raft RESOURCE AREA FOR TEACHING

STEAM SCIENCE TECHNOLOGY ENGINEERING ARTS MATHEMATICS

LEARNING ACTIVITY

Binary Birthday Bracelets

Encode A Date of Birth into a Wearable Band!

Binary numbers are essential to the functioning of common, digital, electronic devices but are usually well hidden! Learning about binary numbers (base 2) incorporates number sense, exponents, and the conversion of numbers between different bases.

Activity Challenge
Convert your birthday into a binary number and wear it as a bracelet!

Preparation

1. Watch this short YouTube Video (https://bit.ly/39VQtlu) for a tutorial on how to convert between binary numbers and decimal numbers.
2. Gather materials to make the binary birthday bracelet.

To Do

1. Refer to the table, and content, on the next page for an example of converting decimal numbers (base 10) into binary numbers (base 2).
2. Write down a birthdate in month-day-year format (MM-DD-YYYY). For example, December 10, 2008 would be 12-10-2008.
3. Convert each number in the birthdate into binary (1's and 0's).
4. Pick 3 bead colors to represent 0, 1, and space. A **single** space bead is put between the converted numbers. A **pair** of space beads is put at the beginning of the birthdate.
5. Collect the necessary number of each bead color (0's, 1's, and spaces).
6. Cut a cord, or something similar, into lengths suitable for a bracelet.
7. String the beads onto the cord with a single space bead between each number, and 2 space beads at the start of the birthdate.
8. Tie the cord ends together, securing the beads onto the bracelet.

Observations

- Compare the decimal and binary representations of the birthdate. What do you notice about the number of digits in the decimal version of the birthdate vs the binary version?
- Think about the experience and write down your ideas regarding the advantages and/or disadvantages of using binary numbers.

Materials Needed

- Beads of 3 different colors
- Cord, string, or something similar

Grade Range
6-8

Topics/Skills
Factors
Problem Solving
Number Systems
Place Value
Exponents
Binary Numbers

Learning Standards
Math: Expressions and Equations; Computer Science

Duration
30 minutes

Prep Time
10 minutes

Extensions

- Make a bracelet for a friend or family member with their binary birthday.
- Encode your phone number, or a numerical passcode, into a binary number and create a bracelet.

Content Behind the Activity

This activity provides an engaging way for students to apply number sense to binary numbers. Students are tasked with converting decimal numbers to binary numbers. Decimal (base 10) is a numeric system that uses ten digits – 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. Binary (base 2) is a numeric system that uses two digits – 0 and 1. We use the Decimal numeric system in everyday life. Computers operate in binary, meaning they store data and perform calculations, using only zeros and ones. People in technological societies deal daily with binary numbers, but this usually goes unnoticed. Binary numbers encode, and store, the information on credit cards, computers, smartphones, and UPC barcodes found on all consumer products.

Base 10	**2^{10}** (1024)	**2^{9}** (512)	**2^{8}** (256)	**2^{7}** (128)	**2^{6}** (64)	**2^{5}** (32)	**2^{4}** (16)	**2^{3}** (8)	**2^{2}** (4)	**2^{1}** (2)	**2^{0}** (1)	**Base 2** (binary)
6									**1**	**1**	**0**	**110**
11								**1**	**0**	**1**	**1**	**1011**
2000	**1**	**1**	**1**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**11111010000**

To convert (change) a number from base 10 to base 2, determine which numbers in the first row from the table above add up to the desired base 10 number. In the case of 11, the combination is 1 from the 2^3 columns, none from the 2^2 column, 1 from the 2^1 column, and 1 from the 2^0 column (8+0+2+1=11). So, 11 in base 10 equals “1011” in base 2. As with base 10 numbers, the “0” is placeholder.