

**1. Convert the following binary numbers to equivalent decimal numbers.**

		2048	1024	512	256	128	64	32	16	8	4	2	1		
a	(1101) <sub>2</sub>									1	1	0	1		
										8	4		1	=	13 <sub>10</sub>
b	(11101) <sub>2</sub>								1	1	1	0	1		
									16	8	4		1	=	29 <sub>10</sub>
c	(0101 1101) <sub>2</sub>					0	1	0	1	1	1	0	1		
						64			16	8	4		1	=	93 <sub>10</sub>
d	(1101 1101) <sub>2</sub>					1	1	0	1	1	1	0	1		
						128	64		16	8	4		1	=	221 <sub>10</sub>
e	(1111 1111) <sub>2</sub>					1	1	1	1	1	1	1	1		
						128	64	32	16	8	4	2	1	=	255 <sub>10</sub>
f	(0101 1001) <sub>2</sub>					0	1	0	1	1	0	0	1		
						64			16	8			1	=	89 <sub>10</sub>
g	(1101 1101 0101) <sub>2</sub>	1	1	0	1	1	1	0	1	0	1	0	1		
		2048	1024		256	128	64		16		4		1	=	3541 <sub>10</sub>
		128	64	32	16	8	4	2	1	.	0.5	0.25	0.125		
h	(11100.101) <sub>2</sub>				1	1	1	0	0	.	1	0	1		
					16	8	4			.	1/2		1/8	=	28.625 <sub>10</sub>

**2. Convert the following decimal numbers to equivalent binary numbers.**

a	(57) <sub>10</sub>	57/2	28/2	14/2	7/2	3/2	1/2								
		1	0	0	1	1	1								111001 <sub>2</sub>
b	(45) <sub>10</sub>	45/2	22/2	11/2	5/2	2/2	1/2								
		1	0	1	1	0	1								101101 <sub>2</sub>
c	(255) <sub>10</sub>	255/2	127/2	63/2	31/2	15/2	7/2	3/2	1/2						
		1	1	1	1	1	1	1	1						11111111 <sub>2</sub>
d	(256) <sub>10</sub>	256/2	128/2	64/2	32/2	16/2	8/2	4/2	2/2	1/2					
		0	0	0	0	0	0	0	0	1					10000000 <sub>2</sub>
e	(2416) <sub>10</sub>	2416/2	1208/2	604/2	302/2	151/2	75/2	37/2	18/2	9/2	4/2	2/2	1/2		
		0	0	0	0	1	1	1	0	1	0	0	1		100101110000 <sub>2</sub>
f	(4195) <sub>10</sub>	4195/2	2097/2	1048/2	524/2	262/2	131/2	65/2	32/2	16/2	8/2	4/2	2/2	1/2	
		1	1	0	0	0	1	1	0	0	0	0	0	1	1000001100011 <sub>2</sub>

**3. Convert the following octal numbers to equivalent decimal numbers**

		512	64	8	1		
a	(45) <sub>8</sub>			4	5		
				32	5	=	37 <sub>10</sub>
b	(2243) <sub>8</sub>	2	2	4	3		
		1024	128	32	3	=	1187 <sub>10</sub>

4. Convert the following decimal numbers to equivalent octal numbers.

a	<b>(19)<sub>10</sub></b>	19/8	2/8				
		3	2			=	<b>23<sub>8</sub></b>
b	<b>(132)<sub>10</sub></b>	132/8	16/8	2/8			
		4	0	2		=	<b>204<sub>8</sub></b>
b	<b>(512)<sub>10</sub></b>	512/8	64/8	8/8	1/8		
		0	0	0	1	=	<b>1000<sub>8</sub></b>

5. Convert the following hexadecimal numbers to equivalent decimal numbers

		<b>4096</b>	<b>256</b>	<b>16</b>	<b>1</b>		
a	<b>(B4)<sub>16</sub></b>			11	4		
				176	4	=	<b>180<sub>10</sub></b>
b	<b>(1FF)<sub>16</sub></b>		1	15	15		
			256	240	15	=	<b>511<sub>10</sub></b>
c	<b>(28AD)<sub>16</sub></b>	2	8	10	13		
		8192	2048	160	13	=	<b>10413<sub>10</sub></b>

6. Convert the following decimal numbers to equivalent hexadecimal numbers.

a	<b>(19)<sub>10</sub></b>	19/16	1/16				
		3	1			=	<b>13<sub>16</sub></b>
b	<b>(312)<sub>10</sub></b>	312/16	19/16	1/16			
		8	3	1		=	<b>138<sub>16</sub></b>
c	<b>(513)<sub>10</sub></b>	513/16	32/16	2/16			
		1	0	2		=	<b>201<sub>16</sub></b>

7. Convert the following binary numbers to equivalent octal numbers.

a	<b>(1 1101)<sub>2</sub></b>		11	101		
			3	5	=	<b>35<sub>8</sub></b>
b	<b>(1 0110 1101)<sub>2</sub></b>	101	101	101		
		5	5	5	=	<b>555<sub>8</sub></b>
c	<b>(1011 0101)<sub>2</sub></b>	10	110	101		
		2	6	5	=	<b>265<sub>8</sub></b>

8. Convert the following binary numbers to equivalent hexadecimal numbers

a	<b>(10 1010)<sub>2</sub></b>		10	1010		
			2	10		
			2	A	=	<b>2A<sub>16</sub></b>
b	<b>(1 1110 0110)<sub>2</sub></b>	1	1110	110		
		1	14	6		
		1	E	6	=	<b>1E6<sub>16</sub></b>
c	<b>(1101 0101)<sub>2</sub></b>		1101	101		
			13	5		
			D	5	=	<b>D5<sub>16</sub></b>

9. Perform the following unsigned binary arithmetic. Verify your answer by converting each problem into decimal. (Note: the last two are subtraction!)

a.

$$\begin{array}{r} 11\ 111 \\ 01110101 \\ +00110011 \\ \hline 10101000_2 \end{array}$$

b.

$$\begin{array}{r} 111111 \\ 00100110 \\ +01011011 \\ \hline 10000001_2 \end{array}$$

c.

$$\begin{array}{r} 11\ 11 \\ 10010011 \\ +00111011 \\ \hline 11001110_2 \end{array}$$

d.

$$\begin{array}{r} 111 \\ 01011100 \\ +00011111 \\ \hline 01111011_2 \end{array}$$

e.

$$\begin{array}{r} /12 \\ 10011011 \\ -00111011 \\ \hline 01100000_2 \end{array}$$

f.

$$\begin{array}{r} 22 \\ /1//12 \\ 01011001 \\ -00011111 \\ \hline 00111010_2 \end{array}$$

		128	64	32	16	8	4	2	1		
a	(01110101) <sub>2</sub>	0	1	1	1	0	1	0	1		
	+		64	32	16		4		1	=	117 <sub>10</sub>
	(0011 0011) <sub>2</sub>	0	0	1	1	0	0	1	1		+
	=			32	16			2	1	=	51 <sub>10</sub>
	(10101000) <sub>2</sub>	1	0	1	0	1	0	0	0		=
		128		32		8				=	168 <sub>10</sub>
b	(00100110) <sub>2</sub>	0	0	1	0	0	1	1	0		
	+			32			4	2		=	38 <sub>10</sub>
	(01011011) <sub>2</sub>	0	1	0	1	1	0	1	1		+
	=		64		16	8		2	1	=	91 <sub>10</sub>
	(10000001) <sub>2</sub>	1	0	0	0	0	0	0	1		=
		128							1	=	129 <sub>10</sub>
c	(10010011) <sub>2</sub>	1	0	0	1	0	0	1	1		
	+	128			16			2	1	=	147 <sub>10</sub>
	(00111011) <sub>2</sub>	0	0	1	1	1	0	1	1		+
	=			32	16	8		2	1	=	59 <sub>10</sub>
	(11001110) <sub>2</sub>	1	1	0	0	1	1	1	0		=
		128	64			8	4	2		=	206 <sub>10</sub>
d	(01011100) <sub>2</sub>	0	1	0	1	1	1	0	0		
	+		64		16	8	4			=	92 <sub>10</sub>
	(00011111) <sub>2</sub>	0	0	0	1	1	1	1	1		+
	=				16	8	4	2	1	=	31 <sub>10</sub>
	(01111011) <sub>2</sub>	0	1	1	1	1	0	1	1		=
			64	32	16	8		2	1	=	123 <sub>10</sub>
e	(10011011) <sub>2</sub>	1	0	0	1	1	0	1	1		
	-	128			16	8		2	1	=	155 <sub>10</sub>
	(00111011) <sub>2</sub>	0	0	1	1	1	0	1	1		-
	=			32	16	8		2	1	=	59 <sub>10</sub>
	(01100000) <sub>2</sub>	0	1	1	0	0	0	0	0		=
			64	32						=	96 <sub>10</sub>
f	(01011001) <sub>2</sub>	0	1	0	1	1	0	0	1		
	+		64		16	8			1	=	89 <sub>10</sub>
	(00011111) <sub>2</sub>	0	0	0	1	1	1	1	1		-
	=				16	8	4	2	1	=	31 <sub>10</sub>
	(00111010) <sub>2</sub>	0	0	1	1	1	0	1	0		=
				32	16	8		2		=	58 <sub>10</sub>

10. Perform the following octal arithmetic. Verify your results by converting each problem into decimal.

			512	64	8	1		
a.								
	1	a	(424) <sub>8</sub>		4	2	4	
	424		+		256	16	4	= 276 <sub>10</sub>
	+163		(163) <sub>8</sub>		1	6	3	+
	----		=		64	48	3	= 115 <sub>10</sub>
	607 <sub>8</sub>		(607) <sub>8</sub>		6	0	7	=
					384	0	7	= 391 <sub>10</sub>
b.		b	(5112) <sub>8</sub>	5	1	1	2	
	1		+	2560	64	8	2	= 2634 <sub>10</sub>
	5112		(1346) <sub>8</sub>	1	3	4	6	+
	+1346		=	512	192	32	6	= 742 <sub>10</sub>
	-----		(6460) <sub>8</sub>	6	4	6	0	=
	6460 <sub>8</sub>			3072	256	48	0	= 3376 <sub>10</sub>

11. Perform the following hexadecimal arithmetic. Verify your results by converting each problem into decimal. (Note: the last two are subtraction!)

			256	16	1		
a.							
	A4		(A4) <sub>16</sub>		10	4	
	+27		+		160	4	= 164 <sub>10</sub>
	---		(27) <sub>16</sub>		2	7	+
	CB <sub>16</sub>		=		32	7	= 39 <sub>10</sub>
			(CB) <sub>16</sub>		C	B	=
					192	11	= 203 <sub>10</sub>
b.		b	(7F3) <sub>16</sub>	7	F	3	
			+	1792	240	3	= 2035 <sub>10</sub>
			(41D) <sub>16</sub>	4	1	D	+
			=	1024	16	13	= 1053 <sub>10</sub>
			(C10) <sub>16</sub>	C	1	0	=
				3072	16	0	= 3088 <sub>10</sub>
c.		c	(806) <sub>16</sub>	8	0	6	
			-	2048	0	6	= 2054 <sub>10</sub>
			(4B) <sub>16</sub>		4	B	-
			=		64	11	= 75 <sub>10</sub>
			(7BB) <sub>16</sub>	7	B	B	=
				1792	176	11	= 1979 <sub>10</sub>
d.		d	(56C) <sub>16</sub>	5	6	C	
			-	1280	96	12	= 1388 <sub>10</sub>
			(1FF) <sub>16</sub>	1	F	F	-
			=	256	240	15	= 511 <sub>10</sub>
			(36D) <sub>16</sub>	3	6	D	=
				768	96	13	= 877 <sub>10</sub>