787	821	861	919	12,15	6,37
366	0,934	813	611	714	793	827	868	927	12,16	6,39
367	0,936	820	612	719	801	835	876	936	12,17	6,42
368	0,938	826	611	722	806	840	882	944	12,17	6,44
369	1,527	811	1149	2300	791	825	866	455	7,43	6,00
370	1,483	826	1143	1885	806	841	882	541	7,70	6,03
371	1,451	828	1111	1578	808	843	885	613	7,87	6,07
372	1,420	844	1081	1336	825	859	902	702	8,09	6,10
373	1,285	865	1243	374	846	881	925	1292	9,02	6,30
374	1,173	911	1781	182	892	929	975	1623	10,05	6,53
375	0,911	811	657	733	791	825	866	912	12,45	6,22
376	0,941	824	599	716	805	839	880	945	12,12	6,31
377	0,875	744	641	691	724	755	793	823	12,60	5,96
378	1,049	747	694	481	727	759	796	968	10,52	5,99
379	0,902	582	465	512	562	587	615	652	11,26	5,46
380	0,925	594	443	510	574	600	629	674	11,05	5,55
381	0,946	619	419	517	599	626	656	712	10,96	5,71
382	0,961	643	387	525	623	651	682	749	10,93	5,80
383	0,970	668	359	538	648	677	709	784	10,96	5,94
384	0,981	703	297	556	683	713	748	834	11,03	5,99
385	0,993	727	217	561	707	738	774	874	11,02	6,16
386	0,998	762	311	584	742	774	812	920	11,14	6,25
387	0,863	582	497	530	562	587	615	641	11,78	5,33
388	0,903	594	474	523	574	600	629	665	11,32	5,58
389	0,921	619	471	537	599	626	656	700	11,26	5,65
390	0,933	643	470	551	623	651	682	733	11,26	5,79
391	0,944	668	461	564	648	677	709	768	11,26	5,84
392	0,955	703	456	587	683	713	748	814	11,33	6,01
393	0,968	727	413	594	707	738	774	852	11,30	6,08
394	0,971	762	418	622	742	774	812	895	11,44	6,15
395	0,916	582	447	504	562	587	615	656	11,09	5,45
396	0,900	594	477	525	574	600	629	664	11,36	5,64
397	0,902	619	498	549	599	626	656	693	11,50	5,72
398	0,900	643	521	574	623	651	682	719	11,66	5,86
399	0,895	668	549	602	648	677	709	745	11,88	5,96
400	0,879	703	599	646	683	713	748	779	12,31	6,07
401	0,867	727	631	677	707	738	774	802	12,62	6,10
402	0,984	762	296	604	742	774	812	907	11,29	6,17
403	0,871	582	491	527	562	587	615	643	11,66	5,42
404	0,903	594	474	524	574	600	629	665	11,32	5,56
405	0,920	619	473	537	599	626	656	700	11,27	5,69

406	0,928	643	479	555	623	651	682	731	11,31	5,82
407	0,938	668	478	570	648	677	709	764	11,34	5,92
408	0,950	703	472	592	683	713	748	812	11,38	6,02
409	0,960	727	452	603	707	738	774	846	11,39	6,18
410	0,963	762	467	632	742	774	812	889	11,54	6,20
411	0,951	582	376	478	562	587	615	672	10,68	5,42
412	0,972	594	302	471	574	600	629	698	10,53	5,56
413	0,986	619	167	477	599	626	656	738	10,52	5,66
414	0,959	643	395	527	623	651	682	748	10,95	5,78
415	0,986	668	204	520	648	677	709	796	10,79	5,92
416	1,008	703	407	518	683	713	748	860	10,73	6,11
417	0,951	727	486	613	707	738	774	840	11,50	6,14
418	0,977	762	375	614	742	774	812	900	11,37	6,30
419	0,997	582	256	433	562	587	615	702	10,19	5,45
420	1,177	594	1157	103	574	600	629	1063	8,69	5,56
421	1,101	619	802	293	599	626	656	886	9,42	5,67
422	0,905	643	515	571	623	651	682	721	11,60	5,83
423	0,912	668	528	591	648	677	709	752	11,66	5,94
424	0,922	703	542	618	683	713	748	796	11,73	5,99
425	0,971	727	394	590	707	738	774	854	11,26	6,09
426	0,986	762	254	601	742	774	812	909	11,27	6,21
427	1,002	810	384	617	790	824	865	983	11,32	6,33
428	0,997	800	307	617	780	814	854	966	11,33	6,37
429	1,006	860	447	653	840	876	919	1048	11,50	6,40
430	0,978	840	420	682	820	855	898	993	11,74	6,48

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