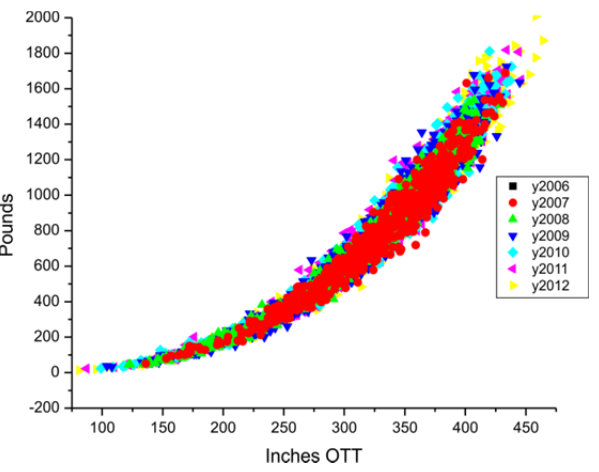
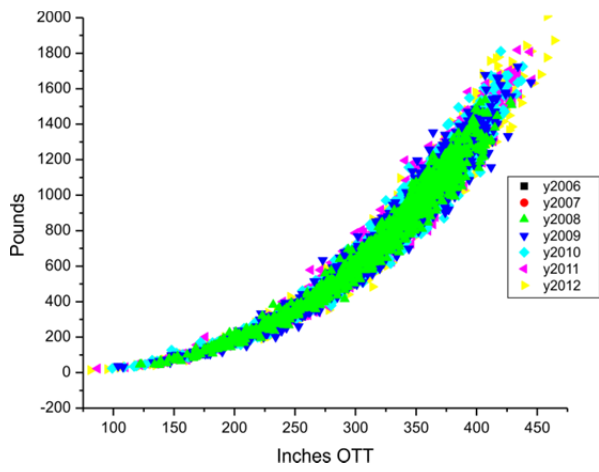
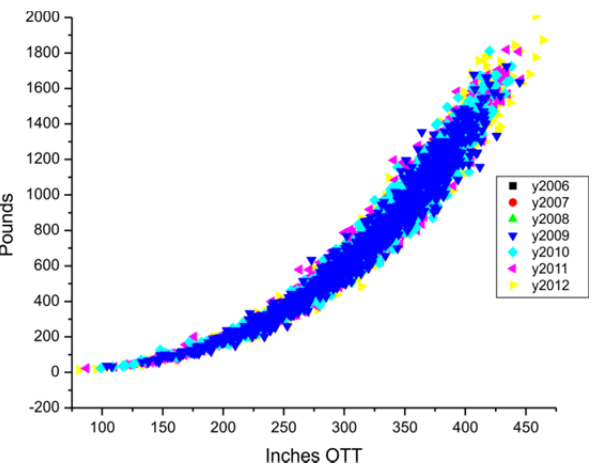
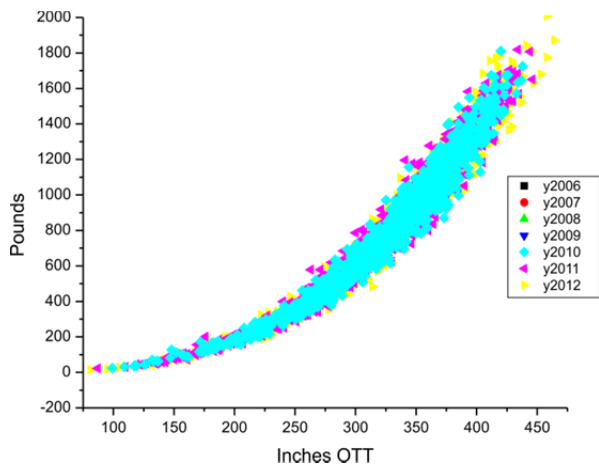
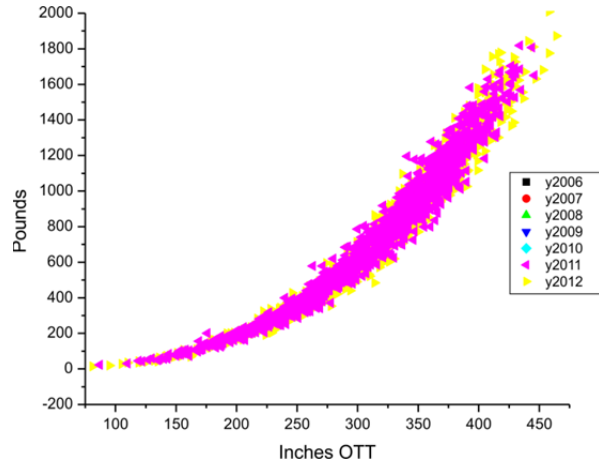
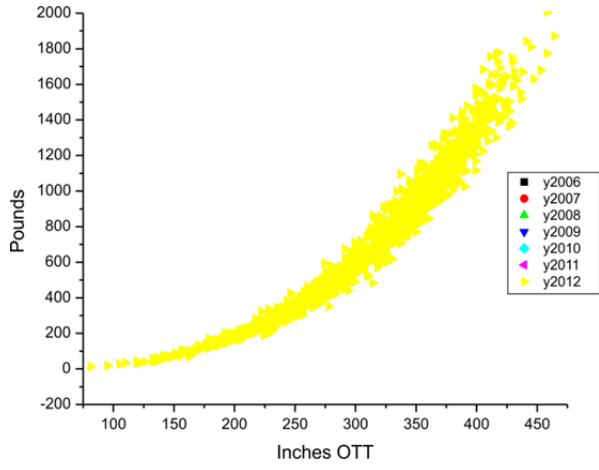


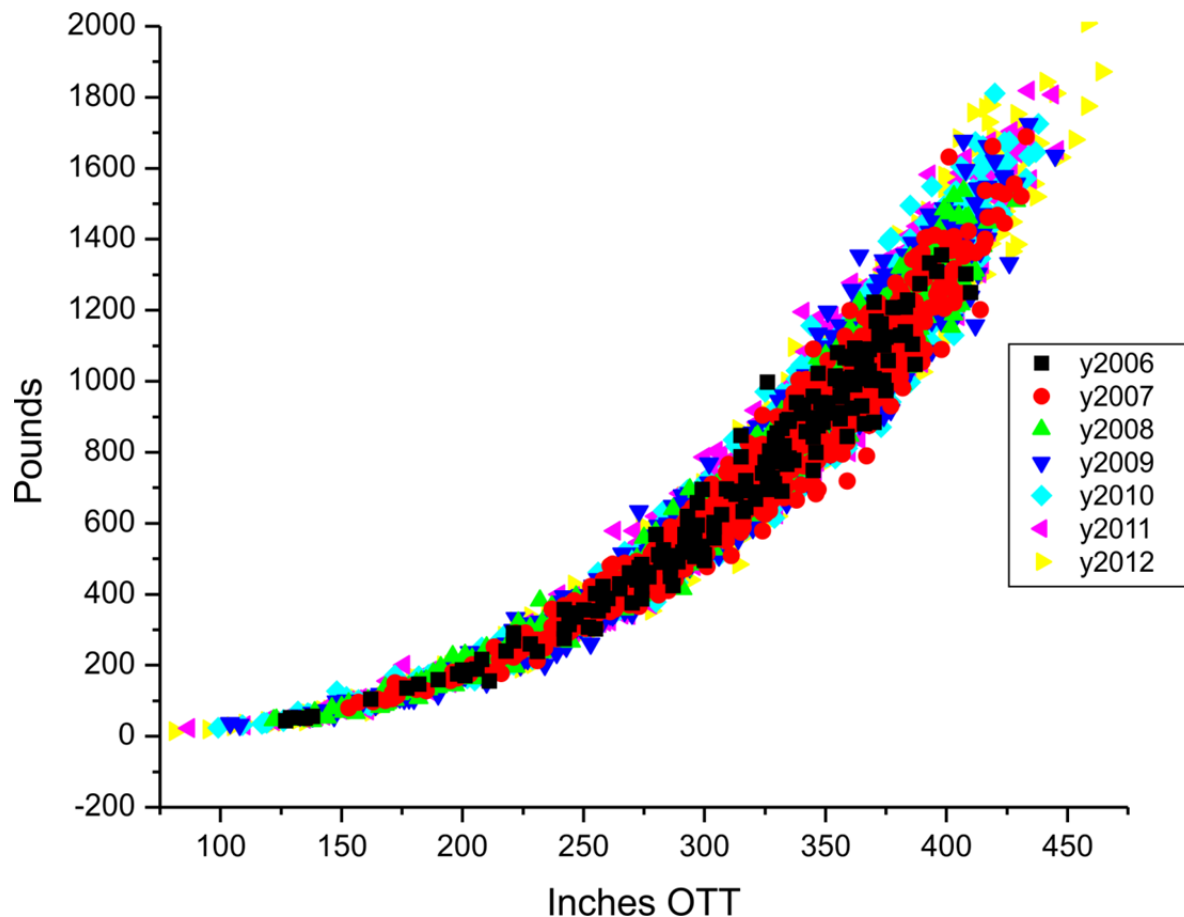
## Team-Pumpkin 2013 Enhanced OTT Table for Estimating Pumpkin Weights

Many growers in recent years have voiced the complaint that too many pumpkins seem to be 'lite to the chart'. This has been especially noticeable at the upper range of the available charts. It appears the form of the equation for the recent charts has changed from earlier years. A better chart is needed so I decided it would be a fine winter project to produce one for Team-Pumpkin.

There are a number of issues that contribute to the problem of finding the best fit which will allow extrapolation beyond the sample data with confidence. An inherent problem of the data is the index we use to evaluate the weight is itself a sum of other measurements. Each of these is done by an array of growers. While they try to follow guidelines for measuring, the shape of the pumpkins can be challenging to get consistent measurements. If you have 3 people measure a pumpkin it is most likely they will all get slightly different values. This adds to the problem of finding a curve fit to the data due to scatter. With more scatter a larger sample population is required to get the fit.

How large does the sample population need to be and which samples to use is a question. It has been suggested our pumpkin genetics have changed over the years so we need to use current genetic data for the sample so it will represent our current pumpkins. It's a reasonable question and something to consider. The integrity of the data itself was addressed by using only data from sanctioned weigh offs as recorded by BigPumpkins.com. With most data sets of this type there are data entry errors and anomalies. I began with a large scatter plot of pumpkins from 2006 through 2012. After removing obvious errors and extreme outliers there are approximately 6500 pumpkins. Once the data was purged of these points I proceeded to run the analysis to find the best curve fit for each year's data. If the genetics are changing we should see a progressive change in the equations that fit the various sample populations. The best fit equation form was always the same. There was no progressive change in the plotted equations as they vary with each year's sample population. Our pumpkins are getting bigger but the relationship of OTT to Weight has not changed. This is easily shown in the following scatter plots. I begin with the most recent (2012) and overlay each preceding year. Each preceding year fits neatly within the previous year's population.





Pumpkin shape is always a question. Long ones vs. wide ones or simply more normal ones. I wanted to know if the shape of the pumpkins would alter the curve fits. As you know most pumpkins are almost equal in OTT from end to end vs. side to side. I looked at the ratio  $ee/ss$  as an indicator of shape. I arbitrarily defined normal pumpkins as having this ratio equal to the mean plus or minus 1 standard deviation. This permitted me to separate pumpkins into long, normal and wide. In short, long pumpkins have a fit almost exactly the same as normal pumpkins. Wide pumpkins have a slightly different equation. The wide equation is not an especially good fit because the number of samples is too small. By my definition the 2009 Wallace was a 'wide' pumpkin which was confirmed by asking an experienced grower who has seen it first hand to describe whether he thought it was 'normal', 'long' or 'wide'. The reply was 'high' but if he had to choose from my groups then it would be wide. The estimate for that pumpkin using the equation for wide pumpkins was especially bad. In the future perhaps I will have enough wide pumpkins to re-evaluate that group. It's interesting to note that when the long and wide pumpkins are removed from the sample population the fit for normal pumpkins becomes unreliable. I have not yet looked to see if there is a relationship between the weights of the pumpkins and their shape. Are the biggest pumpkins longer or wider etc.? Pumpkin

height would be an interesting parameter to look at but I couldn't find a way to look at that from the existing data.

I used the equation fit for each year's data to estimate the weights for all the years. The sum of the errors of the estimates (% heavy or lite) should be zero in a perfect fit. The sums of the errors are better with some equations than others but never as good as when all the data was used.

The Standard Team-Pumpkin Table when used to estimate all of the pumpkins from 2006 to 2012 yields

Sum of the errors = **0.05%**

When used to estimate only 2012 pumpkins yields

Sum of the errors = **0.3%**

Examples

- a) WR 2009 estimates at 2021.1
- b) The smallest pumpkin recorded in 2012 on BP weighs 2 pounds with an estimate =1.9

By comparison, the available table for use in 2012 for all pumpkins from 2006 to 2012 yields

Sum of the errors = **-0.8%**

When used to estimate only 2012 pumpkins yields

Sum of the errors = **-1.1%** (this means more pumpkins went lite)

Examples

- a) WR 2009 estimates at 2045.5
- b) The smallest pumpkin recorded in 2012 on BP weighs 2 pounds with an estimate =11.8

The scatter plots above show while the genetics may be changing the population is the same only we are growing bigger pumpkins giving us more data points in the higher range. The increase in sample size with better distribution yields a better fit for use in the standard table. In spite of that the curve fit could be better. The Team-Pumpkin Standard table is an improvement over the existing table but is not created from the equation that is more likely to fit the population. It is more likely the curve should become sigmoidal. There are suggestions in the sample population that this may be starting but there simply are not enough data points at the higher end. In fact when the data is fit to a sigmoidal equation form the fit is poor. The current table is a compromise between what should be and what works.

We use the estimate for two reasons. First is to provide an estimate of how the pumpkin is growing during the season. Later we use the estimate to give insight into which pumpkin seeds to plant based on their relationship to the normal curve. We all want to grow the ones that are heavier for their size. The percent heavy or lite has influence so the better the estimate for all pumpkins the better it will be to tease out the ones that are truly heavier than the rest for their size. So what is heavy to the chart? With as much scatter as we have in the data it's difficult to be precise which leads us to the Team-Pumpkin Enhanced Table. For a pumpkin to be truly heavier for its size it needs to be above the range of the table error. The scatter in pounds increases as the pumpkins get heavier. When calculating % heavy you need to consider the number of pounds above the range of error. For example, if the OTT has an error of plus or minus 50 pounds then a pumpkin that is 49 pounds heavier than the standard chart will be ZERO percent heavy. This is the basis for the enhanced chart. The error range in the chart is a compromise from the statistical error range which growers wouldn't like but it's a fair evaluation and a starting place. If used for 2012 pumpkins many more would be 'to the chart' and others would have significantly smaller heavy or lite %. (nobody likes lite pumpkins except you competition when it's yours).

Even with the enhanced chart method you should use caution when interpreting you pumpkin based on the highest ranges (gray background). Extrapolation is risky and there is suggestion the form of the curve/equation may change with new data.

# Team-Pumpkin, 2013 Standard OTT Chart for Estimating Pumpkin Weights

Copyright © 2013 Team-Pumpkin. All rights reserved

Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds
100	25	136	60	172	119	208	206	244	326	280	486	316	690	352	943	388	1250	424	1617	460	2047
101	25	137	61	173	121	209	208	245	330	281	491	317	696	353	951	389	1260	425	1628	461	2060
102	26	138	63	174	123	210	211	246	334	282	496	318	703	354	959	390	1269	426	1639	462	2073
103	27	139	64	175	125	211	214	247	338	283	501	319	709	355	967	391	1278	427	1650	463	2086
104	28	140	65	176	127	212	217	248	342	284	507	320	716	356	974	392	1288	428	1661	464	2099
105	28	141	67	177	129	213	220	249	346	285	512	321	722	357	982	393	1297	429	1672	465	2112
106	29	142	68	178	131	214	223	250	350	286	517	322	729	358	990	394	1307	430	1684	466	2125
107	30	143	69	179	133	215	226	251	354	287	522	323	735	359	998	395	1317	431	1695	467	2138
108	31	144	71	180	135	216	229	252	358	288	527	324	742	360	1006	396	1326	432	1706	468	2152
109	32	145	72	181	137	217	232	253	362	289	533	325	748	361	1015	397	1336	433	1718	469	2165
110	32	146	74	182	140	218	235	254	367	290	538	326	755	362	1023	398	1346	434	1729	470	2178
111	33	147	75	183	142	219	239	255	371	291	544	327	762	363	1031	399	1356	435	1741	471	2192
112	34	148	77	184	144	220	242	256	375	292	549	328	769	364	1039	400	1366	436	1753	472	2205
113	35	149	78	185	146	221	245	257	379	293	554	329	775	365	1047	401	1375	437	1764	473	2219
114	36	150	80	186	149	222	248	258	384	294	560	330	782	366	1056	402	1385	438	1776	474	2232
115	37	151	81	187	151	223	251	259	388	295	565	331	789	367	1064	403	1395	439	1788	475	2246
116	38	152	83	188	153	224	255	260	392	296	571	332	796	368	1073	404	1405	440	1800	476	2260
117	39	153	84	189	156	225	258	261	397	297	577	333	803	369	1081	405	1416	441	1811	477	2274
118	40	154	86	190	158	226	261	262	401	298	582	334	810	370	1090	406	1426	442	1823	478	2287
119	41	155	88	191	161	227	265	263	405	299	588	335	817	371	1098	407	1436	443	1835	479	2301
120	42	156	89	192	163	228	268	264	410	300	594	336	824	372	1107	408	1446	444	1847	480	2315
121	43	157	91	193	166	229	272	265	414	301	599	337	831	373	1115	409	1456	445	1859	481	2329
122	44	158	93	194	168	230	275	266	419	302	605	338	838	374	1124	410	1467	446	1872	482	2343
123	45	159	94	195	171	231	279	267	424	303	611	339	846	375	1133	411	1477	447	1884	483	2357
124	46	160	96	196	173	232	282	268	428	304	617	340	853	376	1142	412	1488	448	1896	484	2372
125	47	161	98	197	176	233	286	269	433	305	623	341	860	377	1150	413	1498	449	1908	485	2386
126	48	162	100	198	178	234	289	270	438	306	629	342	868	378	1159	414	1509	450	1921	486	2400
127	49	163	101	199	181	235	293	271	442	307	635	343	875	379	1168	415	1519	451	1933	487	2414
128	50	164	103	200	183	236	296	272	447	308	641	344	882	380	1177	416	1530	452	1945	488	2429
129	52	165	105	201	186	237	300	273	452	309	647	345	890	381	1186	417	1540	453	1958	489	2443
130	53	166	107	202	189	238	304	274	457	310	653	346	897	382	1195	418	1551	454	1970	490	2458
131	54	167	109	203	192	239	307	275	461	311	659	347	905	383	1204	419	1562	455	1983	491	2472
132	55	168	111	204	194	240	311	276	466	312	665	348	912	384	1213	420	1573	456	1996	492	2487
133	56	169	113	205	197	241	315	277	471	313	671	349	920	385	1222	421	1584	457	2008	493	2501
134	58	170	115	206	200	242	319	278	476	314	677	350	928	386	1232	422	1595	458	2021	494	2516
135	59	171	117	207	203	243	322	279	481	315	684	351	935	387	1241	423	1606	459	2034	495	2531

# Team-Pumpkin, 2013 Enhanced OTT Chart for Estimating Pumpkin Weights

Copyright © 2013 Team-Pumpkin. All rights reserved

Inches	EST	Inches	EST	Inches	EST	Inches	EST	Inches	EST	Inches	EST
100	22 - 26	135	53 - 63	170	104 - 124	205	179 - 214	240	284 - 338	275	421 - 501
101	23 - 27	136	54 - 65	171	106 - 126	206	182 - 217	241	287 - 342	276	425 - 506
102	23 - 28	137	56 - 66	172	108 - 128	207	185 - 220	242	290 - 346	277	430 - 512
103	24 - 29	138	57 - 68	173	110 - 131	208	187 - 223	243	294 - 350	278	434 - 517
104	25 - 30	139	58 - 69	174	111 - 133	209	190 - 226	244	297 - 354	279	439 - 522
105	25 - 30	140	59 - 71	175	113 - 135	210	192 - 229	245	301 - 358	280	443 - 528
106	26 - 31	141	60 - 72	176	115 - 137	211	195 - 232	246	305 - 363	281	448 - 533
107	27 - 32	142	62 - 73	177	117 - 140	212	198 - 236	247	308 - 367	282	453 - 539
108	28 - 33	143	63 - 75	178	119 - 142	213	201 - 239	248	312 - 371	283	457 - 544
109	28 - 34	144	64 - 77	179	121 - 144	214	203 - 242	249	315 - 376	284	462 - 550
110	29 - 35	145	66 - 78	180	123 - 147	215	206 - 245	250	319 - 380	285	467 - 556
111	30 - 36	146	67 - 80	181	125 - 149	216	209 - 249	251	323 - 385	286	471 - 561
112	31 - 37	147	68 - 81	182	127 - 151	217	212 - 252	252	327 - 389	287	476 - 567
113	32 - 38	148	70 - 83	183	129 - 154	218	215 - 255	253	330 - 393	288	481 - 573
114	32 - 39	149	71 - 85	184	131 - 156	219	217 - 259	254	334 - 398	289	486 - 579
115	33 - 40	150	72 - 86	185	133 - 159	220	220 - 262	255	338 - 403	290	491 - 584
116	34 - 41	151	74 - 88	186	135 - 161	221	223 - 266	256	342 - 407	291	496 - 590
117	35 - 42	152	75 - 90	187	137 - 164	222	226 - 269	257	346 - 412	292	501 - 596
118	36 - 43	153	77 - 91	188	140 - 166	223	229 - 273	258	350 - 416	293	506 - 602
119	37 - 44	154	78 - 93	189	142 - 169	224	232 - 276	259	354 - 421	294	511 - 608
120	38 - 45	155	80 - 95	190	144 - 171	225	235 - 280	260	358 - 426	295	516 - 614
121	39 - 46	156	81 - 97	191	146 - 174	226	238 - 284	261	362 - 431	296	521 - 620
122	40 - 47	157	83 - 98	192	148 - 177	227	241 - 287	262	366 - 435	297	526 - 626
123	40 - 48	158	84 - 100	193	151 - 179	228	244 - 291	263	370 - 440	298	531 - 632
124	41 - 49	159	86 - 102	194	153 - 182	229	247 - 295	264	374 - 445	299	536 - 639
125	42 - 51	160	87 - 104	195	155 - 185	230	251 - 298	265	378 - 450	300	541 - 645
126	43 - 52	161	89 - 106	196	158 - 188	231	254 - 302	266	382 - 455	301	547 - 651
127	44 - 53	162	91 - 108	197	160 - 190	232	257 - 306	267	386 - 460	302	552 - 657
128	46 - 54	163	92 - 110	198	162 - 193	233	260 - 310	268	390 - 465	303	557 - 664
129	47 - 56	164	94 - 112	199	165 - 196	234	263 - 314	269	395 - 470	304	563 - 670
130	48 - 57	165	95 - 114	200	167 - 199	235	267 - 318	270	399 - 475	305	568 - 676
131	49 - 58	166	97 - 116	201	169 - 202	236	270 - 322	271	403 - 480	306	573 - 683
132	50 - 59	167	99 - 118	202	172 - 205	237	273 - 326	272	408 - 485	307	579 - 689
133	51 - 61	168	101 - 120	203	174 - 208	238	277 - 330	273	412 - 491	308	584 - 696
134	52 - 62	169	102 - 122	204	177 - 211	239	280 - 334	274	416 - 496	309	590 - 702

# Team-Pumpkin, 2013 Enhanced OTT Chart for Estimating Pumpkin Weights

Copyright © 2013 Team-Pumpkin. All rights reserved

Inches	EST	Inches	EST	Inches	EST	Inches	EST	Inches	EST	Inches	EST
310	595 - 709	345	812 - 967	380	1074 - 1279	415	1386 - 1651	450	1753 - 2087	485	2178 - 2593
311	601 - 716	346	819 - 975	381	1082 - 1289	416	1396 - 1662	451	1764 - 2101	486	2191 - 2608
312	607 - 722	347	826 - 983	382	1091 - 1299	417	1406 - 1674	452	1776 - 2114	487	2204 - 2624
313	612 - 729	348	832 - 991	383	1099 - 1308	418	1416 - 1686	453	1787 - 2128	488	2217 - 2640
314	618 - 736	349	839 - 1000	384	1107 - 1318	419	1426 - 1697	454	1798 - 2141	489	2230 - 2655
315	624 - 743	350	846 - 1008	385	1116 - 1328	420	1435 - 1709	455	1810 - 2155	490	2243 - 2671
316	629 - 750	351	853 - 1016	386	1124 - 1338	421	1445 - 1721	456	1822 - 2169	491	2257 - 2687
317	635 - 756	352	861 - 1025	387	1132 - 1348	422	1455 - 1733	457	1833 - 2183	492	2270 - 2703
318	641 - 763	353	868 - 1033	388	1141 - 1359	423	1465 - 1745	458	1845 - 2196	493	2283 - 2719
319	647 - 770	354	875 - 1042	389	1150 - 1369	424	1475 - 1757	459	1856 - 2210	494	2297 - 2735
320	653 - 777	355	882 - 1050	390	1158 - 1379	425	1485 - 1769	460	1868 - 2224	495	2310 - 2751
321	659 - 784	356	889 - 1059	391	1167 - 1389	426	1496 - 1781	461	1880 - 2238	496	2324 - 2767
322	665 - 792	357	896 - 1067	392	1175 - 1399	427	1506 - 1793	462	1892 - 2252	497	2337 - 2783
323	671 - 799	358	904 - 1076	393	1184 - 1410	428	1516 - 1805	463	1904 - 2267	498	2351 - 2799
324	677 - 806	359	911 - 1085	394	1193 - 1420	429	1526 - 1817	464	1916 - 2281	499	2365 - 2816
325	683 - 813	360	918 - 1094	395	1202 - 1431	430	1537 - 1830	465	1928 - 2295	500	2379 - 2832
326	689 - 820	361	926 - 1102	396	1210 - 1441	431	1547 - 1842	466	1940 - 2309		
327	695 - 828	362	933 - 1111	397	1219 - 1452	432	1557 - 1854	467	1952 - 2324		
328	701 - 835	363	941 - 1120	398	1228 - 1462	433	1568 - 1867	468	1964 - 2338		
329	708 - 842	364	948 - 1129	399	1237 - 1473	434	1578 - 1879	469	1976 - 2353		
330	714 - 850	365	956 - 1138	400	1246 - 1484	435	1589 - 1892	470	1988 - 2367		
331	720 - 857	366	963 - 1147	401	1255 - 1495	436	1600 - 1905	471	2001 - 2382		
332	726 - 865	367	971 - 1156	402	1264 - 1505	437	1610 - 1917	472	2013 - 2397		
333	733 - 872	368	979 - 1165	403	1274 - 1516	438	1621 - 1930	473	2025 - 2411		
334	739 - 880	369	987 - 1175	404	1283 - 1527	439	1632 - 1943	474	2038 - 2426		
335	746 - 888	370	994 - 1184	405	1292 - 1538	440	1642 - 1956	475	2050 - 2441		
336	752 - 895	371	1002 - 1193	406	1301 - 1549	441	1653 - 1969	476	2063 - 2456		
337	759 - 903	372	1010 - 1203	407	1310 - 1560	442	1664 - 1981	477	2075 - 2471		
338	765 - 911	373	1018 - 1212	408	1320 - 1571	443	1675 - 1994	478	2088 - 2486		
339	772 - 919	374	1026 - 1221	409	1329 - 1583	444	1686 - 2008	479	2101 - 2501		
340	778 - 927	375	1034 - 1231	410	1339 - 1594	445	1697 - 2021	480	2113 - 2516		
341	785 - 935	376	1042 - 1240	411	1348 - 1605	446	1708 - 2034	481	2126 - 2531		
342	792 - 943	377	1050 - 1250	412	1358 - 1616	447	1719 - 2047	482	2139 - 2547		
343	798 - 951	378	1058 - 1260	413	1367 - 1628	448	1730 - 2060	483	2152 - 2562		
344	805 - 959	379	1066 - 1269	414	1377 - 1639	449	1742 - 2074	484	2165 - 2577		



