

## STUDENT WORKSHEET

**Translating Decimal to Binary**

Name: \_\_\_\_\_

Explanation: Below are three groups of columns. One group is the “letter” column; the second group is the “decimal” column; and the third group is the “binary number” column. Using your understanding of binary numbers, translate the letter and decimal into a binary number.

Letter	Decimal		Binary Number				
	10	1	16	8	4	2	1
A		0					
B		1					
C		2					
D		3					
E		4					
F		5					
G		6					
H		7					
I		8					
J		9					
K	1	0					
L	1	1					
M	1	2					
N	1	3					
O	1	4					
P	1	5					
Q	1	6					
R	1	7					
S	1	8					
T	1	9					
U	2	0					
V	2	1					
W	2	2					
X	2	3					
Y	2	4					
Z	2	5					

## STUDENT WORKSHEET

**Translating Binary to Decimal**

Name: \_\_\_\_\_

Explanation: Below are three groups of columns. One group is the “letter” column, the second group is the “decimal” column, and the third group is the “binary number” column. Using your understanding of binary numbers, translate the binary number into decimal notation.

Letter	Decimal		Binary Number				
	10	1	16	8	4	2	1
A			1	1	0	0	1
B			1	0	1	1	1
C			1	0	1	0	1
D			1	0	0	1	1
E			1	0	0	0	1
F			0	1	1	1	1
G			0	1	1	0	1
H			0	1	0	1	1
I			0	1	0	0	1
J			0	0	1	1	1
K			0	0	1	0	1
L			0	0	0	1	1
M			0	0	0	0	1
N			1	1	0	0	0
O			1	0	1	1	0
P			1	0	1	0	0
Q			1	0	0	1	0
R			1	0	0	0	0
S			0	1	1	1	0
T			0	1	1	0	0
U			0	1	0	1	0
V			0	1	0	0	0
W			0	0	1	1	0
X			0	0	1	0	0
Y			0	0	0	1	0
Z			0	0	0	0	0

## Teacher Answer Key

### Answer Key: Binary - Decimal Conversion Worksheet

Letter	Decimal		Binary Number				
	10	1	16	8	4	2	1
A		0	0	0	0	0	0
B		1	0	0	0	0	1
C		2	0	0	0	1	0
D		3	0	0	0	1	1
E		4	0	0	1	0	0
F		5	0	0	1	0	1
G		6	0	0	1	1	0
H		7	0	0	1	1	1
I		8	0	1	0	0	0
J		9	0	1	0	0	1
K	1	0	0	1	0	1	0
L	1	1	0	1	0	1	1
M	1	2	0	1	1	0	0
N	1	3	0	1	1	0	1
O	1	4	0	1	1	1	0
P	1	5	0	1	1	1	1
Q	1	6	1	0	0	0	0
R	1	7	1	0	0	0	1
S	1	8	1	0	0	1	0
T	1	9	1	0	0	1	1
U	2	0	1	0	1	0	0
V	2	1	1	0	1	0	1
W	2	2	1	0	1	1	0
X	2	3	1	0	1	1	1
Y	2	4	1	1	0	0	0
Z	2	5	1	1	0	0	1

**Answer Key: Decimal - Binary  
Conversion Worksheet**

Letter	Decimal		Binary Number				
	10	1	16	8	4	2	1
A	2	5	1	1	0	0	1
B	2	3	1	0	1	1	1
C	2	1	1	0	1	0	1
D	1	9	1	0	0	1	1
E	1	7	1	0	0	0	1
F	1	5	0	1	1	1	1
G	1	3	0	1	1	0	1
H	1	1	0	1	0	1	1
I		9	0	1	0	0	1
J		7	0	0	1	1	1
K		5	0	0	1	0	1
L		3	0	0	0	1	1
M		1	0	0	0	0	1
N	2	4	1	1	0	0	0
O	2	2	1	0	1	1	0
P	2	0	1	0	1	0	0
Q	1	8	1	0	0	1	0
R	1	6	1	0	0	0	0
S	1	4	0	1	1	1	0
T	1	2	0	1	1	0	0
U	1	0	0	1	0	1	0
V		8	0	1	0	0	0
W		6	0	0	1	1	0
X		4	0	0	1	0	0
Y		2	0	0	0	1	0
Z		0	0	0	0	0	0

**Note:** We decided to create boxes with only four switches. Thus, we had to figure out which messages we were going to code, then assign different patterns of ones and zeros (on/off) to different letters in order to create the secret messages for the students to decode.

Each box is numbered 1 – 10, and each box has its own message.

message #	1	2	3	4	5	6	7	8	9	10
0000	c	b	a	a	b	a	a	a	a	a
0001	d	c	b	d	c	b	b	b	d	d
0010	e	e	c	e	d	e	c	d	e	e
0011	h	f	d	f	e	f	e	e	g	g
0100	l	h	e	h	g	g	f	l	h	h
0101	k	l	l	l	h	h	h	j	l	l
0110	l	l	j	l	j	l	j	k	k	l
0111	n	n	l	m	k	k	k	l	l	n
1000	o	o	n	n	l	n	m	n	m	o
1001	p	p	p	o	o	o	o	o	n	r
1010	r	r	r	r	q	p	p	r	o	s
1011	s	s	s	t	r	r	r	t	r	t
1100	t	u	t	u	t	s	s	u	s	u
1101	u	v	u	w	u	t	t	v	t	v
1110	v	w	v	y	x	u	u	w	v	w
1111	y	y	y	z	y	v	w	x	w	y

**Messages:**

- Message 1: The key to success is discipline.
- Message 2: Believe in yourself.
- Message 3: Celebrate diversity.
- Message 4: You are the winner.
- Message 5: You broke the binary code.
- Message 6: Engineering is fun.
- Message 7: Reach for the stars.
- Message 8: Turn an idea into an invention.
- Message 9: Imagination is more important than knowledge.
- Message 10: You learn new things every day.







STUDENT WORKSHEET

Name: \_\_\_\_\_

**Online Binary Box Worksheet**

*Use website:*

<http://www.engineering.tufts.edu/stemteams/binarybox/STEMSrb.html>

Binary  
Code \_\_\_\_\_

Letter \_\_\_\_\_

Binary  
Code \_\_\_\_\_

Letter \_\_\_\_\_

Binary  
Code \_\_\_\_\_

Letter \_\_\_\_\_

Binary  
Code \_\_\_\_\_

Letter \_\_\_\_\_

Binary  
Code \_\_\_\_\_

Letter \_\_\_\_\_

*Solution:* \_\_\_\_\_

## “You are the Wizard” Binary Quiz

1. When creating the binary conversion table, **HOW** do we get the numbers to fill in the title row? You may use sentences or a mathematical formula.

2. What are the first five numbers in the title row?

\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

3. Binary: 11001010                      Decimal: \_\_\_\_\_

4. Binary: 1000111                      Decimal: \_\_\_\_\_

5. Decimal: 200                      Binary: \_\_\_\_\_

6. Decimal: 111                      Binary: \_\_\_\_\_

7-9. Name three uses of binary: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

10. How many bits are in a byte? \_\_\_\_\_