VS **Vaughn's Summaries**

Computer Summaries
Computer Math

Powers of 2 Table

(This page is NOT suitable for small screens.)
by Vaughn Aubuchon

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Here is a brief summary chart illustrating the mathematical powers of two, shown in binary, decimal, and hexadecimal notation.

The table goes up to the 64th power of two. This power-of-2 chart is grouped into 8-bit-long computer bytes and 16-bit word organization, showing address space vs. numbered bit lines.

Here is this file in Adobe **Acrobat format - powers-of-2.pdf**
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Powers of 2 Table

Bit Line Number	Powers of 2 Exponent	Binary Bit Weight in Decimal	Highest Number Count (Memory Address)			Computer Hardware Address Organization	
			Decimal	**Hexadecimal**	**Binary**	**Bytes**	**Words**
1	2^0	1	1	0001	0000 0001		**First word** (16 bits)
2	2^1	2	3	0003	0000 0011		
3	2^2	4	7	0007	0000 0111	**First byte** (8 lines can count to 255)	(if little endian)
4	2^3	8	15	000F	0000 1111		
5	2^4	16	31	001F	0001 1111		
6	2^5	32	63	003F	0011 1111		
7	2^6	64	127	007F	0111 1111		
8	$\mathbf{2^7}$	128	**255**	00FF	1111 1111		
9	2^8	256	511	0000 01FF	0001 1111	**Second**	

						byte (16 lines can count to 65,535)	
					1111		
10	2^9	512	1,023	0000 03FF	0011 1111 1111		
11	2^{10}	1,024	2,047	0000 07FF	0111 1111 1111		
12	2^{11}	2,048	4,095	0000 0FFF	1111 1111 1111		
13	2^{12}	4,096	8,191	0000 1FFF	etc.		
14	2^{13}	8,192	16,383	0000 3FFF	etc.		
15	2^{14}	16,384	32,767	0000 7FFF	etc.		
16	2^{15}	32,768	**65,535**	0000 FFFF	-		
17	2^{16}	65,536	131,071	0001 FFFF		**Third byte** (24 lines can count to 16.7M)	**Second word** (32 bits) (if little endian)
18	2^{17}	131,072	262,143	0003 FFFF			
19	2^{18}	262,144	524,287	0007 FFFF			
20	2^{19}	524,288	1,048,575	000F FFFF	-		
21	2^{20}	1,048,576	2,097,151	001F FFFF			
22	2^{21}	2,097,152	4,194,303	003F FFFF			
23	2^{22}	4,194,304	8,388,607	007F FFFF			
24	2^{23}	8,388,608	**16,777,215**	00FF FFFF			
25	2^{24}	16,777,216	33,554,431	01FF FFFF		**Fourth byte** (32 lines can count to 4.2B) (4 Gigabytes)	32-bit machine limitation
26	2^{25}	33,554,432	67,108,863	03FF FFFF			
27	2^{26}	67,108,864	134,217,727	07FF FFFF			
28	2^{27}	134,217,728	268,435,455	0FFF FFFF	-		
29	2^{28}	268,435,456	536,870,911	1FFF FFFF			
30	2^{29}	536,870,912	1,073,741,823	3FFF FFFF			
31	2^{30}	1,073,741,824	2,147,483,647	7FFF FFFF			
32	2^{31}	2,147,483,648	**4,294,967,295**	FFFF FFFF			
		This is the 32-bit machine addressing limitation, unless double-words or extra bits are used. Although a reputed "Google wall", regarding the number of web pages that can be indexed, Google now reports over 47 Billion pages indexed.					
33	2^{32}	4,294,967,296	8,589,934,591	etc.	-	**Fifth byte** (40 lines)	**Third word** (48 bits)
34	2^{33}	8,589,934,592	17,179,869,183	etc.			
35	2^{34}	17,179,869,184	34,359,738,367	etc.			
36	2^{35}	34,359,738,368	68,719,476,735	etc.			
37	2^{36}	68,719,476,736	137,438,953,471	-			
38	2^{37}	137,438,953,472	274,877,906,943				
39	2^{38}	274,877,906,944	549,755,813,887				

40	2^{39}	549,755,813,888	**1,099,511,627,775**				
41	2^{40}	1,099,511,627,776	2,199,023,255,551	-	-	**Sixth byte** (48 lines)	
42	2^{41}	2 Trillion	4,398,046,511,103				
43	2^{42}	4 Trillion	etc.				
44	2^{43}	9 Trillion	etc.				
45	2^{44}	18 Trillion	-				
46	2^{45}	35 Trillion	-				
47	2^{46}	70 Trillion	70,368,744,177,664				
48	2^{47}	140 Trillion	-				
49	2^{48}	281 Trillion	-	-	-	**Seventh Byte** (56 lines)	**Fourth word** (64 bits)
50	2^{49}	563 Trillion	-				
51	2^{50}	One Quadrillion	-				
52	2^{51}	2 Quadrillion	-				
53	2^{52}	4 Quadrillion	-				
54	2^{53}	9 Quadrillion	-				
55	2^{54}	18 Quadrillion	18,014,398,509,482,000				
56	2^{55}	36 Quadrillion	-				
57	2^{56}	72 Quadrillion	-	-	-	**Eighth byte** (64 lines)	
58	2^{57}	144 Quadrillion	-				
59	2^{58}	288 Quadrillion	-				
60	2^{59}	576 Quadrillion	-				
61	2^{60}	One Quintillion	-				
62	2^{61}	Two Quintillion	-				
63	2^{62}	(63 lines can count to 4.6 quintillion) 4,611,686,018,4xx,xxx,xxx 4.6×10^{18} (approx. weight of the EARTH in Tons)					
64	2^{63}	9.2 quintillion (64 lines can count to 9.2 quintillion) 9,223,372,036,xxx,xxx,xxx					64-bit machine limitation
50	60	130 - 710	130	90	90	70	70

DISCLAIMER
Although the author has tried to be as accurate as possible, errors are possible.
I could not find an online chart like the above. So, I made this Powers of 2 Chart, to help myself visualize the inner workings of a data computer. I hope that it helps you.

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Tags: powers-of-2 table, computer byte values

Author Bio

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Site Map

This Vaughns Powers-of-Two Table
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