Topic: Number systems: Binary, Octal, Decimal and Hexadecimal

True and False

- Today we covered 4 types of number system: binary, unary, decimal, hexadecimal
- Decimal numbers can be converted into binary by dividing by two and recording the remainders.
- The most significant digit is the rightmost, largest-weight digit in a number.
- In a number system, each position of a digit represents a specific power of the base.
- The octal number system consists of eight digits, 0 through 7.
- When converting from decimal to binary by the repeated division-by-two method, the initial remainder becomes the MSD.
- This numbers has the same value in decimal and hexadecimal: 8
- 1111 in Binary is the same as 10 in Octal?

Multiple choice questions

1. What could be the maximum value of a single digit in an octal number system?

   (a) 8
   (b) 7
   (c) 6
   (d) 5

2. The maximum number of bits sufficient to represent an octal number in binary is

   (a) 4
   (b) 3
   (c) 7
   (d) 8

3. Convert $(22)_8$ into its corresponding decimal number.

   (a) 28
   (b) 18
   (c) 81
   (d) 82

4. The binary number 111 in octal format is

   (a) 6
   (b) 7
   (c) 8
   (d) 5

5. The next hexadecimal number after F is:

   (a) 10
   (b) F0
   (c) G
   (d) 11

6. Any number with an exponent of zero is equal to

   (a) itself
   (b) ten
   (c) zero
   (d) one

Solve on the board

Problem 1
Convert the following decimal numbers into binary and show solving procedure

Decimal	Binary
54	
43	
39	
27	
82	
76	
101	
210	

Problem 2
Convert the following binary numbers into decimal and show solving procedure

Binary	Decimal
1000111001	
1100010001	
1010111001	
1000110001	
1111100011	
1110000001	
11110111101	
1000011111	

Problem 3
Convert the given numbers to appropriate number system

Binary	Octal	Decimal	Hex
10010011			
	1407		
		1407	
			FACE
		555	
	765		
1010110101			
	603		

Problem 2
Convert the following binary numbers into decimal and show solving procedure

Binary	Decimal
1000111001	
1100010001	
1010111001	
1000110001	
1111100011	
1110000001	
11110111101	
1000011111	

Problem 4
Fill in the missing values and show solving procedure

binary	decimal	octal	hex
10111011			
	653		
		437	
			65D
		213	
	427		
11011110			
	92		

Problem 5
Convert the following hexadecimal numbers to decimal

11E =	197 =
1B0 =	150 =
198 =	191 =
146 =	1D2 =
73 =	1A2 =
86 =	18D =
71 =	83 =
47 =	1DA =

Solve on the board

Problem 6
Convert the following binary numbers to decimal numbers:

a) 101010
b) 111000
c) 100001
d) 10111000

Problem 7
Convert the following decimal numbers to binary numbers:

a) 129
b) 34
c) 98
d) 202

Problem 8
Determine in binary form:

a) 1111 + 11101
b) 10000101 + 10000101
c) 110011 + 1000100
d) 1000100 + 1010100

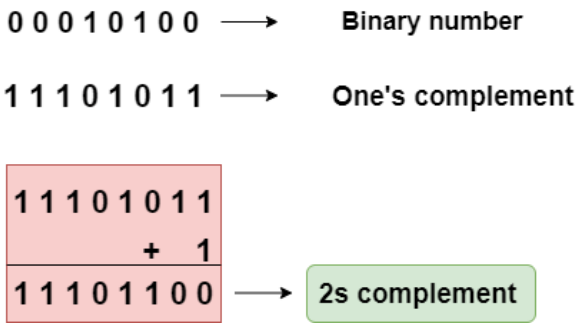
Problem 9
Convert:

a) $2C_{16}$ into decimal
b) $2F1_{16}$ into decimal
c) 54_{10} into hex
d) 200_{10} into hex
e) 11010111_2 into hex
f) 10100101_2 into hex
g) $A21_{16}$ into binary
h) 572_8 into binary
i) 1265_8 into binary

Problem 10
Match the correct answer

octal	**hex**
35	a. B9
642	b. 1D4
271	c. 1F9
724	d. 1A2
102	e. 35
65	f. 85
771	g. 1D
205	h. 42

Review



1's and 2's complement

Questions

1. What extra step do we take when we form the 2's complement of a negative binary number?
2. In 2's complement, what do all the positive numbers have in common?
3. What advantage does 2's complement have over 1's complement?
4. If you want to write the number 7_{10} using 2's complement representation, what do you need to do?
5. If you want to write the number -7_{10} using 2's complement representation, what do you need to do?
6. What is the general technique for converting a decimal number to 2's complement representation?

Problem 1
Write the 2's complement for each of the following 5-bit binary numbers.

a) 01001_2
b) 01011_2
c) 00111_2
d) 00001_2
e) 01101_2
f) 00011_2

Problem 2
Convert the following decimal numbers to binary using 6-bit 2's complement representation.

a) -16_{10}
b) 13_{10}
c) -3_{10}
d) -10_{10}
e) 26_{10}
f) -31_{10}

Problem 3
Solve the expressions in binary representation:

a) $25_{10}+44_{10}=?_2$
b) $1001110_2+11100_2=?_2$
c) $348_{10}-213_{10}=?_2$
d) $1010101_2-1011101_2=?_2$

Problem 4
Show 2's complement of the following binary numbers with 8 bits:

a) 110011_2
b) 110001_2
c) 101010_2
d) 100110_2
