
Digits in Units and Tens Places of 2-PrimeFactors Numbers till 1 Trillion

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Abstract

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Prime number;
 k -PrimeFactors number;
2-PrimeFactors number;
Digits in units and tens places.

'2-PrimeFactors numbers' are numbers having exactly 2 prime divisors, which need not be necessarily distinct. In this analysis, digits occurring in units and tens places of 2-PrimeFactors numbers are inspected. All possible digits combinations in these places for 2-PrimeFactors numbers till 1 trillion are determined in increasing ranges.

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1. Introduction

The prime numbers are positive integers greater than 1 having only two positive divisors, which are trivial divisors 1 and self. The list of primes

$$2, 3, 5, 7, 11, 13, 17, \dots$$

extends infinitely. These prime numbers are special types of what are called k -PrimeFactors numbers [6], with $k = 1$.

Definition (k -PrimeFactors Number) : For any integer $k \geq 0$, a positive integer having k number of prime divisors, which need not be necessarily distinct, is called as k -PrimeFactors number.

$k = 0$ gives 0-PrimeFactors number. There is only one such number with 0 or no prime factors which is the very first positive integer 1 itself.

$k = 1$, as remarked earlier, gives usual prime numbers.

$k = 2$, gives 2-PrimeFactors numbers, the numbers having exactly 2 prime divisors. Like primes [3] and its types [4] have been examined in detail, 2-PrimeFactors numbers are also dealt with for their maximum [7] and minimum occurrences [6] as well as for maximum [9] and minimum spacings [8] between them in increasing number ranges for blocks of different sizes. For exhaustively probing higher ranges of numbers, less resource-demanding algorithms were used in generation of primes [2] and those were implemented by using structured computer programming languages like Java [5].

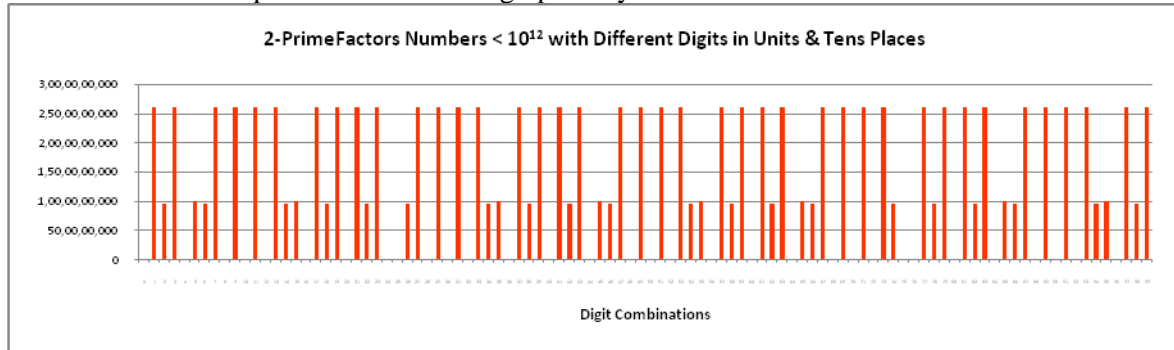
2. Digits in Units and Tens Places of 2-PrimeFactors Numbers

Worldwide, on majority, decimal number system with base 10 is used. It has 10 digits. Earlier, digits in units place of 2-PrimeFactors numbers have been analysed [10]. There can be $10^2 = 100$ digit combinations in units and tens places. The number of 2-PrimeFactors numbers till 10^{12} having each of these digit combinations in these places is exhaustively calculated.

<i>Digit in Units & Tens Places</i>	<i>Number of 2-PrimeFactors Numbers < 10¹²</i>	<i>Digit in Units & Tens Places</i>	<i>Number of 2-PrimeFactors Numbers < 10¹²</i>
00	0	10	1
01	2,595,254,930	11	2,595,293,075
02	965,408,819	12	0
03	2,595,267,332	13	2,595,263,160
04	1	14	965,404,512
05	1,000,884,015	15	1,000,889,623
06	965,406,575	16	0
07	2,595,263,931	17	2,595,292,445
08	0	18	965,408,322
09	2,595,268,713	19	2,595,192,434
20	0	30	0
21	2,595,247,903	31	2,595,268,371
22	965,405,091	32	0
23	2,595,248,648	33	2,595,270,805
24	0	34	965,409,129
25	1	35	1,000,887,177
26	965,401,604	36	0
27	2,595,244,378	37	2,595,267,283
28	0	38	965,409,399
29	2,595,271,454	39	2,595,276,481
40	0	50	0
41	2,595,283,868	51	2,595,248,313
42	965,403,041	52	0
43	2,595,263,428	53	2,595,278,384
44	0	54	965,413,202
45	1,000,885,434	55	1,000,891,421
46	965,411,340	56	0
47	2,595,265,838	57	2,595,291,489
48	0	58	965,405,165
49	2,595,267,821	59	2,595,261,971
60	0	70	0
61	2,595,275,866	71	2,595,266,743
62	965,401,633	72	0
63	2,595,277,685	73	2,595,274,589
64	0	74	965,411,184
65	1,000,891,385	75	0
66	965,414,429	76	0
67	2,595,255,137	77	2,595,265,398
68	0	78	965,410,683
69	2,595,339,031	79	2,595,295,145
80	0	90	0
81	2,595,316,230	91	2,595,288,156
82	965,405,882	92	0
83	2,595,284,374	93	2,595,262,807
84	0	94	965,403,977
85	1,000,887,657	95	1,000,888,345
86	965,411,522	96	0
87	2,595,261,747	97	2,595,234,217
88	0	98	965,390,631

<i>Digit in Units & Tens Places</i>	<i>Number of 2-PrimeFactors Numbers < 10¹²</i>	<i>Digit in Units & Tens Places</i>	<i>Number of 2-PrimeFactors Numbers < 10¹²</i>
89	2,595,250,677	99	2,595,275,721

These values compare with each other graphically as follows.



3. Range-wise Digits in Units & Tens Places of 2-PrimeFactors Numbers

The previous figures were directly for range till 1 trillion. Now these values in gradually increasing range are presented.

<i>Sr. No.</i>	<i>Range</i>	<i>Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places</i>				
		<i>00</i>	<i>01</i>	<i>02</i>	<i>03</i>	<i>04</i>
1	<10 ¹	0	0	0	0	1
2	<10 ²	0	0	0	0	1
3	<10 ³	0	4	4	5	1
4	<10 ⁴	0	42	34	42	1
5	<10 ⁵	0	392	257	400	1
6	<10 ⁶	0	3,748	2,077	3,753	1
7	<10 ⁷	0	35,254	17,417	35,096	1
8	<10 ⁸	0	329,228	149,979	328,617	1
9	<10 ⁹	0	3,083,936	1,317,463	3,082,703	1
10	<10 ¹⁰	0	29,015,974	11,748,916	29,018,454	1
11	<10 ¹¹	0	273,958,332	105,982,900	273,955,921	1
12	<10 ¹²	0	2,595,254,930	965,408,819	2,595,267,332	1

<i>Sr. No.</i>	<i>Range</i>	<i>Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places</i>				
		<i>05</i>	<i>06</i>	<i>07</i>	<i>08</i>	<i>09</i>
1	<10 ¹	0	1	0	0	1
2	<10 ²	0	1	0	0	1
3	<10 ³	4	4	3	0	3
4	<10 ⁴	35	33	39	0	43
5	<10 ⁵	281	254	404	0	410
6	<10 ⁶	2,233	2,085	3,815	0	3,773
7	<10 ⁷	18,586	17,469	35,310	0	35,283
8	<10 ⁸	158,711	150,083	328,601	0	329,471
9	<10 ⁹	1,384,697	1,318,233	3,082,748	0	3,083,630
10	<10 ¹⁰	12,276,583	11,747,210	29,014,933	0	29,013,872
11	<10 ¹¹	110,272,676	105,981,133	273,956,171	0	273,945,031
12	<10 ¹²	1,000,884,015	965,406,575	2,595,263,931	0	2,595,268,713

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		10	11	12	13	14
1	$<10^2$	1	0	0	0	1
2	$<10^3$	1	4	0	5	6
3	$<10^4$	1	41	0	45	37
4	$<10^5$	1	398	0	393	258
5	$<10^6$	1	3,767	0	3,785	2,077
6	$<10^7$	1	35,092	0	35,245	17,408
7	$<10^8$	1	329,063	0	328,587	150,051
8	$<10^9$	1	3,083,952	0	3,082,888	1,318,146
9	$<10^{10}$	1	29,014,062	0	29,015,539	11,748,579
10	$<10^{11}$	1	273,956,316	0	273,950,031	105,985,944
11	$<10^{12}$	1	2,595,293,075	0	2,595,263,160	965,404,512

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		15	16	17	18	19
1	$<10^2$	1	0	0	0	0
2	$<10^3$	6	0	6	4	4
3	$<10^4$	38	0	46	35	35
4	$<10^5$	282	0	394	257	404
5	$<10^6$	2,256	0	3,749	2,072	3,724
6	$<10^7$	18,640	0	35,216	17,379	35,191
7	$<10^8$	158,867	0	328,988	149,879	329,006
8	$<10^9$	1,384,907	0	3,082,512	1,317,966	3,084,566
9	$<10^{10}$	12,278,030	0	29,013,986	11,747,434	29,018,475
10	$<10^{11}$	110,275,162	0	273,965,476	105,984,665	273,954,527
11	$<10^{12}$	1,000,889,623	0	2,595,292,445	965,408,322	2,595,192,434

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		20	21	22	23	24
1	$<10^2$	0	1	1	0	0
2	$<10^3$	0	6	5	5	0
3	$<10^4$	0	36	33	34	0
4	$<10^5$	0	392	251	392	0
5	$<10^6$	0	3,815	2,071	3,732	0
6	$<10^7$	0	35,160	17,390	35,173	0
7	$<10^8$	0	329,026	150,086	329,133	0
8	$<10^9$	0	3,084,698	1,318,156	3,084,610	0
9	$<10^{10}$	0	29,020,691	11,746,971	29,012,125	0
10	$<10^{11}$	0	273,949,120	105,980,023	273,956,284	0
11	$<10^{12}$	0	2,595,247,903	965,405,091	2,595,248,648	0

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		25	26	27	28	29
1	$<10^2$	1	1	0	0	0
2	$<10^3$	1	6	3	0	4
3	$<10^4$	1	34	49	0	36
4	$<10^5$	1	255	386	0	390
5	$<10^6$	1	2,058	3,732	0	3,840

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		25	26	27	28	29
6	$<10^7$	1	17,452	35,156	0	35,317
7	$<10^8$	1	150,255	329,020	0	328,884
8	$<10^9$	1	1,317,996	3,083,871	0	3,083,071
9	$<10^{10}$	1	11,748,117	29,015,756	0	29,014,537
10	$<10^{11}$	1	105,982,350	273,958,375	0	273,964,927
11	$<10^{12}$	1	965,401,604	2,595,244,378	0	2,595,271,454

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		30	31	32	33	34
1	$<10^2$	0	0	0	1	1
2	$<10^3$	0	2	0	5	6
3	$<10^4$	0	41	0	41	35
4	$<10^5$	0	391	0	401	249
5	$<10^6$	0	3,762	0	3,749	2,057
6	$<10^7$	0	35,210	0	35,312	17,445
7	$<10^8$	0	329,119	0	328,860	150,124
8	$<10^9$	0	3,083,290	0	3,084,101	1,317,809
9	$<10^{10}$	0	29,013,264	0	29,013,593	11,748,479
10	$<10^{11}$	0	273,945,086	0	273,950,537	105,981,843
11	$<10^{12}$	0	2,595,268,371	0	2,595,270,805	965,409,129

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		35	36	37	38	39
1	$<10^2$	1	0	0	1	1
2	$<10^3$	6	0	4	3	3
3	$<10^4$	41	0	39	31	41
4	$<10^5$	287	0	391	259	386
5	$<10^6$	2,247	0	3,728	2,079	3,744
6	$<10^7$	18,630	0	35,144	17,475	35,049
7	$<10^8$	158,820	0	329,148	149,959	329,405
8	$<10^9$	1,385,049	0	3,085,228	1,317,557	3,084,371
9	$<10^{10}$	12,277,855	0	29,014,673	11,747,674	29,012,034
10	$<10^{11}$	110,277,876	0	273,945,060	105,982,454	273,956,124
11	$<10^{12}$	1,000,887,177	0	2,595,267,283	965,409,399	2,595,276,481

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		40	41	42	43	44
1	$<10^2$	0	0	0	0	0
2	$<10^3$	0	3	3	4	0
3	$<10^4$	0	47	34	39	0
4	$<10^5$	0	421	252	403	0
5	$<10^6$	0	3,782	2,083	3,774	0
6	$<10^7$	0	35,176	17,425	35,152	0
7	$<10^8$	0	329,026	150,036	328,930	0
8	$<10^9$	0	3,084,289	1,317,666	3,084,149	0
9	$<10^{10}$	0	29,015,705	11,747,055	29,012,291	0
10	$<10^{11}$	0	273,954,524	105,982,856	273,952,444	0

Sr. No.	Range	<i>Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places</i>				
		<i>40</i>	<i>41</i>	<i>42</i>	<i>43</i>	<i>44</i>
11	$<10^{12}$	0	2,595,283,868	965,403,041	2,595,263,428	0

Sr. No.	Range	<i>Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places</i>				
		<i>45</i>	<i>46</i>	<i>47</i>	<i>48</i>	<i>49</i>
1	$<10^2$	0	1	0	0	1
2	$<10^3$	4	5	2	0	6
3	$<10^4$	35	36	39	0	46
4	$<10^5$	274	256	406	0	413
5	$<10^6$	2,226	2,060	3,776	0	3,769
6	$<10^7$	18,576	17,425	35,097	0	35,185
7	$<10^8$	158,711	149,985	328,861	0	328,755
8	$<10^9$	1,384,158	1,318,122	3,084,132	0	3,084,927
9	$<10^{10}$	12,277,442	11,748,407	29,008,974	0	29,016,607
10	$<10^{11}$	110,273,732	105,985,679	273,939,392	0	273,957,524
11	$<10^{12}$	1,000,885,434	965,411,340	2,595,265,838	0	2,595,267,821

Sr. No.	Range	<i>Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places</i>				
		<i>50</i>	<i>51</i>	<i>52</i>	<i>53</i>	<i>54</i>
1	$<10^2$	0	1	0	0	0
2	$<10^3$	0	5	0	4	3
3	$<10^4$	0	36	0	42	30
4	$<10^5$	0	392	0	399	254
5	$<10^6$	0	3,768	0	3,734	2,104
6	$<10^7$	0	35,242	0	35,170	17,463
7	$<10^8$	0	328,973	0	328,878	150,104
8	$<10^9$	0	3,083,937	0	3,083,430	1,317,800
9	$<10^{10}$	0	29,015,522	0	29,014,323	11,747,201
10	$<10^{11}$	0	273,942,300	0	273,958,437	105,983,931
11	$<10^{12}$	0	2,595,248,313	0	2,595,278,384	965,413,202

Sr. No.	Range	<i>Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places</i>				
		<i>55</i>	<i>56</i>	<i>57</i>	<i>58</i>	<i>59</i>
1	$<10^2$	1	0	1	1	0
2	$<10^3$	6	0	1	6	4
3	$<10^4$	38	0	39	32	43
4	$<10^5$	282	0	404	252	395
5	$<10^6$	2,245	0	3,776	2,060	3,755
6	$<10^7$	18,602	0	35,150	17,401	35,357
7	$<10^8$	158,876	0	328,837	150,047	328,724
8	$<10^9$	1,385,070	0	3,083,083	1,317,619	3,083,408
9	$<10^{10}$	12,278,307	0	29,014,640	11,747,500	29,015,989
10	$<10^{11}$	110,277,974	0	273,947,528	105,981,810	273,951,368
11	$<10^{12}$	1,000,891,421	0	2,595,291,489	965,405,165	2,595,261,971

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		60	61	62	63	64
1	$<10^2$	0	0	1	0	0
2	$<10^3$	0	3	6	1	0
3	$<10^4$	0	44	32	43	0
4	$<10^5$	0	419	253	404	0
5	$<10^6$	0	3,765	2,070	3,744	0
6	$<10^7$	0	35,182	17,397	35,175	0
7	$<10^8$	0	328,925	150,164	328,448	0
8	$<10^9$	0	3,082,593	1,317,990	3,083,361	0
9	$<10^{10}$	0	29,015,835	11,748,015	29,012,482	0
10	$<10^{11}$	0	273,956,266	105,982,593	273,958,829	0
11	$<10^{12}$	0	2,595,275,866	965,401,633	2,595,277,685	0

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		65	66	67	68	69
1	$<10^2$	1	0	0	0	1
2	$<10^3$	6	5	3	0	5
3	$<10^4$	40	36	39	0	45
4	$<10^5$	287	264	401	0	408
5	$<10^6$	2,261	2,093	3,813	0	3,785
6	$<10^7$	18,616	17,412	35,074	0	35,028
7	$<10^8$	158,877	150,023	328,624	0	328,662
8	$<10^9$	1,384,941	1,317,715	3,084,189	0	3,084,708
9	$<10^{10}$	12,277,886	11,748,292	29,014,074	0	29,018,198
10	$<10^{11}$	110,278,192	105,983,546	273,948,142	0	273,955,331
11	$<10^{12}$	1,000,891,385	965,414,429	2,595,255,137	0	2,595,339,031

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		70	71	72	73	74
1	$<10^2$	0	0	0	0	1
2	$<10^3$	0	5	0	3	4
3	$<10^4$	0	47	0	39	32
4	$<10^5$	0	401	0	413	262
5	$<10^6$	0	3,704	0	3,780	2,086
6	$<10^7$	0	35,218	0	35,130	17,452
7	$<10^8$	0	328,620	0	329,369	150,082
8	$<10^9$	0	3,083,851	0	3,082,527	1,317,892
9	$<10^{10}$	0	29,014,132	0	29,011,483	11,747,480
10	$<10^{11}$	0	273,953,062	0	273,958,119	105,982,229
11	$<10^{12}$	0	2,595,266,743	0	2,595,274,589	965,411,184

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		75	76	77	78	79
1	$<10^2$	0	0	1	0	0
2	$<10^3$	0	0	3	5	5
3	$<10^4$	0	0	40	34	43
4	$<10^5$	0	0	421	263	399
5	$<10^6$	0	0	3,766	2,087	3,786

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		75	76	77	78	79
6	$<10^7$	0	0	35,086	17,347	35,188
7	$<10^8$	0	0	328,544	149,994	328,749
8	$<10^9$	0	0	3,084,087	1,317,454	3,083,718
9	$<10^{10}$	0	0	29,015,999	11,747,596	29,012,580
10	$<10^{11}$	0	0	273,952,292	105,981,742	273,951,307
11	$<10^{12}$	0	0	2,595,265,398	965,410,683	2,595,295,145

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		80	81	82	83	84
1	$<10^2$	0	0	1	0	0
2	$<10^3$	0	5	4	2	0
3	$<10^4$	0	39	30	40	0
4	$<10^5$	0	404	261	386	0
5	$<10^6$	0	3,810	2,085	3,740	0
6	$<10^7$	0	35,342	17,433	35,126	0
7	$<10^8$	0	328,714	150,075	328,996	0
8	$<10^9$	0	3,084,546	1,317,139	3,084,484	0
9	$<10^{10}$	0	29,012,310	11,746,914	29,015,932	0
10	$<10^{11}$	0	273,952,791	105,980,143	273,947,612	0
11	$<10^{12}$	0	2,595,316,230	965,405,882	2,595,284,374	0

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		85	86	87	88	89
1	$<10^2$	1	1	1	0	0
2	$<10^3$	6	4	4	0	7
3	$<10^4$	36	33	40	0	43
4	$<10^5$	282	261	390	0	396
5	$<10^6$	2,256	2,086	3,714	0	3,766
6	$<10^7$	18,637	17,458	35,172	0	35,248
7	$<10^8$	158,870	150,049	328,868	0	328,827
8	$<10^9$	1,385,023	1,317,680	3,083,051	0	3,084,101
9	$<10^{10}$	12,277,748	11,747,147	29,017,890	0	29,017,209
10	$<10^{11}$	110,277,289	105,982,762	273,951,553	0	273,953,440
11	$<10^{12}$	1,000,887,657	965,411,522	2,595,261,747	0	2,595,250,677

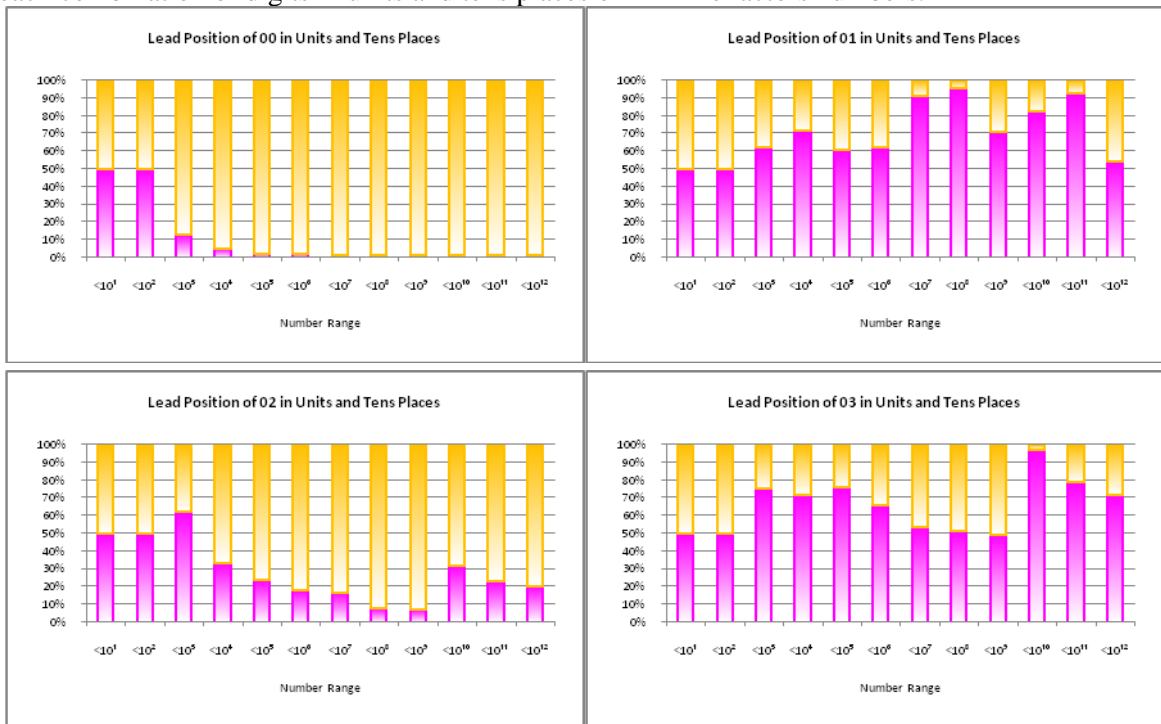
Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		90	91	92	93	94
1	$<10^2$	0	1	0	1	1
2	$<10^3$	0	5	0	6	5
3	$<10^4$	0	42	0	43	35
4	$<10^5$	0	407	0	390	265
5	$<10^6$	0	3,722	0	3,744	2,079
6	$<10^7$	0	34,918	0	34,991	17,410
7	$<10^8$	0	328,497	0	328,638	150,033
8	$<10^9$	0	3,084,350	0	3,084,707	1,317,612
9	$<10^{10}$	0	29,016,905	0	29,016,403	11,747,929
10	$<10^{11}$	0	273,956,784	0	273,956,295	105,982,150

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		90	91	92	93	94
11	$<10^{12}$	0	2,595,288,156	0	2,595,262,807	965,403,977

Sr. No.	Range	Number of 2-PrimeFactors Numbers with Following Digits in Units & Tens Places				
		95	96	97	98	99
1	$<10^2$	1	0	0	0	0
2	$<10^3$	6	0	3	5	4
3	$<10^4$	38	0	43	31	43
4	$<10^5$	285	0	373	248	415
5	$<10^6$	2,258	0	3,766	2,067	3,759
6	$<10^7$	18,644	0	35,120	17,453	35,144
7	$<10^8$	158,873	0	329,013	150,124	328,884
8	$<10^9$	1,385,090	0	3,084,620	1,317,850	3,083,310
9	$<10^{10}$	12,278,434	0	29,016,932	11,747,305	29,015,551
10	$<10^{11}$	110,273,813	0	273,955,360	105,983,823	273,951,031
11	$<10^{12}$	1,000,888,345	0	2,595,234,217	965,390,631	2,595,275,721

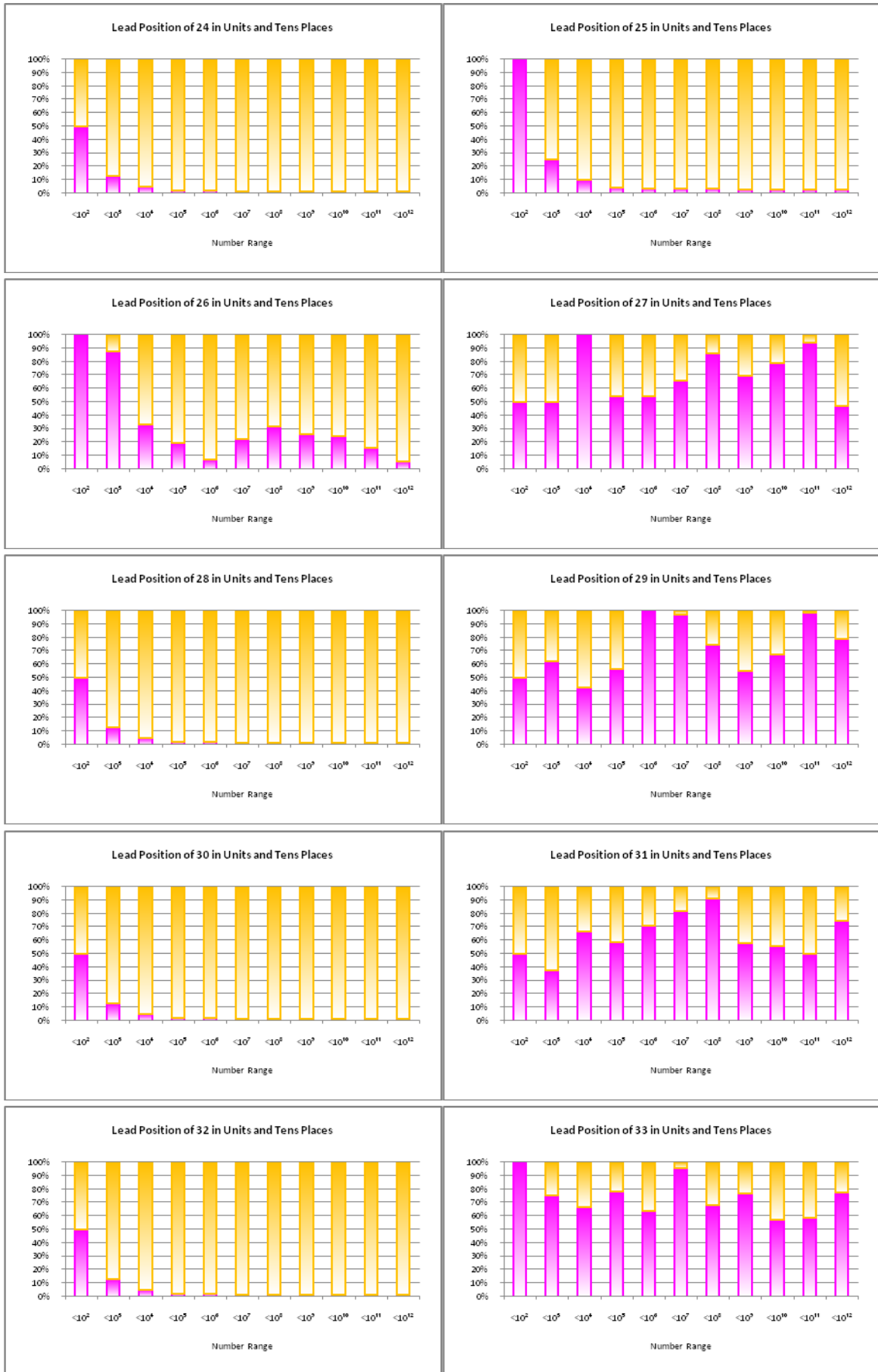
4. Range-wise Lead Positions Digits in Units & Tens Places of 2-PrimeFactors Numbers

Using the values determined in earlier section, we have plotted lead positions in percentages of each combination of digits in units and tens places of 2-PrimeFactors numbers.





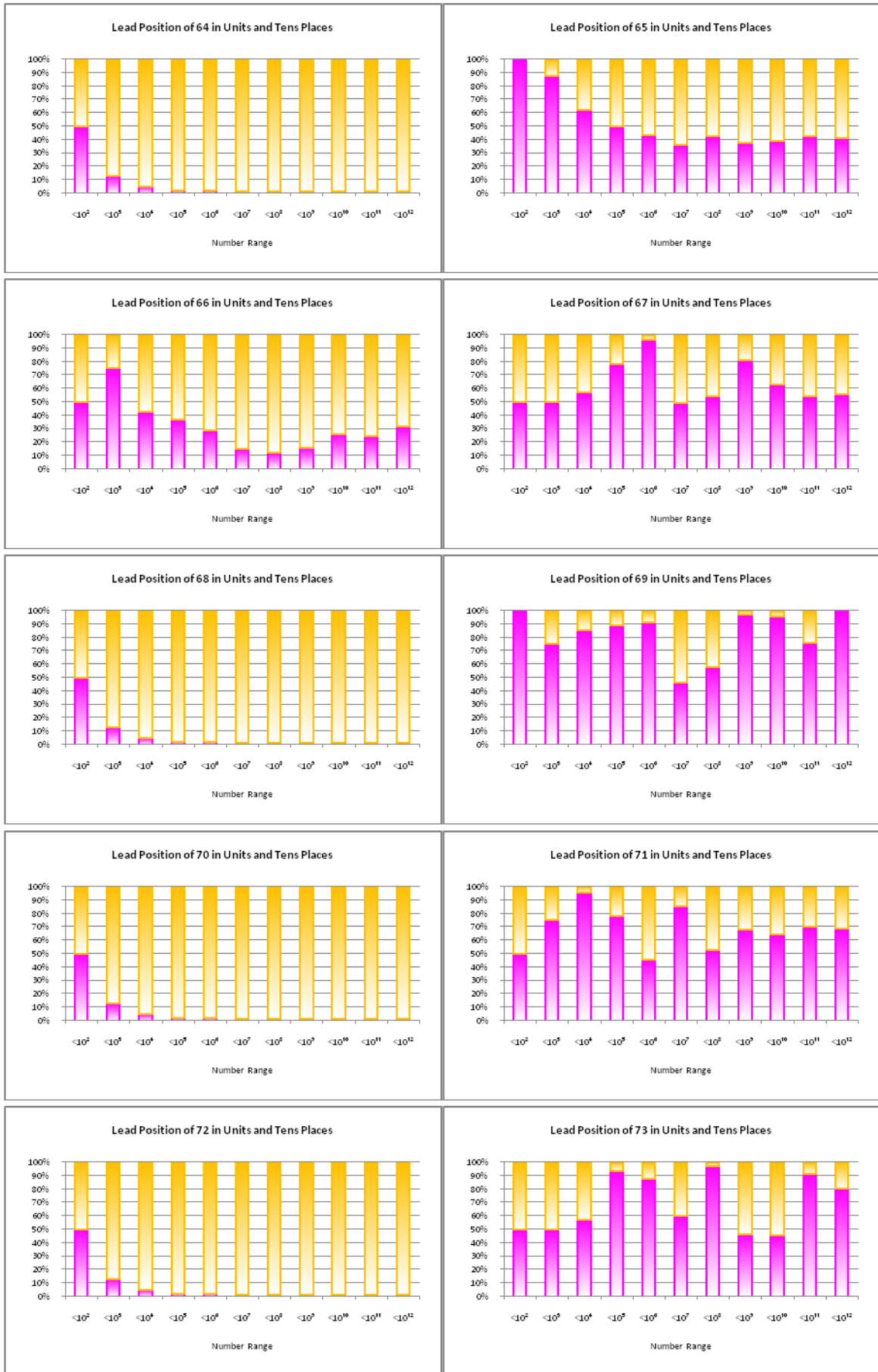




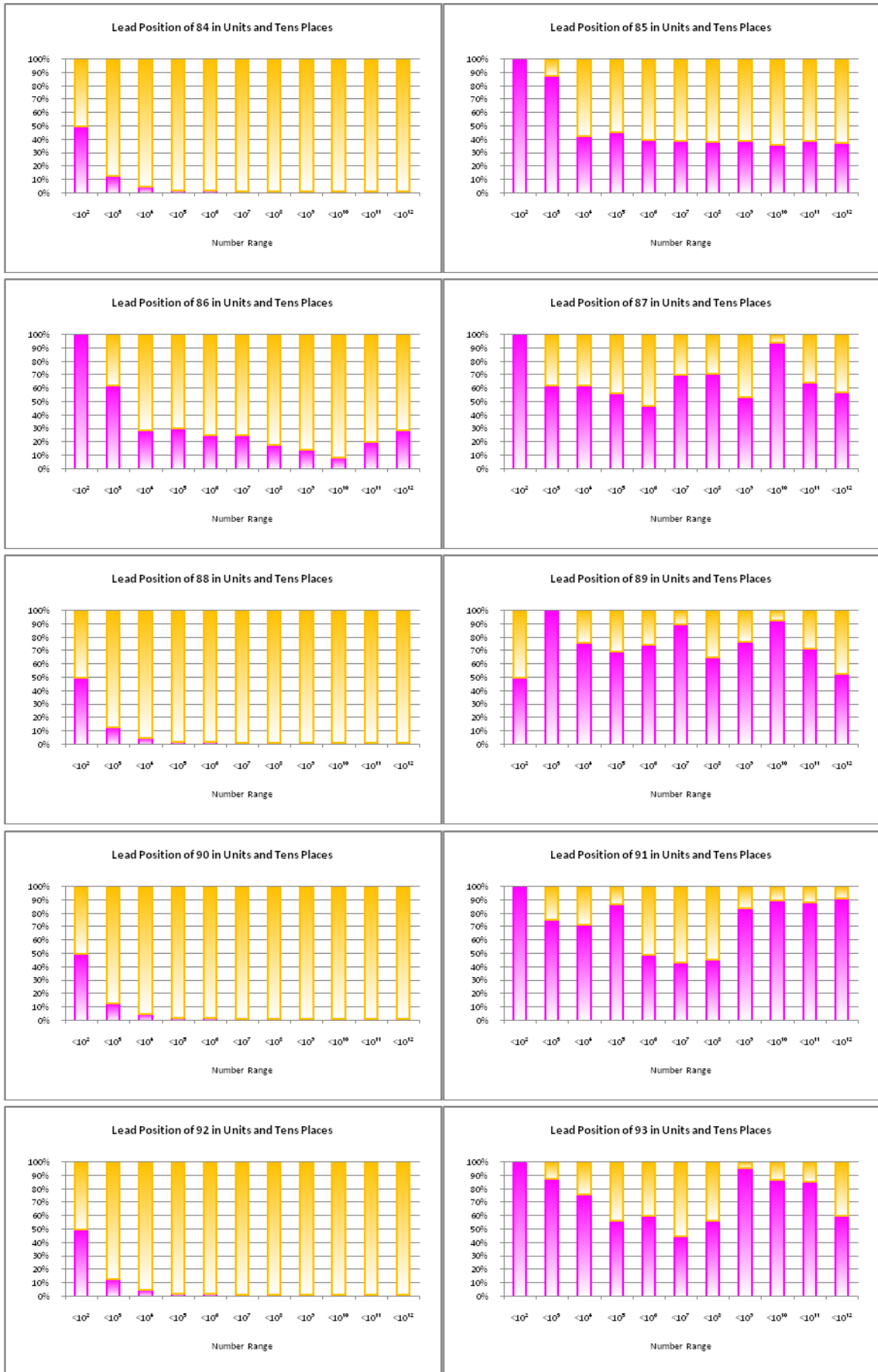














5. Patterns of Digits in Units & Tens Places of 2-PrimeFactors Numbers

Following patterns are observed in occurrences and quantitative dominance of digit combinations in units and tens places.

The 29 digit combinations 00, 08, 12, 16, 20, 24, 28, 30, 32, 36, 40, 44, 48, 50, 52, 56, 60, 64, 68, 70, 72, 75, 76, 80, 84, 88, 90, 92, 96 never occur in units and tens places of 2-PrimeFactors numbers. Irrespective of digits in higher places, all numbers with these digits in units and tens places contain minimum 3 prime factors, viz., multiple 2's, 5's or combinations of 2, 5 and at times 3 and 7; and of course, other prime factors also for higher numbers. This is the reason why there are no, and just cannot be, 2-PrimeFactors numbers with these digits in units and tens places even in higher ranges than what we have considered.

The 3 combinations 04, 10, 25 occur only once, in fact, these are the numbers also with these digits and there are no other. There are unique primes with digits 2 and 5 in units place and they are their product combinations as $04 = 2 \times 2$, $10 = 2 \times 5$ and $25 = 5 \times 5$ and hence their uniqueness.

Amongst other combinations, those with even digits in units places occur less frequently than those with odd digits there.

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