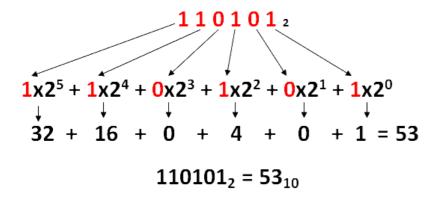
NUMBERING SYSTEMS

Numbering Sys	tems	
System	Base	Digits
Binary	2	01
Octal	8	01234567
Decimal	10	0123456789
Hexadecimal	16	0123456789ABCDEF

Dec	Hex	Oct	Bin	Dec	Hex	Oct	Bin	Dec	Hex	Oct	Bin	Dec	Hex	Oct	Bin
0	0	000	00000000	16	10	020	00010000	32	20	040	00100000	48	30	060	00110000
1	1	001	00000001	17	11	021	00010001	33	21	041	00100001	49	31	061	00110001
2	2		00000010	18	12		00010010	34	22	042	00100010	50	32		00110010
3	3	003	00000011	19	13	023	00010011	35	23	043	00100011	51	33	063	00110011
4	4	004	00000100	20	14	024	00010100	36	24	044	00100100	52	34	064	00110100
5	5	005	00000101	21	15	025	00010101	37	25	045	00100101	53	35	065	00110101
6	6	006	00000110	22	16	026	00010110	38	26	046	00100110	54	36	066	00110110
7	7	007	00000111	23	17	027	00010111	39	27	047	00100111	55	37	067	00110111
8	8	010	00001000	24	18	030	00011000	40	28	050	00101000	56	38	070	00111000
9	9	011	00001001	25	19	031	00011001	41	29	051	00101001	57	39	071	00111001
10	A	012	00001010	26	1A	032	00011010	42	2A	052	00101010	58	3A	072	00111010
11	В	013	00001011	27	1B	033	00011011	43	2B	053	00101011	59	3B	073	00111011
12	C	014	00001100	28	1C	034	00011100	44	2C	054	00101100	60	3C	074	00111100
13	D	015	00001101	29	1D	035	00011101	45	2D	055	00101101	61	3D	075	00111101
14	E	016	00001110	30	1E		00011110	46	2E		00101110	62	3E	076	00111110
15	F	017	00001111	31	1F	037	00011111	47	2F	057	00101111	63	3F	077	00111111
Dec	Hex	Oct	Bin	Dec	Hex	Oct	Bin	Dec	Hex	Oct	Bin	Dec	Hex	Oct	Bin
Dec 64	Hex 40	Tables :	Bin 01000000	Dec 80	Hex 50	line of	Bin 01010000	Dec 96	Hex 60	16 -544	Bin 01100000	Dec 112	Hex 70	NAME OF	
JeyGir	2,522	100		-	CARDO.	120		-	10000	140	FORTUS SUBSECTION	2000	93.83	160	Bin 01110000 01110001
64	40	100 101	01000000	80	50	120 121	01010000	96	60	140 141	01100000	112	70	160 161	01110000
64 65	40 41	100 101 102	01000000 01000001	80 81	50 51	120 121 122	01010000 01010001	96 97	60 61	140 141 142	01100000 01100001	112 113	70 71	160 161 162	01110000 0111000 01110010
64 65 66	40 41 42	100 101 102 103	01000000 01000001 01000010	80 81 82	50 51 52	120 121 122 123	01010000 01010001 01010010	96 97 98	60 61 62	140 141 142 143	01100000 01100001 01100010	112 113 114	70 71 72	160 161 162 163	01110000
64 65 66 67	40 41 42 43	100 101 102 103 104	01000000 01000001 01000010 01000011	80 81 82 83	50 51 52 53	120 121 122 123 124	01010000 01010001 01010010 01010011	96 97 98 99	60 61 62 63	140 141 142 143 144	01100000 01100001 01100010 01100011	112 113 114 115	70 71 72 73	160 161 162 163 164	01110000 0111000 01110010 0111001
64 65 66 67 68	40 41 42 43 44	100 101 102 103 104 105	01000000 01000001 01000010 01000011 01000100	80 81 82 83 84	50 51 52 53 54	120 121 122 123 124 125	01010000 01010001 01010010 01010011 01010100	96 97 98 99 100	60 61 62 63 64	140 141 142 143 144 145	01100000 01100001 01100010 01100011 01100100	112 113 114 115 116	70 71 72 73 74	160 161 162 163 164 165	01110000 0111000 01110010 01110010
64 65 66 67 68 69	40 41 42 43 44 45	100 101 102 103 104 105 106	01000000 01000001 01000010 01000011 01000100 01000101	80 81 82 83 84 85	50 51 52 53 54 55	120 121 122 123 124 125 126	01010000 01010001 01010010 01010011 01010100 01010101 01010110	96 97 98 99 100 101	60 61 62 63 64 65	140 141 142 143 144 145 146	01100000 01100001 01100010 01100011 01100100	112 113 114 115 116 117	70 71 72 73 74 75	160 161 162 163 164 165 166	0111000 0111000 01110010 01110010 0111010 0111010
64 65 66 67 68 69 70 71	40 41 42 43 44 45 46	100 101 102 103 104 105 106 107	01000000 01000001 01000010 01000011 01000100 01000101 01000110	80 81 82 83 84 85 86	50 51 52 53 54 55 56	120 121 122 123 124 125 126 127	01010000 01010001 01010010 01010011 01010100 01010101	96 97 98 99 100 101 102	60 61 62 63 64 65 66	140 141 142 143 144 145 146 147	01100000 01100001 01100010 01100011 01100100	112 113 114 115 116 117 118	70 71 72 73 74 75 76	160 161 162 163 164 165 166 167	0111000 0111001 0111001 0111001 0111010 0111010 0111011
64 65 66 67 68 69 70	40 41 42 43 44 45 46 47	100 101 102 103 104 105 106 107 110	01000000 01000001 01000010 01000011 01000100 01000101 01000110 01000111	80 81 82 83 84 85 86 87	50 51 52 53 54 55 56 57	120 121 122 123 124 125 126 127 130	01010000 01010001 01010010 01010011 01010100 01010101 01010110 01010111	96 97 98 99 100 101 102 103	60 61 62 63 64 65 66 67	140 141 142 143 144 145 146 147 150	01100000 01100001 01100010 01100011 01100100	112 113 114 115 116 117 118 119	70 71 72 73 74 75 76 77	160 161 162 163 164 165 166 167 170	01110000 01110010 01110010 01110010 0111010 01110110
64 65 66 67 68 69 70 71 72	40 41 42 43 44 45 46 47 48	100 101 102 103 104 105 106 107 110 111	01000000 01000001 01000010 01000011 01000100 01000101 01000110 01000111 01000100	80 81 82 83 84 85 86 87 88	50 51 52 53 54 55 56 57 58	120 121 122 123 124 125 126 127 130 131	01010000 01010001 01010010 01010011 01010100 01010101 01010110 01010111 01011000	96 97 98 99 100 101 102 103 104	60 61 62 63 64 65 66 67 68	140 141 142 143 144 145 146 147 150 151	01100000 01100001 01100010 01100011 01100100	112 113 114 115 116 117 118 119 120	70 71 72 73 74 75 76 77 78	160 161 162 163 164 165 166 167 170	01110000 01110010 01110010 0111010 0111010 01110110
64 65 66 67 68 69 70 71 72 73	40 41 42 43 44 45 46 47 48 49	100 101 102 103 104 105 106 107 110 111 112	01000000 01000001 01000010 01000011 01000100 01000101 01000110 01000111 010010	80 81 82 83 84 85 86 87 88	50 51 52 53 54 55 56 57 58 59	120 121 122 123 124 125 126 127 130 131 132	01010000 01010001 01010010 01010011 01010100 01010101 01010110 01010111 01011000 01011001 01011001	96 97 98 99 100 101 102 103 104 105	60 61 62 63 64 65 66 67 68 69	140 141 142 143 144 145 146 147 150 151 152	01100000 01100001 01100010 01100011 01100100	112 113 114 115 116 117 118 119 120 121	70 71 72 73 74 75 76 77 78 79	160 161 162 163 164 165 166 167 170 171 172	01110000 0111000 01110010 01110010 0111010
64 65 66 67 68 69 70 71 72 73 74	40 41 42 43 44 45 46 47 48 49 4A	100 101 102 103 104 105 106 107 110 111 112 113	01000000 01000001 01000010 01000011 01000100 01000101 01000110 01000111 010010	80 81 82 83 84 85 86 87 88 89 90	50 51 52 53 54 55 56 57 58 59 5A	120 121 122 123 124 125 126 127 130 131 132 133	01010000 01010001 01010010 01010011 01010100 01010101 01010110 01010111 01011000 01011001 0101101	96 97 98 99 100 101 102 103 104 105 106	60 61 62 63 64 65 66 67 68 69 6A	140 141 142 143 144 145 146 147 150 151 152 153	01100000 01100001 01100010 01100011 01100100	112 113 114 115 116 117 118 119 120 121 122 123	70 71 72 73 74 75 76 77 78 79 7A	160 161 162 163 164 165 166 167 170 171 172 173	0111000 0111001 0111001 0111010 0111010 0111010 0111011 0111011 0111100 0111101
64 65 66 67 68 69 70 71 72 73 74 75	40 41 42 43 44 45 46 47 48 49 4A 4B	100 101 102 103 104 105 106 107 110 111 112 113 114	01000000 01000001 01000010 01000011 01000100 01000101 01000110 01000111 010010	80 81 82 83 84 85 86 87 88 89 90	50 51 52 53 54 55 56 57 58 59 5A 5B	120 121 122 123 124 125 126 127 130 131 132 133 134	01010000 01010001 01010010 01010011 01010100 01010101 01010110 01010111 01011000 01011001 01011001	96 97 98 99 100 101 102 103 104 105 106	60 61 62 63 64 65 66 67 68 69 6A 6B	140 141 142 143 144 145 146 147 150 151 152 153 154	01100000 01100001 01100010 01100011 01100100	112 113 114 115 116 117 118 119 120 121 122 123 124	70 71 72 73 74 75 76 77 78 79 7A 7B	160 161 162 163 164 165 166 167 170 171 172 173 174	01110000 0111001 0111001 0111010 0111010 0111011 0111011 0111100 0111100
64 65 66 67 68 69 70 71 72 73 74 75 76	40 41 42 43 44 45 46 47 48 49 4A 4B 4C	100 101 102 103 104 105 106 107 110 111 112 113 114 115	01000000 01000001 01000010 01000011 01000100 01000101 01000110 01000111 010010	80 81 82 83 84 85 86 87 88 89 90 91	50 51 52 53 54 55 56 57 58 59 5A 5B 5C	120 121 122 123 124 125 126 127 130 131 132 133 134 135	01010000 01010001 01010010 01010011 01010100 01010101 01010111 01010111 01011000 0101101	96 97 98 99 100 101 102 103 104 105 106 107 108	60 61 62 63 64 65 66 67 68 69 6A 6B 6C	140 141 142 143 144 145 146 147 150 151 152 153 154 155	01100000 01100001 01100010 01100011 01100100	112 113 114 115 116 117 118 119 120 121 122 123	70 71 72 73 74 75 76 77 78 79 7A 7B 7C	160 161 162 163 164 165 166 167 170 171 172 173 174 175	0111000 0111001 0111001 0111010 0111010 0111010 0111011 0111100 0111101 0111101

Converting decimal to binary

Converting binary to decimal

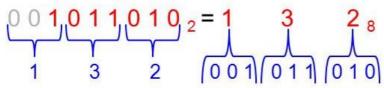


Converting between binary, octal, and hexadecimal numbers

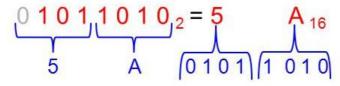
Because binary, octal, and hex number systems are all powers of two (which is the reason we use them) there is a relationship that we can exploit to make conversion easier.

$$1011010_{2} = 132_{8} = 5A_{H}$$

To convert directly between binary and octal, group the binary bits into sets of 3 (because $2^3 = 8$). You may need to pad with leading zeros.



To convert directly between binary and hexadecimal number systems, group the binary bits into sets of 4 (because $2^4 = 16$). You may need to pad with leading zeros.



Exercises

- 1. Convert C5C1 from base 16 to base 2.
- 2. Convert 238 from base 10 to base 2.
- 3. Convert 1010 0010 1011 1001 from binary to hexadecimal.
- 4. Convert 0 from base 8 to binary.
- 5. Convert 0111 0110 1011 1011 from binary to base 16.
- 6. Convert 0100 0100 1000 0011 from binary to base 16.
- 7. Convert 0001 1101 1101 1111 from base 2 to hexadecimal.
- 8. Convert 53 from base 8 to base 2.
- 9. Convert 1101 1111 from base 2 to decimal.
- 10. Convert 0100 0110 1101 0111 from binary to base 16.
- 11. Convert 101 100 001 from binary to base 8.
- 12. Convert 0110 0100 1000 1101 from binary to base 16.
- 13. Convert 44 from base 8 to binary.
- 14. Convert 9ABF from base 16 to base 2.
- 15. Convert 1100 1111 from base 2 to base 10.
- 16. Convert 10B2 from base 16 to binary.
- 17. Convert A1ED from base 16 to binary.
- 18. Convert 1010 0001 1111 1100 from base 2 to base 16.
- 19. Convert 77 from base 8 to binary.
- 20. Convert 1000 1111 from binary to decimal.
- 21. Convert 0011 1101 from base 2 to base 10.
- 22. Convert 57 from base 8 to binary.
- 23. Convert 0100 0100 1011 0100 from binary to hexadecimal.
- 24. Convert 0110 0110 from binary to base 10.
- 25. Convert 31 from octal to binary.
- 26. Convert 1110 1101 from base 2 to base 10.
- 27. Convert EC2C from base 16 to base 2.
- 28. Convert 208 from base 10 to binary.
- 29. Convert 1 from base 10 to binary.
- 30. Convert 101 from base 2 to base 8.

Solution to exercises

1. 1100 0101 1100 0001.

2. 1110 1110.

3. A2B9.

4.0.

5.76BB.

6.4483.

7. 1DDF.

8.101011.

9.223.

10.46D7.

11.541.

12.648D.

13.100100.

14. 1001 1010 1011 1111.

15.207.

16.0001000010110010.

17. 1010 0001 1110 1101.

18. A1FC.

19.111111.

20. 143.

21.61.

22. 101 111.

23. 44B4.

24. 102.

25.011001.

26, 237.

27. 1110 1100 0010 1100.

28, 1101 0000.

29.0001.

30.5.