Introduction to Coding

ASCII Code

Decimal	Octal	Hexadecimal	Binary	Symbol		Decimal	Octal	Hexadecimal	Binary	Symbol
000	000	00	00000000	NUL		064	100	40	01000000	@
001	001	01	00000001	SOH		065	101	41	01000001	A
002	002	02	00000010	STX		066	102	42	01000010	B
003	003	03	00000011	ETX		067	103	43	01000011	C
004	004	04	00000100	EOT		068	104	44	01000100	D
005	005	05	00000101	ENQ		069	105	45	01000101	E
006	006	06	00000110	ACK		070	106	46	01000110	F
007	007	07	00000111	BEL		071	107	47	01000111	G
008	010	08	00001000	BS		072	110	48	01001000	H
009	011	09	00001001	HT		073	111	49	01001001	I
010	012	0A	00001010	LF		074	112	4A	01001010	J
011	013	0B	00001011	VT		075	113	4B	01001011	K
012	014	0C	00001100	FF		076	114	4C	01001100	L
013	015	0D	00001101	CR		077	115	4D	01001101	M
014	016	0E	00001110	SO		078	116	4E	01001110	N
015	017	0F	00001111	SI		079	117	4F	01001111	O
016	020	10	00010000	DLE		080	120	50	01010000	P
017	021	11	00010001	DC1		081	121	51	01010001	Q
018	022	12	00010010	DC2		082	122	52	01010010	R
019	023	13	00010011	DC3		083	123	53	01010011	S
020	024	14	00010100	DC4		084	124	54	01010100	T
021	025	15	00010101	NAK		085	125	55	01010101	U
022	026	16	00010110	SYN		086	126	56	01010110	V
023	027	17	00010111	ETB		087	127	57	01010111	W
024	030	18	00011000	CAN		088	130	58	01011000	X
025	031	19	00011001	EM		089	131	59	01011001	Y
026	032	1A	00011010	SUB		090	132	5A	01011010	Z
027	033	1B	00011011	ESC		091	133	5B	01011011	[
028	034	1C	00011100	FS		092	134	5C	01011100	\
029	035	1D	00011101	GS		093	135	5D	01011101	]
030	036	1E	00011110	RS		094	136	5E	01011110	^
031	037	1F	00011111	US		095	137	5F	01011111	_
032	040	20	00100000			096	140	60	01100000	`
033	041	21	00100001	!		097	141	61	01100001	a
034	042	22	00100010	"		098	142	62	01100010	b
035	043	23	00100011	#		099	143	63	01100011	c
036	044	24	00100100	$		100	144	64	01100100	d
037	045	25	00100101	%		101	145	65	01100101	e
038	046	26	00100110	&		102	146	66	01100110	f
039	047	27	00100111	'		103	147	67	01100111	g
040	050	28	00101000	(		104	150	68	01101000	h
041	051	29	00101001	)		105	151	69	01101001	i
042	052	2A	00101010	*		106	152	6A	01101010	j
043	053	2B	00101011	+		107	153	6B	01101011	k
044	054	2C	00101100	,		108	154	6C	01101100	l
045	055	2D	00101101	-		109	155	6D	01101101	m
046	056	2E	00101110	.		110	156	6E	01101110	n
047	057	2F	00101111	/		111	157	6F	01101111	o
048	060	30	00110000	0		112	160	70	01110000	p
049	061	31	00110001	1		113	161	71	01110001	q
050	062	32	00110010	2		114	162	72	01110010	r
051	063	33	00110011	3		115	163	73	01110011	s
052	064	34	00110100	4		116	164	74	01110100	t
053	065	35	00110101	5		117	165	75	01110101	u
054	066	36	00110110	6		118	166	76	01110110	v
055	067	37	00110111	7		119	167	77	01110111	w
056	070	38	00111000	8		120	170	78	01111000	x
057	071	39	00111001	9		121	171	79	01111001	y
058	072	3A	00111010	:		122	172	7A	01111010	z
059	073	3B	00111011	;		123	173	7B	01111011	{
060	074	3C	00111100	<		124	174	7C	01111100	|
061	075	3D	00111101	=		125	175	7D	01111101	}
062	076	3E	00111110	>		126	176	7E	01111110	~
063	077	3F	00111111	?		127	177	7F	01111111	delete

Decoding with the ASCII Code

All text must be converted to strings of 1's and 0's in order to be stored in a computer. Use the ascii code, shown on the previous page to decode this sentence. It may be helpful to draw dividing lines on this page to help read the strings of 1's and 0's. Only decode enough to tell you what the sentence says and to determine who first wrote the words.

When you are done, encode the same words with octal code and then with hexidecimal code.

0 1 0 0 0 1 1 0 0 1 1 0 1 1 1 1 0 1 1 1 0 1 0 1 0 1 1 1 0 0 1 0 0 0 1 0 0 0 0 0 0 0 1 1 1 0 0 1 1

0 1 1 0 0 0 1 1 0 1 1 0 1 1 1 1 0 1 1 1 0 0 1 0 0 1 1 0 0 1 0 1 0 0 1 0 0 0 0 0 0 1 1 0 0 0 0 1

0 1 1 0 1 1 1 0 0 1 1 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 1 1 1 0 0 1 1 0 1 1 0 0 1 0 1 0 1 1 1 0 1 1 0

0 1 1 0 0 1 0 1 0 1 1 0 1 1 1 0 0 0 1 0 0 0 0 0 0 0 1 1 1 1 0 0 1 0 1 1 0 0 1 0 1 0 1 1 0 0 0 0 1

0 1 1 1 0 0 1 0 0 1 1 1 0 0 1 1 0 0 1 0 0 0 0 0 0 0 1 1 0 0 0 0 1 0 1 1 0 0 1 1 1 0 1 1 0 1 1 1 1

0 0 1 0 0 0 0 0 0 1 1 0 1 1 1 1 0 1 1 1 0 1 0 1 0 1 1 1 0 0 1 0 0 0 1 0 0 0 0 0 0 0 1 1 0 0 1 1 0

0 1 1 0 0 0 0 1 0 1 1 1 0 1 0 0 0 1 1 0 1 0 0 0 0 1 1 0 0 1 0 1 0 1 1 1 0 0 1 0 0 1 1 1 0 0 1 1

0 0 1 0 0 0 0 0 0 1 1 0 0 0 1 0 0 1 1 1 0 0 1 0 0 1 1 0 1 1 1 1 0 1 1 1 0 1 0 1 0 1 1 0 0 1 1 1

0 1 1 0 1 0 0 0 0 1 1 1 0 1 0 0 0 0 1 0 0 0 0 0 0 1 1 0 0 1 1 0 0 1 1 0 1 1 1 1 0 1 1 1 0 0 1 0

0 1 1 1 0 1 0 0 0 1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 1 1 1 1 0 1 1 0 1 1 1 0 0 0 1 0 0 0 0 0

0 1 1 1 0 1 0 0 0 1 1 0 1 0 0 0 0 1 1 0 1 0 0 1 0 1 1 1 0 0 1 1 0 0 1 0 0 0 0 0 0 0 1 1 0 0 0 1 1

0 1 1 0 1 1 1 1 0 1 1 0 1 1 1 0 0 1 1 1 0 1 0 0 0 1 1 0 1 0 0 1 0 1 1 0 1 1 1 0 0 1 1 0 0 1 0 1

0 1 1 0 1 1 1 0 0 1 1 1 0 1 0 0 0 0 1 0 1 1 0 0 0 0 1 0 0 0 0 0 0 0 1 1 0 0 0 0 1 0 0 1 0 0 0 0 0

0 1 1 0 1 1 1 0 0 1 1 0 0 1 0 1 0 1 1 1 0 1 1 1 0 0 1 0 0 0 0 0 0 1 1 0 1 1 1 0 0 1 1 0 0 0 0 1

0 1 1 1 0 1 0 0 0 1 1 0 1 0 0 1 0 1 1 0 1 1 1 1 1 0 1 1 0 1 1 1 0 0 0 1 0 1 1 0 0 0 0 1 0 0 0 0 0

0 1 1 0 0 0 1 1 0 1 1 0 1 1 1 1 0 1 1 0 1 1 1 0 0 1 1 0 0 0 1 1 0 1 1 0 0 1 0 1 0 1 1 0 1 0 0 1

0 1 1 1 0 1 1 0 0 1 1 0 0 1 0 1 0 1 1 0 0 1 0 0 0 0 1 0 0 0 0 0 0 1 1 0 1 0 0 1 0 1 1 0 1 1 1 0

0 0 1 0 0 0 0 0 0 1 0 0 1 1 0 0 0 1 1 0 1 0 0 1 0 1 1 0 0 0 1 0 0 1 1 0 0 1 0 1 0 1 1 1 0 0 1 0

0 1 1 1 0 1 0 0 0 1 1 1 0 0 1 0 0 1 0 1 1 0 0 0 0 1 0 0 0 0 0 0 0 1 1 0 0 0 0 1 0 1 1 0 1 1 1 0

0 1 1 0 0 1 0 0 0 0 1 0 0 0 0 0 0 1 1 0 0 1 0 0 0 1 1 0 0 1 0 1 0 1 1 0 0 1 0 0 0 1 1 0 1 0 0 1

0 1 1 0 0 0 1 1 0 1 1 0 0 0 0 1 0 1 1 1 0 1 0 0 0 1 1 0 0 1 0 1 0 1 1 0 0 1 0 0 0 0 1 0 0 0 0 0

0 1 1 1 0 1 0 0 0 1 1 0 1 1 1 1 0 0 1 0 0 0 0 0 0 0 1 1 1 0 1 0 0 0 1 1 0 1 0 0 0 0 1 1 0 0 1 0 1

ASCII Code: Patterns

Looking for patterns in number tables is one way middle school mathematics students learn about algebra. The ASCII Code table is like a function input/output table. We can focus on two columns and think of one column as the input and the other as the output.

There are two ways to look for patterns in a table like the table of ascii codes. One way is to look for a pattern going down the table. For example, going down the column labeled **Decimal** the pattern is increasing by +1 each time.

1. In the ASCII Code tables, describe a pattern you see going down the column labeled **Octal**. That is say something about how the numbers change as you go down that column. The best answer is to say exactly how to go from the number in one row to the number in the next row.

Another way to look for patterns is going across. Generally, these patterns are more difficult to describe and may require formulas and procedures. We would like to be able to completely describe the pattern from one column in the ASCII table to another. We would like to find ways of describing how to take a number from one column and calculate the number in the same row of another column.

2. Describe how to convert a **Octal** numeral to it in an **decimal** numeral.

3. Describe how to convert a **decimal** numeral to the **octal** numeral.

Teaching Patterns: 1213121412131215 . . .

On this page, write down your summary and reactions to each way the 1213 pattern was described. Write down enough information so that you could refer to this later and teach it to someone else. Which way was best for you to learn? Why? Which way would you like to teach? Why?

chanting – describing patterns
Auditory learning is a teaching and learning style in which a person learns through listening.

inches
Visual learning is a teaching and learning style in which ideas, concepts, data and other information are associated with images and techniques.

counting with fingers, standing and sitting
Kinesthetic learning is a teaching and learning style in which learning takes place by the student actually carrying out a physical activity.

Assignment: 1213121412131215 . . .

1	2	3	4
fingers	counting, place value two	counting, place value ten	1213 numbers
T	00001	1	1
I	00010	2	2
IT	00011	3	1
M	00100	4	3
MT	00101	5	1
MI	00110	6	2
MIT	00111	7	1
R	01000	8	4
RT	01001	9	1
RI	01010	10	2
RIT	01011	11	1
RM	01100	12	3
RMT	01101	13	1
RMI	01110	14	2
RMIT	01111	15	1
P	10000	16	5
PT	10001	17	1
PI	10010	18	2
PIT	10011	19	1
PM	10100	20	3
PMT	10101	21	1
PMI	10110	22	2
PMIT	10111	23	1
PR	11000	24	4
PRT	11001	25	1
PRI	11010	26	2
PRIT	11011	27	1
PRM	11100	28	3
PRMT	11101	29	1
PRMI	11110	30	2
PRMIT	11111	31	1

1. On another sheet of paper, write out the first 512 1213 numbers. Organize your work in such a way that a pattern emerges. You may use an excel worksheet if you know how. Write an explanation of this pattern.

2. Explain a pattern that you observe going down column 2 of the table on the left. Explain well enough so the reader can continue the numbers using your pattern.

3. Find pattern, or formula, that explains how to go from left to right in the table. Explain the pattern or formula. For example, explain a procedure that takes a number from column 3 and computes the corresponding number in column 2.

4. Write a careful explanation: There are 32 different ways one can hold up the five fingers of a hand.

Counting in Octaland

In Octaland the people, although similar to us in every other way, have only four fingers on each hand. Consequently, their numeration system has developed very different from our own. Here is a table that summarizes their system:

Octites count by saying	To represent this many things	The octal numeral for this number	the decimal numeral for this number
one	**I**	1	
two	**II**	2	
three	**III**	3	
four	**IIII**	4	
five	**IIII I**	5	
six	**IIII II**	6	
seven	**IIII III**	7	
oct	**IIII IIII**	10	
one-oct-one	**IIII IIII I**	11	
one-oct -two	**IIII IIII II**	12	
one-oct-three	**IIII IIII III**	13	
one-oct-four	**IIII IIII IIII**	14	
one-oct-five	**IIII IIII IIII I**	15	
one-oct-six	**IIII IIII IIII II**	16	
one-oct-seven	**IIII IIII IIII III**	17	
two-oct	**IIII IIII IIII IIII**	20	
two-oct-one	**IIII IIII IIII IIII I**	21	
two-oct-two	**IIII IIII IIII IIII II**	22	
two-oct-three	**IIII IIII IIII IIII III**	23	
two-oct-four	**IIII IIII IIII IIII IIII**	24	
two-oct-five	**IIII IIII IIII IIII IIII I**	25	
two-oct-six	**IIII IIII IIII IIII IIII II**	26	
two-oct-seven	**IIII IIII IIII IIII IIII III**	27	
three-oct	**IIII IIII IIII IIII IIII IIII**	30	
three-oct-one	**IIII IIII IIII IIII IIII IIII I**	31	
three-oct-two	**IIII IIII IIII IIII IIII IIII II**	32	
three-oct-three	**IIII IIII IIII IIII IIII IIII III**	33	
three-oct-four	**IIII IIII IIII IIII IIII IIII IIII**	34	
three-oct-five	**IIII IIII IIII IIII IIII IIII IIII I**	35	
three-oct-six	**IIII IIII IIII IIII IIII IIII IIII II**	36	
three-oct-seven	**IIII IIII IIII IIII IIII IIII IIII III**	37	
four-oct	**IIII IIII IIII IIII IIII IIII IIII IIII**	40	
four-oct-one	**IIII IIII IIII IIII IIII IIII IIII IIII I**	41	
four-oct-two	**IIII IIII IIII IIII IIII IIII IIII IIII II**	41	

Arithmetic in Octaland

All numbers on this page are octal numbers. How would you teach an Octite child to do these problems in a way that emphasizes concepts over procedures?

Adding

$$\begin{array}{r} 14 \\ +11 \\ \hline \end{array} \qquad \begin{array}{r} 27 \\ +35 \\ \hline \end{array}$$

Subtracting

$$\begin{array}{r} 55 \\ -16 \\ \hline \end{array} \qquad \begin{array}{r} 200 \\ -17 \\ \hline \end{array}$$

Multiplying

$$\begin{array}{r} 15 \\ \times\ 7 \\ \hline \end{array} \qquad \begin{array}{r} 65 \\ \times 17 \\ \hline \end{array}$$

Dividing

$$3\overline{)14} \qquad 12\overline{)604}$$

Numbernames in Octaland

Cryptographers often use base 8 arithmetic to encode messages. This suggests another way to keep your name secret: convert it to a base 8 numeral. Cathy's numbername in base 8 is 1373525404 because

$$1x8^9 + 3x8^8 + 7x8^7 + 3x8^6 + 5x8^5 + 2x8^4 + 5x8^3 + 4x8^2 + 4 = 200190724$$

1. Convert your numbername to base 8. Explain your method.

Sideways Arithmetic in Octaland

These puzzles from Octaland Sideways Arithmetic look just like the puzzles on page XX. But this time each one represents an arithmetic problem done in base 8 like the Octaland problems on page XX The digits 0, 1, 2, 3, 4, 5, 6, and 7 have been replaced by a letter of the alphabet.

These problems look the same but the arithmetic statements they encode represent different numbers than they did in decimal arithmetic. Do these same puzzles have a solution in base 8?

1.

```
  boys
+ boys
 silly
```

input:	0	1	2	3	4	5	6	7
output:		s	y		l	b	o	

2.

```
  girls
+ girls
  silly
```

input:	0	1	2	3	4	5	6	7
output:	l	g		s	r		y	i

3.

```
  arcs
+ bras
 crass
```

input:	0	1	2	3	4	5	6	7
output:	s	c		r	b			a

4.

```
 llama
- seal
  seal
```

input:	0	1	2	3	4	5	6	7
output:		l	a		ms	e		