## **IPv4 Addresses and IPv4 Subnetting**

by Gokhan Kosem, www.ipcisco.com

CIDR	SUBNET MASK	ADDRESSES	WILDCARD MASK
/32	255.255.255. 255	1	0.0.0.0
/31	255.255.255. 254	2	0.0.0.1
/30	255.255.255. 252	4	0.0.0.3
/29	255.255.255. 248	8	0.0.0.7
/28	255.255.255. 240	16	0.0.0.15
/27	255.255.255. 224	32	0.0.0.31
/26	255.255.255. 192	64	0.0.0.63
/25	255.255.255. 128	128	0.0.0.127
/24	255.255.255.0	256	0.0.0.255
/23	255.255.254.0	512	0.0.1.255
/22	255.255.252.0	1024	0.0.3.255
/21	255.255.248.0	2048	0.0.7.255
/20	255.255.240.0	4096	0.0.15.255
/19	255.255.224.0	8192	0.0.31.255
/18	255.255.192.0	16384	0.0.63.255
/17	255.255.128.0	32768	0.0.127.255
/16	255.255.0.0	65536	0.0.255.255
/15	255.254.0.0	131072	0.1.255.255
/14	255.252.0.0	262144	0.3.255.255
/13	255.248.0.0	524288	0.7.255.255
/12	255.240.0.0	1048576	0.15.255.255
/11	255.224.0.0	2097152	0.31.255.255
/10	255.192.0.0	4194304	0.63.255.255
/9	255.128.0.0	8388608	0.127.255.255
/8	255.0.0.0	16777216	0.255.255.255
/7	254.0.0.0	33554432	1 .255.255.255
/6	252.0.0.0	67108864	3 .255.255.255
/5	248.0.0.0	134217728	7 .255.255.255
/4	240.0.0.0	268435456	15. 255.255.255
/3	224.0.0.0	536870912	31. 255.255.255
/2	192.0.0.0	1073741824	63. 255.255.255
/1	128.0.0.0	2147483648	127. 255.255.255
/0	0.0.0.0	4294967296	255. 255.255.255

Classful IPv4 Addresses								
Class A	0.0.0.0 - 127.255.255.255							
Class B	128.0.0.0 - 191.255.255.255							
Class C	192.0.0.0 - 223.255.255.255							
Class D	224.0.0.0 - 239.255.255.255							
Class E	240.0.0.0 - 255.255.255.255							
Private IPv4 Addresses								
10.0.0.0 - 10.255.255.255								
172.16.0.0 - 172.31.255.255								
192.168.0.0 - 192.168.255.255								
Special IPv4 Addresses								
Local Host	127.0.0.0 - 127.255.255.255							
APIPA	169.254.0.0 - 169.254.255.255							
Bogon IPv4 Addresses								
0.0.0.0/8	This network							
10.0.0.0/8	Private IPv4 Address Block							
100.64.0.0/10	Carrier-grade NAT							
127.0.0.0/8	Loopback							
127.0.53.53	Name collision occurrence							
169.254.0.0/16	Link local							
172.16.0.0/12	Private IPv4 Address Block							
192.0.0.0/24	IETF protocol assignments							
192.0.2.0/24	TEST-NET-1							
192.168.0.0/16	Private IPv4 Address Block							
198.18.0.0/15	Network benchmark testing							
198.51.100.0/24	TEST-NET-2							
203.0.113.0/24	TEST-NET-3							
224.0.0.0/4	Multicast							
240.0.0.0/4	Reserved							
255.255.255.255/32 Limited broadcast								
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## **Decimal to Binary Table**

by Gokhan Kosem, www.ipcisco.com

1	DEC	DiN	DEC	pin	DEC	pin				Dia.			DEC	pin	DEC	pin
2	DEC	BİN	DEC	BİN	DEC		DEC	BİN	DEC	BİN	DEC	BİN	DEC	BİN	DEC	BİN
3		1	33												225	
4   100   36   100100   68   1000100   100   1100100   132   1000100   164   1010100   196   1100100   228   11101010     5   101   37   100101   69   1000101   101   1100101   133   1000101   165   1010010   197   1100010   229   11100101     6   110   38   10011   7   100011   103   1100111   134   1000011   166   1010011   198   11000110   23   11101011     7   111   39   10011   71   1001001   105   1101000   136   1001000   168   1010100   20   11001010   23   11101001     9   1001   41   101000   74   1001001   105   1101001   137   1001001   129   11010100   22   11010101   23   11101001     10   10110   74   101010   76   101010   1									130		162		194		226	
5   101   37   100101   69   1000101   101   1100101   133   1000101   165   10100101   197   11000101   229   11100101     6   110   38   100110   70   1000110   102   1100110   134   10000110   166   10100110   198   11000110   230   11100101     7   111   39   10011   71   1000111   103   1100111   135   10001001   166   1010100   20   11001011   231   11101011     8   1000   40   101000   72   100100   105   1101001   137   10001001   169   10101001   201   11010000   231   11101001     10   1010   42   101010   74   1001010   105   1101011   137   10010010   202   11001010   231   1110101     11   1101   43   101011   75   100110   107   1101010	3	11	35	100011	67	1000011	99	1100011	131	10000011	163	10100011	195	11000011	227	11100011
6   110   38   100110   70   1000110   102   1100110   134   10000110   166   10100110   198   11000110   230   11100111     7   111   39   100111   71   1000111   103   1100111   135   10000111   167   10100111   199   11001010   231   11101011     8   1000   40   101000   72   100100   105   1101001   137   10001001   169   10101001   201   1101000   231   11101001     10   1010   42   101010   74   1001010   105   1101010   138   1000101   170   1010101   202   11001010   231   1110101     11   1011   43   101011   75   1001011   107   1101011   137   10010101   202   11001010   231   1110101     12   1100   44   101100   76   1001010   107   1100101 </td <td>4</td> <td>100</td> <td>36</td> <td>100100</td> <td>68</td> <td>1000100</td> <td>100</td> <td>1100100</td> <td>132</td> <td>10000100</td> <td>164</td> <td>10100100</td> <td>196</td> <td>11000100</td> <td>228</td> <td>11100100</td>	4	100	36	100100	68	1000100	100	1100100	132	10000100	164	10100100	196	11000100	228	11100100
7	5	101	37	100101	69	1000101	101	1100101	133	10000101	165	10100101	197	11000101	229	11100101
8   1000   40   101000   72   1001000   104   1101000   136   10010000   168   10101000   200   1101000   232   11101000     9   1001   41   101000   73   1001001   105   1101001   137   10010010   169   1010100   201   11001001   233   11101001     10   1010   42   101010   74   1001011   107   1010101   138   1000101   170   1010101   22   11001011   23   11010101     11   1011   43   101010   75   1001101   108   1101100   144   10001101   172   1001101   203   1101101     13   1101   45   101101   76   1001101   109   1101101   144   1001110   173   1001101   205   1101100   23   11111001     14   1110   46   101110   142   1000111   173   1001101 <td>6</td> <td>110</td> <td>38</td> <td>100110</td> <td>70</td> <td>1000110</td> <td>102</td> <td>1100110</td> <td>134</td> <td>10000110</td> <td>166</td> <td>10100110</td> <td>198</td> <td>11000110</td> <td>230</td> <td>11100110</td>	6	110	38	100110	70	1000110	102	1100110	134	10000110	166	10100110	198	11000110	230	11100110
9	7	111	39	100111	71	1000111	103	1100111	135	10000111	167	10100111	199	11000111	231	11100111
10	8	1000	40	101000	72	1001000	104	1101000	136	10001000	168	10101000	200	11001000	232	11101000
1	9	1001	41	101001	73	1001001	105	1101001	137	10001001	169	10101001	201	11001001	233	11101001
12   1100   44   101100   76   1001100   108   1101100   140   10001100   172   10101100   204   11001100   236   11101100     13   1101   45   101101   77   1001101   109   1101101   141   10001101   173   10101101   205   11001101   237   11101101     14   1110   46   101110   78   1001110   110   1101110   142   10001110   174   1010111   206   11001110   238   1110110     15   1111   47   101111   79   100111   11   1101110   142   10001111   175   1010111   206   1100111   239   1110111     16   10000   48   110000   80   1010000   144   10010000   176   10110000   208   1010000   240   1111000     18   10000   50   110010   82   1010010   145   1100	10	1010	42	101010	74	1001010	106	1101010	138	10001010	170	10101010	202	11001010	234	11101010
13   1101   45   101101   77   1001101   109   1101101   141   10001101   173   10101101   205   11001101   237   11101101     14   1110   46   101110   78   1001110   110   1101110   142   10001110   174   1010110   206   11001110   238   11101110     15   1111   47   101111   79   1001111   111   1101111   143   10001111   175   10101111   207   11001111   239   11101111     16   10000   48   110000   80   1010000   112   1110000   144   10010000   176   10110000   208   1010000   240   11110000     17   10001   49   110010   81   1010000   114   1110010   146   10010000   177   10110001   209   11010001   241   11110001     18   10010   50   110010   81	11	1011	43	101011	75	1001011	107	1101011	139	10001011	171	10101011	203	11001011	235	11101011
14   1110   46   101110   78   1001110   110   1101110   142   10001110   174   10101110   206   11001110   238   11101110     15   1111   47   101111   79   1001111   111   1101111   143   10001111   175   10101111   207   11001111   238   11101111     16   10000   48   110000   80   1010000   112   1110000   144   10010000   176   10110000   208   11010000   240   11110000     18   10010   50   110010   81   1010010   144   1110001   145   10010001   177   10110001   209   11010001   241   11110001   146   10010010   178   10110010   20   11010010   242   11110001   146   10010010   178   10110010   210   11010010   242   11110001   141   10101001   148   10010010   180   10110001	12	1100	44	101100	76	1001100	108	1101100	140	10001100	172	10101100	204	11001100	236	11101100
15   1111   47   101111   79   1001111   111   1101111   143   10001111   175   10101111   207   11001111   239   1110111     16   10000   48   110000   80   1010000   112   1110000   144   10010000   176   10110000   208   1101000   240   11110000     17   10001   49   110001   81   1010001   113   1110001   145   10010001   177   10110001   209   11010001   241   11110001     18   10010   50   110010   82   1010010   114   1110011   147   10010010   178   10110010   20   11010010   242   11110010     19   10010   51   110001   81   1010101   145   10101001   179   10110010   210   1010101   242   1111001     20   10100   52   110100   84   1010100   116   <	13	1101	45	101101	77	1001101	109	1101101	141	10001101	173	10101101	205	11001101	237	11101101
16   10000   48   110000   80   1010000   112   1110000   144   10010000   176   10110000   208   1101000   240   1111000     17   10001   49   110001   81   1010001   113   1110001   145   10010001   177   10110001   209   11010010   241   11110001     18   10010   50   110010   82   1010010   114   1110011   146   10010010   178   10110010   210   11010010   242   11110010     19   10010   51   110011   83   1010011   115   1110011   147   10010011   179   10110011   211   1101001   243   11110010     20   10100   52   110101   84   1010100   148   10010100   180   1011010   212   1101010   244   1111010     21   10110   53   110101   85   1010101   118   <	14	1110	46	101110	78	1001110	110	1101110	142	10001110	174	10101110	206	11001110	238	11101110
17   10001   49   110001   81   1010001   113   1110001   145   10010001   177   10110001   209   11010001   241   11110010     18   10010   50   110010   82   1010010   114   1110010   146   10010010   178   10110010   210   11010010   242   11110010     19   10011   51   110011   83   1010011   115   1110011   147   10010011   179   10110011   211   11010010   244   1111001     20   10100   52   110100   84   1010101   117   1110101   149   10010101   180   10110100   212   11010100   244   1111010     21   10101   53   110101   185   1010101   117   1110101   149   10010101   181   10110101   213   11010101   245   11110101     21   10110   54   110111   87	15	1111	47	101111	79	1001111	111	1101111	143	10001111	175	10101111	207	11001111	239	11101111
18   10010   50   110010   82   1010010   114   1110010   146   10010010   178   10110010   210   11010010   242   11110010     19   10011   51   110011   83   1010011   115   1110011   147   10010011   179   10110011   211   11010011   243   11110011     20   10100   52   110100   84   1010100   116   1110100   148   10010100   180   10110100   212   11010100   244   1111010     21   10101   53   110101   85   1010101   117   1110101   149   10010101   181   10110101   213   11010101   244   1111010     22   10110   54   110110   86   1010110   118   1110110   150   10010111   182   10110110   214   11010110   246   1111011     24   11000   56   111010   88	16	10000	48	110000	80	1010000	112	1110000	144	10010000	176	10110000	208	11010000	240	11110000
19   10011   51   110011   83   101001   115   1110011   147   10010011   179   10110011   211   11010011   243   11110011     20   10100   52   110100   84   1010100   116   1110100   148   10010100   180   10110100   212   1101010   244   1111010     21   10101   53   110101   85   1010101   117   1110101   149   10010101   181   1011010   213   11010101   245   1111010     22   10110   54   110110   86   1010111   119   1110111   150   10010110   182   10110110   214   11010111   246   1111010     23   10111   55   110111   87   1010111   119   1110111   151   10010111   183   1011011   215   11010111   247   1111011     24   11000   56   111000   88 <td< td=""><td>17</td><td>10001</td><td>49</td><td>110001</td><td>81</td><td>1010001</td><td>113</td><td>1110001</td><td>145</td><td>10010001</td><td>177</td><td>10110001</td><td>209</td><td>11010001</td><td>241</td><td>11110001</td></td<>	17	10001	49	110001	81	1010001	113	1110001	145	10010001	177	10110001	209	11010001	241	11110001
20   10100   52   110100   84   1010100   116   1110100   148   10010100   180   10110100   212   1101010   244   11110100     21   10101   53   110101   85   1010101   117   1110101   149   10010101   181   1011010   213   1101010   245   1111010     22   10110   54   110110   86   1010110   118   1110110   150   10010110   182   10110110   214   11010110   246   1111010     23   10111   55   110111   87   1010111   119   11101011   151   10010111   183   10110110   214   11010110   246   1111011     24   11000   56   111000   88   1011000   120   1111000   152   10011000   184   10111001   217   11011001   249   11111001     25   11001   57   111001   89	18	10010	50	110010	82	1010010	114	1110010	146	10010010	178	10110010	210	11010010	242	11110010
21 10101 53 110101 85 1010101 117 1110101 149 10010101 181 10110101 213 11010101 245 11110101   22 10110 54 110110 86 1010110 118 1110110 150 10010110 182 10110110 214 11010110 246 11110110   23 10111 55 110111 87 1010111 119 1110111 151 10010111 183 10110111 215 11010111 247 11110111   24 11000 56 111000 88 1011000 120 1111000 152 10011000 184 10111000 216 11011000 248 11111000   25 11001 57 111001 89 1011001 121 1111001 153 10011001 185 10111001 217 11011001 249 11111001   26 11010 58 111011 91 1011011 123 1111011 155 10011011 187 10110101 21	19	10011	51	110011	83	1010011	115	1110011	147	10010011	179	10110011	211	11010011	243	11110011
22 10110 54 110110 86 1010110 118 1110110 150 10010110 182 10110110 214 11010110 246 11110110   23 10111 55 110111 87 1010111 119 1110111 151 10010111 183 10110111 215 11010111 247 11110111   24 11000 56 111000 88 1011000 152 10011000 184 10111000 216 11011000 248 11111000   25 11001 57 111001 89 1011001 121 1111001 153 10011001 185 10111001 217 11011001 249 11111001   26 11010 58 111010 90 1011010 122 1111010 154 10011010 186 10111010 218 11011010 250 11111010   27 11011 59 111011 91 1011011 123 1111011 155 10011011 187 10111011 219 11011011 2	20	10100	52	110100	84	1010100	116	1110100	148	10010100	180	10110100	212	11010100	244	11110100
23 10111 55 110111 87 1010111 119 1110111 151 10010111 183 10110111 215 11010111 247 11110111   24 11000 56 111000 88 1011000 120 1111000 152 10011000 184 10111000 216 11011000 248 11111000   25 11001 57 111001 89 1011001 121 1111001 153 10011001 185 10111001 217 11011001 249 11111001   26 11010 58 111010 90 1011010 122 1111010 154 10011010 186 10111010 218 11011010 250 11111010   27 11011 59 111011 91 1011001 123 1111001 155 10011011 187 10111011 219 11011011 251 1111101   28 11100 60 111100 92 1011100 125 1111101 157 10011101 189 10111101 221	21	10101	53	110101	85	1010101	117	1110101	149	10010101	181	10110101	213	11010101	245	11110101
24 11000 56 111000 88 1011000 120 1111000 152 10011000 184 10111000 216 11011000 248 11111000   25 11001 57 111001 89 1011001 121 1111001 153 10011001 185 10111001 217 11011001 249 11111001   26 11010 58 111010 90 1011010 122 1111010 154 10011010 186 10111010 218 11011010 250 11111010   27 11011 59 111011 91 1011011 123 1111001 155 10011011 187 10111011 219 11011011 251 11111011   28 11100 60 111100 92 1011100 124 1111100 156 10011100 188 10111100 220 11011100 252 11111100   29 11101 61 111100 94 1011110 125 1111110 157 10011101 189 10111101 22	22	10110	54	110110	86	1010110	118	1110110	150	10010110	182	10110110	214	11010110	246	11110110
25 11001 57 111001 89 1011001 121 1111001 153 10011001 185 10111001 217 11011001 249 11111001   26 11010 58 111010 90 1011010 122 1111010 154 10011010 186 10111010 218 11011010 250 11111010   27 11011 59 111011 91 1011011 123 1111011 155 10011011 187 10111011 219 11011011 251 11111011   28 11100 60 111100 92 1011100 124 1111100 156 10011100 188 10111100 220 11011100 252 11111100   29 11101 61 111101 93 1011101 125 1111101 157 10011101 189 10111101 221 11011101 253 11111101   30 1110 62 111110 94 1011111 127 1111111 159 10011111 191 10111111 223	23	10111	55	110111	87	1010111	119	1110111	151	10010111	183	10110111	215	11010111	247	11110111
26 11010 58 111010 90 1011010 122 1111010 154 10011010 186 10111010 218 11011010 250 11111010   27 11011 59 111011 91 1011011 123 1111011 155 10011011 187 10111011 219 11011011 251 11111011   28 11100 60 111100 92 1011100 124 1111100 156 10011100 188 10111100 220 11011100 252 11111100   29 11101 61 111101 93 1011101 125 1111101 157 10011101 189 10111101 221 11011101 253 11111101   30 11110 62 111110 94 1011111 126 1111110 158 10011110 190 10111110 222 11011110 254 11111110   31 11111 63 111111 95 1011111 127 11111111 159 100111111 191 101111111 <td< td=""><td>24</td><td>11000</td><td>56</td><td>111000</td><td>88</td><td>1011000</td><td>120</td><td>1111000</td><td>152</td><td>10011000</td><td>184</td><td>10111000</td><td>216</td><td>11011000</td><td>248</td><td>11111000</td></td<>	24	11000	56	111000	88	1011000	120	1111000	152	10011000	184	10111000	216	11011000	248	11111000
27 11011 59 111011 91 1011011 123 1111011 155 10011011 187 10111011 219 11011011 251 11111011   28 11100 60 111100 92 1011100 124 1111100 156 10011100 188 10111100 220 11011100 252 11111100   29 11101 61 111101 93 1011101 125 1111101 157 10011101 189 10111101 221 11011101 253 11111101   30 11110 62 111110 94 1011111 126 1111110 158 10011110 190 10111110 222 11011110 254 11111110   31 11111 63 111111 95 1011111 127 11111111 159 10011111 191 10111111 223 11011111 255 11111111	25	11001	57	111001	89	1011001	121	1111001	153	10011001	185	10111001	217	11011001	249	11111001
27 11011 59 111011 91 1011011 123 1111011 155 10011011 187 10111011 219 11011011 251 11111011   28 11100 60 111100 92 1011100 124 1111100 156 10011100 188 10111100 220 11011100 252 11111100   29 11101 61 111101 93 1011101 125 1111101 157 10011101 189 10111101 221 11011101 253 11111101   30 11110 62 111110 94 1011111 126 1111110 158 10011110 190 10111110 222 11011110 254 11111110   31 11111 63 111111 95 1011111 127 11111111 159 10011111 191 10111111 223 11011111 255 11111111	26	11010	58	111010	90	1011010	122	1111010	154	10011010	186	10111010	218	11011010	250	11111010
28 11100 60 111100 92 1011100 124 1111100 156 10011100 188 10111100 220 11011100 252 11111100   29 11101 61 111101 93 1011101 125 1111101 157 10011101 189 10111101 221 11011101 253 11111101   30 11110 62 111110 94 1011110 126 1111110 158 10011110 190 10111110 222 11011110 254 11111110   31 11111 63 111111 95 1011111 127 11111111 159 10011111 191 10111111 223 11011111 255 11111111																
29 11101 61 111101 93 1011101 125 1111101 157 10011101 189 10111101 221 11011101 253 11111101   30 11110 62 111110 94 1011110 126 1111110 158 10011110 190 10111110 222 11011110 254 11111110   31 11111 63 111111 95 1011111 127 11111111 159 10011111 191 10111111 223 11011111 255 111111111																
30 11110 62 111110 94 1011110 126 1111110 158 10011110 190 10111110 222 11011110 254 11111110 31 11111 63 111111 95 1011111 127 1111111 159 10011111 191 10111111 223 11011111 255 11111111	$\vdash$															
31 11111 63 111111 95 1011111 127 1111111 159 10011111 191 10111111 223 11011111 255 11111111																
	32	100000	64	1000000	96			10000000	160	10100000	192	11000000	224	11100000	256	

To determine the 8 bits Octet value, add 0s in front of the binary value. For example: For Decimal 5, the Binary value is 101. 8 bits value is 00000101.