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Chapter 2 – Data Representation exercises

1. Decimal to Binary conversions
   All numbers are positive (unsigned numbers). First line is a solved example

No.	Decimal Number	Binary Number
1	123	111 1011
2	1 023	
3	765	
4	9 898	
5	3 999	
6	159	
7	762	
8	7 602	
9	5 577	
10	2 004	
11	11 000	
12	35 355	
13	404	
14	1 234	
15	4 949	
16	573	
17	669	
18	917	
19	8 192	
20	7 811	
21	8 642	
22	3 789	
23	7 003	

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No.	Decimal Number	Binary Number
24	3 887	
25	6 423	
26	12 129	
27	27 298	
28	19 999	
29	9 873	
30	17 399	
31	57	
32	634	
33	9 824	
34	10 000	
35	5 665	
36	7 991	
37	999	
38	800	
39	3 333	
40	7 007	
41	12 123	
42	255	
43	7 777	
44	5 656	
45	4 321	
46	99	
47	375	
48	1 010	
49	8 119	

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No.	Decimal Number	Binary Number
50	6 944	
51	2 468	
52	1 753	
53	4 762	
54	8 117	
55	1 928	
56	7 956	
57	19 175	
58	22 222	
59	7 275	
60	1 983	
61	5 555	
62	36 133	
63	11 223	
64	4 590	
65	21 325	
66	9 176	
67	9	
68	81	
69	5 933	
70	9 724	
71	5 311	
72	14 000	
73	781	
74	35	
75	28 753	

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2. Binary to Decimal conversions

All numbers are positive (unsigned numbers). First line is a solved example

No.	Binary Number	Decimal Number
1	1 0000 0000	256
2	1100 1100 1101	
3	1 0010 0011 0100	
4	1 1000 0100 0010	
5	100 0000 0001	
6	1010 1010 1010	
7	1 0000 0000 0001	
8	100 1000 1000 1101	
9	1100 1100 1100	
10	111 1000 0111	
11	1 0000 0010 0100	
12	10 1010 1010 1010	
13	111 0111 0111 0111	
14	111 1011 0110	
15	1101 0000 1101	
16	1110 1001 1110	
17	101 0010 1100 0001	
18	101 0000 0000 1010	
19	101 0001 0001 1111	
20	100 1101 1100 0001	
21	1 1111 0011 0011	
22	11 0001 1111 1111	
23	11 0100 0101 0110	
24	111 1010 0001 0011	

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No.	Binary Number	Decimal Number
25	111 1010 1011 1100	
26	11 0011 1001 1000	
27	1111 1010 1010	
28	10 1000 1100 1001	
29	1011 0101 0101	
30	110 1110 1111	
31	11 1111 0100 0000	
32	1 0001 0000 0001	
33	1 1111 1111 1111	
34	110 0110 1000 0100	
35	1001 1001 1001	
36	1001 1010 1010	
37	11 0110 0111	
38	1111 0000 0000	
39	1000 0000 0001	
40	1010 0000 1111	
41	1000 1001 1010 1011	
42	1001 0111 0110	
43	11 0011 0011 0011	
44	1001 0111 0101 0011	
45	11 1000 1010	
46	1011 1011 1000	
47	1001 1110 1110	
48	1110 1110 1001	
49	101 0001 1110 0101	
50	11 0000 0000 0011	

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No.	Binary Number	Decimal Number
51	10 0100 0110 1001	
52	111 1010 1011	
53	1 1010 0010 0010	
54	101 0001 0001 0001	
55	111 0110 0101 0100	
56	1001 0010 0011 0100	
57	1 1001 0010 1000	
58	1000 0010 0111 0011	
59	1011 1100 1100	
60	1010 1001 1000	
61	110 1000 1010 0001	
62	100 1011 0001 1010	
63	10 1011 0110 1001	
64	111 0001 0101 0111	
65	111 0101 1001 0100	
66	1 1111 0000 1000	
67	1 0101 1011	
68	10 1011 0000 0011	
69	10 0010 1011 1000	
70	1 1000 1011 1101	
71	1110 1001 1001	
72	1 1110 1000 1111	
73	110 1100 0001 1001	
74	100 1010 0011 1101	
75	10 0000 0011 0110	
76	100 0000 0000 0000	

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3. Decimal to Hexadecimal conversions

All numbers are positive (unsigned numbers). First line is a solved example

No.	Decimal Number	Hexadecimal Number
1	31 987	7CF3
2	21 007	
3	17 000	
4	14 555	
5	17 800	
6	15 841	
7	14 773	
8	17 183	
9	79 891	
10	22 888	
11	12 871	
12	21 680	
13	14 000	
14	29 612	
15	16 658	
16	22 888	
17	10 000	
18	29 999	
19	30 651	
20	31 113	
21	30 001	
22	17 325	
23	9 876	
24	21 111	

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No.	Decimal Number	Hexadecimal Number
25	911	
26	14 590	
27	17 618	
28	9 784	
29	11 011	
30	8 933	
31	12 617	
32	21 039	
33	10 000	
34	6 785	
35	12 777	
36	24 242	
37	19 898	
38	6 444	
39	717	
40	3 982	
41	10 986	
42	519	
43	4 102	
44	22 097	
45	27 963	
46	16 741	
47	3 785	
48	9 261	
49	4 022	
50	26 789	

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4. Hexadecimal to Decimal conversions

All numbers are positive (unsigned numbers). First line is a solved example

No.	Hexadecimal Number	Decimal Number
1	8 000	32 768
2	6 B8C	
3	3 5DD	
4	3 E1D	
5	2 B67	
6	3 FCD	
7	2 6A0	
8	4 705	
9	A FC8	
10	2 FAD	
11	8 791	
12	7 A7A	
13	B 00F	
14	A 000	
15	7 575	
16	2 FAD	
17	5 AB0	
18	5 7E4	
19	4 944	
20	313	
21	3 745	
22	6 20B	
23	2 2CF	
24	5 A9B	

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No.	Hexadecimal Number	Decimal Number
25	9 C40	
26	20F	
27	7E0	
28	7 97B	
29	2 F59	
30	2 333	
31	4 2E0	
32	2 000	
33	1 D6B	
34	395	
35	3 30A	
36	2 222	
37	4 D6D	
38	4 36F	
39	2C7	
40	1 B63	
41	DAB	
42	FFA	
43	1 F62	
44	1 565	
45	393	
46	9A	
47	4 7B3	
48	4 267	
49	2 DE2	
50	2 107	

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5. Decimal to Octal conversions

All numbers are positive (unsigned numbers). First line is a solved example

No.	Decimal Number	Octal Number
1	3 755	7 253
2	11 111	
3	1 733	
4	12 121	
5	9 875	
6	9 077	
7	96 017	
8	23 777	
9	35 000	
10	33 333	
11	44 330	
12	45 145	
13	53 723	
14	2 323	
15	47 474	
16	32 432	
17	53 521	
18	39 999	
19	22 555	
20	40 960	
21	261 549	
22	20 480	
23	32 767	
24	319	

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No.	Decimal Number	Octal Number
25	26 788	
26	10 976	
27	17 435	
28	8 099	
29	11 099	
30	25 000	
31	9 822	
32	12 377	
33	5 077	
34	7 333	
35	49	
36	18 555	
37	9 000	
38	7 102	
39	8 989	
40	15 415	
41	2 017	
42	6 522	
43	16 581	
44	14 037	
45	9 378	
46	14 043	
47	9 998	
48	5 037	
49	17 321	
50	12 055	

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6. Octal to Decimal conversions

All numbers are positive (unsigned numbers). First line is a solved example

No.	Octal Number	Decimal Number
1	4 227	2 199
2	23 417	
3	1 733	
4	6 474	
5	36 475	
6	1 761	
7	17 630	
8	47 037	
9	76 220	
10	67 175	
11	137 743	
12	114 265	
13	67 742	
14	2 274	
15	27 351	
16	105 033	
17	202 152	
18	121 666	
19	51 167	
20	65 500	
21	17 777	
22	77 123	
23	37 000	
24	325	

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No.	Octal Number	Decimal Number
25	1 111	
26	12 345	
27	25 252	
28	6 666	
29	70 001	
30	56 712	
31	1 000	
32	63 451	
33	36 712	
34	3 412	
35	6 711	
36	7 033	
37	4 510	
38	2 777	
39	10 666	
40	12 012	
41	43 651	
42	33 773	
43	6 236	
44	1 177	
45	17 451	
46	6 755	
47	23 773	
48	5 000	
49	16 666	
50	7 654	

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7. Bases conversions (3-10)

All numbers are positive (unsigned numbers). First line is a solved example

No.	Decimal Number	Base 3	Base 4	Base 5	Base 6	Base 7
1	159	12 220	2 133	1 114	423	315
2	1 991					
3		101 111 111				
4			133 102			
5				304		
6						363
7	789					
8		1 210 010				
9			33 221			
10				24 102		
11					21 241	
12						20 352
13	8 192					
14		101 021 210				
15			332 133			
16				112 421		
17					51 155	
18						20 410
19	2 966					
20		2 121 021				
21			120 132			
22				21 401		
23					5 153	
24						11 520

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No.	Decimal Number	Base 3	Base 4	Base 5	Base 6	Base 7
25	1 733					
26		22 212 210				
27			20 321 323			
28				24 021		
29					213 342	
30						212 660
31	16 220					
32		1 101 021 111				
33			21 031 233			
34				424 030		
35					114 143	
36						6 426
37	21 351					
38		111 202 121				
39			10 322 320			
40				331 313		
41					140 543	
42						22 015
43	6 236					
44		1 121 121				
45			3 201 303			
46				222 010		
47					302 021	
48						20 402
49	16 666					
50		101 021 022				

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8. Bases conversions (10-15)
All numbers are positive (unsigned numbers). First line is a solved example

No.	Decimal Number	Base 11	Base 12	Base 13	Base 14	Base 15
1	1234	A22	86A	73C	642	574
2	3591					
3		586A				
4			3580			
5				101C		
6					1386	
7						13AC
8	2987					
9		911A				
10			5953			
11				3B3B		
12					2939	
13						1DBC
14	3926					
15		4151				
16			4238			
17				5BB0		
18					4099	
19						2E74
20	13456					
21		15211				
22			B6A7			
23				62BC		
24					5655	

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9. Decimal fractions to Binary fractions conversions

All numbers are positive (unsigned numbers). First line is a solved example

No.	Decimal Fraction	Binary Fraction
1	0.4375	0.0111
2	0.1875	
3	0.625	
4	0.1171875	
5	0.546875	
6	0.875	
7	0.34375	
8	0.9375	
9	0.375	
10	0.40625	
11	0.140625	
12	0.65625	
13	0.234375	
14	0.734375	
15	0.8125	
16	0.8984375	
17	0.71875	
18	0.109375	
19	0.578125	
20	0.953125	
21	0.5546875	
22	0.4765625	
23	0.13671875	
24	0.49609375	

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10. Binary fractions to Decimal fractions conversions

All numbers are positive (unsigned numbers). First line is a solved example

No.	Binary Fraction	Decimal Fraction
1	0.1	0.5
2	0.001	
3	0.1111111	
4	0.010001	
5	0.010111	
6	0.000001	
7	0.00011	
8	0.1011	
9	0.00101	
10	0.000101	
11	0.10001	
12	0.001101	
13	0.11101	
14	0.11	
15	0.100001	
16	0.00111	
17	0.1001	
18	0.010011	
19	0.011011	
20	0.11111	
21	0.0101101	
22	0.1100101	
23	0.0000011	
24	0.00011011	

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11. Negative numbers representations

Convert the negative decimal number to binary (16 bits). First line is a solved example

No.	Decimal Number	Binary Numbers		
		One's Complement	Two's Complement	Sign and Magnitude
1	- 4095	1111 0000 0000 0000	1111 0000 0000 0001	1000 1111 1111 1111
2	- 7612			
3	- 1985			
4	- 5777			
5	- 8000			
6	- 729			
7	- 3333			
8	- 4799			
9	- 6222			
10	- 3488			
11	- 8190			
12	- 9999			
13	- 7231			
14	- 3			
15	- 127			
16	- 4777			
17	- 1741			
18	- 7676			
19	- 4288			
20	- 3636			
21	- 1901			
22	- 8076			
23	- 5555			

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12. Numbers representations

Assuming the Hexadecimal number represents a 16 bits signed binary number convert it to a decimal number. The three columns represent the binary notation. First line is a solved example

No.	Hexadecimal Number	Decimal Numbers		
		One's Complement	Two's Complement	Sign and Magnitude
1	64	100	100	100
2	8FFF			
3	6ABC			
4	F0F0			
5	FC92			
6	FAB0			
7	2000			
8	EEEE			
9	D012			
10	8111			
11	7FFF			
12	BAD1			
13	A000			
14	E900			
15	D780			
16	9BBB			
17	AAAA			
18	6819			
19	8750			
20	C009			
21	ABCD			
22	DFEF			

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13. Adding binary numbers

First line is a solved example

No.	Binary Numbers		
	First Number	**Second Number**	**Result**
1	0011 0000 1101 0100	0010 0111 0000 0011	0101 0111 1101 0111
2	0010 0111 0000 1111	0010 1110 1110 1100	
3	0000 1010 1110 0100	0010 1110 0000 1000	
4	0010 1011 0110 0111	0000 0010 0010 1011	
5	0001 1111 1111 1111	0001 1111 1111 1111	
6	0000 1111 1111 1111	0010 1010 1100 1010	
7	0010 1010 0101 1010	0000 0111 1111 1111	
8	0001 1010 1011 1100	0001 1011 1100 1101	
9	0001 1111 1110 1111	0000 1111 1101 1011	
10	0011 1011 1010 1101	0001 1101 1101 1101	
11	0101 1001 1001 0011	0001 1111 1111 1111	
12	0001 0010 0011 0100	0001 0010 0011 0100	
13	0100 1010 1011 0101	0010 0101 0111 1011	
14	0011 1111 1111 1111	0011 1111 1111 1111	
15	0001 1010 1010 1010	0010 1101 1101 1101	
16	0100 1110 1110 1110	0001 1100 1100 1100	
17	0101 0101 0101 0101	0001 1111 1111 1111	
18	0001 1001 1111 1011	0011 1111 1011 1001	
19	0011 1010 0110 0111	0001 0110 0111 1010	
20	0001 1111 1011 1110	0011 1010 1100 1101	
21	0101 1010 1000 1011	0000 1010 1000 1011	
22	0010 0111 0111 0111	0010 1011 1011 1011	
23	0100 0100 0100 0100	0001 1100 1100 1100	

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14. Adding Hexadecimal unsigned numbers

First line is a solved example

No.	Hexadecimal Numbers		
	First Number	**Second Number**	**Result**
1	7895	4ABC	C351
2	1DDD	2CCC	
3	3DEF	2999	
4	42BD	2BFC	
5	4623	3BDE	
6	23DD	3D1F	
7	5A96	1E0F	
8	8B1E	1ED6	
9	22FF	3DF9	
10	2D2D	3F3F	
11	3DDE	3EED	
12	17EF	6E3F	
13	9ABC	1234	
14	5555	6789	
15	1FFF	6BAD	
16	6841	30FB	
17	351D	4FE2	
18	10FF	3EC7	
19	22EE	3DC9	
20	6699	1EB5	
21	3D8E	3F0F	
22	90E9	2E3F	
23	4BA4	5CB5	

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15. Adding Octal unsigned numbers

First line is a solved example

No.	Octal Numbers		
	First Number	**Second Number**	**Result**
1	3125	5632	10757
2	7777	1111	
3	21430	6705	
4	23561	17777	
5	36217	23567	
6	15374	25517	
7	52527	12774	
8	22337	33557	
9	17652	21576	
10	11666	55645	
11	21766	51622	
12	62357	22366	
13	12345	12345	
14	76543	1111	
15	32145	12306	
16	17365	36547	
17	47147	15647	
18	16736	26576	
19	26077	25716	
20	37437	26726	
21	42637	20675	
22	33512	32645	
23	32325	35353	

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16. Adding Base 3 unsigned numbers

First line is a solved example

No.	Base 3 Numbers		
	First Number	**Second Number**	**Result**
1	111020	11221	200011
2	11101	100022	
3	10121	20120	
4	10202	21111	
5	11010	22020	
6	11120	21220	
7	101201	20111	
8	101011	102121	
9	21101	21102	
10	21201	21220	
11	22020	20120	
12	101120	20021	
13	102010	2001	
14	100212	20011	
15	101210	21002	
16	20101	12201	
17	22122	20120	
18	101201	21110	
19	100110	20111	
20	21202	12111	
21	21211	101010	
22	102101	11121	
23	22002	101011	

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17. Adding Base 4 unsigned numbers

First line is a solved example

No.	Base 4 Numbers		
	First Number	**Second Number**	**Result**
1	30110	10320	101030
2	22323	11120	
3	20223	11031	
4	21223	11322	
5	22333	10332	
6	30312	12233	
7	30112	10331	
8	22100	20311	
9	32011	12003	
10	31221	2001	
11	23331	22032	
12	33031	12300	
13	31320	22122	
14	32211	23020	
15	22323	21121	
16	23202	30322	
17	30230	13212	
18	32003	23113	
19	32331	22233	
20	33220	13310	
21	103102	3222	
22	101113	11031	
23	31333	30122	

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18. Multiplying binary numbers

All are unsigned 16 bits numbers. First line is a solved example

No.	Binary Numbers		
	First Number	**Second Number**	**Result**
1	1111 1111	110 0010	110 0001 1001 1110
2	10 0011	101 0110	
3	100 1000	1000 1010	
4	1 1010 1011 0010	1101	
5	101 1101 1111	1 0011	
6	100 0000 1111	1 1111	
7	11 1100 1011	1001	
8	1 1000 0011	1 1101	
9	111 1000 1001	1101	
10	1101 1101 1110	110	
11	1 0000 1000 1001	101	
12	10 0011 1001	1011	
13	1010 1011 1011	111	
14	1 1010 1011	1 0010	
15	11 0110 1001	1110	
16	101 0101 0010	1 1110	
17	1110 1110 0010	1011	
18	1011 1010 1101	1110	
19	1011 0000 0000	1101	
20	100 1000 0011	1 1011	
21	1011 1011 0001	110	
22	1111 1111	1111 1111	
23	1011 1011	1011 1011	

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19. Floating point (754) notation (signed integers)

Convert between the numbers. First line is a solved example

No.	Decimal Number	Floating point Number
1	1	3F800000
2	2	
3		40400000
4	5	
5		41300000
6	17	
7		41C00000
8	28	
9		42000000
10	49	
11		426C0000
12	65	
13		429E0000
14	85	
15		42C60000
16	127	
17		436E0000
18	256	
19		43808000
20	313	
21		43B18000
22	485	
23		43F50000
24	515	

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No.	Decimal Number	Floating point Number
25		44054000
26	-4	
27		C0E00000
28	-13	
29		C1980000
30	-25	
31		C1F80000
32	-37	
33		C22C0000
34	-55	
35		C2860000
36	-73	
37		C29E0000
38	-86	
39		C2BA0000
40	-101	
41		C2EC0000
42	-197	
43		C3710000
44	-267	
45		C39A8000
46	-333	
47		C3C80000
48	-499	
49		C4034000
50	-541	

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20. Floating point (754) notation (signed fractions)

Convert between the numbers. First line is a solved example

No.	Decimal Number	Floating point Number
1	123.75	42F78000
2	76.25	
3		429B0000
4	64.3125	
5		42378000
6	75.75	
7		42158000
8	19.25	
9		41F90000
10	0.625	
11		42478000
12	63.5	
13		42C68000
14	12.125	
15		41C40000
16	31.625	
17		42B10000
18	73.25	
19		3F900000
20	3.375	
21		419E0000
22	66.875	
23		425A8000
24	27.25	

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No.	Decimal Number	Floating point Number
25		C2B24000
26	-25.625	
27		BE000000
28	-8.125	
29		C1CA0000
30	-26.375	
31		C2AF0000
32	-63.75	
33		C2250000
34	-0.3125	
35		C0BC0000
36	-33.375	
37		C1420000
38	-68.875	
39		C2978000
40	-1.75	
41		C2854000
42	-49.5	
43		C1CE0000
44	-99.125	
45		BF600000
46	-61.25	
47		C21D8000
48	-25.25	
49		C2560000
50	-71.125	

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21. Adding Floating point (754) numbers

Add the floating-point numbers, then covert them to decimal, add the decimal numbers and check against the floating-point result obtained. First line is a solved example

	Floating Point Numbers			Decimal Numbers		
No.	**First Number**	**Second Number**	**Result**	**First Number**	**Second Number**	**Result**
1	41700000	420C0000	42480000	15.0	35.0	50.0
2	C14C0000	40300000				
3	418E0000	41B20000				
4	3F600000	4280A000				
5	C2AF0000	422D0000				
6	429A0000	42080000				
7	44400000	43800000				
8	41CA0000	43BBB000				
9	414A0000	41460000				
10	C1EC0000	3F000000				
11	C18E0000	C20B0000				
12	BE400000	BF500000				
13	41DD0000	C0500000				
14	42C00000	41C00000				
15	44B08000	43008000				
16	42C80000	41100000				
17	41E40000	3FC00000				
18	BF400000	40300000				
19	413E0000	411E0000				
20	C0FC0000	41140000				
21	40C40000	40C40000				
22	40B80000	C1340000				

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22. Multiplying Floating point (754) numbers

Multiply the floating-point numbers, then covert them to decimal, multiply the decimal numbers and check against the floating-point result obtained. First line is a solved example

	Floating Point Numbers			Decimal Numbers		
No.	**First Number**	**Second Number**	**Result**	**First Number**	**Second Number**	**Result**
1	40A00000	C0000000	C1200000	5	-2	-10
2	41400000	40800000				
3	C0700000	C1000000				
4	40200000	40700000				
5	42C80000	C17C0000				
6	43000000	3FC00000				
7	C2800000	C2000000				
8	40900000	40B00000				
9	44800000	44000000				
10	C1C00000	42120000				
11	41700000	42080000				
12	411C0000	C0500000				
13	44200000	3E000000				
14	C2960000	C0800000				
15	417A0000	40900000				
16	41940000	C22D0000				
17	C1900000	C2B60000				
18	C2F00000	C2600000				
19	41C80000	41C00000				
20	C0C80000	42EC0000				
21	414A0000	41840000				

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23. BCD numbers (8421, 2421)

All are unsigned 16 bits numbers. First line is a solved example

No.	Decimal Number	BCD Numbers	
		8421	**2421**
1	1234	0001 0010 0011 0100	0001 0010 0011 0100
2	2468		
3	7136		
4	5497		
5	3780		
6	9026		
7	4512		
8	7462		
9	3297		
10	4582		
11	1097		
12	7651		
13	1928		
14	8763		
15	7329		
16	8461		
17	1357		
18	9042		
19	6703		
20	2730		
21	4587		
22	9768		
23	8264		

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24. BCD numbers (84-2-1, Excess-3)

All are unsigned 16 bits numbers. First line is a solved example

No.	Decimal Number	BCD Numbers	
		84-2-1	Excess - 3
1	1234	0111 0110 0101 0100	0100 0101 0110 0111
2	2468		
3	7136		
4	5497		
5	3780		
6	9026		
7	4512		
8	7462		
9	3297		
10	4582		
11	1097		
12	7651		
13	1928		
14	8763		
15	7329		
16	8461		
17	1357		
18	9042		
19	6703		
20	2730		
21	4587		
22	9768		
23	8264		

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