SPECIAL PROGRAM IN TECHNICAL VOCATIONAL EDUCATION (SPTVE)
COMPUTER SYSTEMS SERVICING 8 Q3-W7

I. Topic: BINARY CONVERSION

II. Objectives:

1. identify the appropriate arithmetic operation to be use in performing calculation and the decimal value of ASCII code to be able to convert it to binary values;
2. perform calculation using different arithmetic operation in converting binary to decimal, binary to ASCII code and vice versa and;
3. value the importance of binary number system in computer and the use of arithmetic operations in converting binary to decimal, ASCII to binary and vice versa.

III. Brief Introduction of the Lesson

Steps in Converting Binary to Decimal Number System

Given: **1011001_2 = _____$_{10}$**

1. **First step is to create a binary table.** You have to create a table consist of 2 rows and 8 columns. The 1st row should contain table values and the 2nd row is the place where you have to write the given binary digits.

								→ Table values
								→ Binary digits (given)

2. **Identify the table values to be written in the 1st row of the binary table.** Values came from **2^0** to **2^7**. **$2^0 = 1$** *Every number with an exponent of 0 is equal to 1.*

$2^1 = 2$
2^2 = 2 * 2 **= 4**
2^3 = 2 * 2 * 2 **= 8**
2^4 = 2 * 2 * 2 * 2 **= 16**
2^5 = 2 * 2 * 2 * 2 * 2 **= 32**
2^6 = 2 * 2 * 2 * 2 * 2 * 2 **= 64**
2^7 = 2 * 2 * 2 * 2 * 2 * 2 * 2 **= 128**

2^7	**2^6**	**2^5**	**2^4**	**2^3**	**2^2**	**2^1**	**2^0**
128	64	32	16	8	4	2	1

→ Table values came from the product of base of 2 with an exponent of 0 to 7 consecutively. from right to left.

3. **Write the given binary digits on the table starting from the right to left.** If the given binary values do not complete the 8 binary digits, you may just add 0 to the left part to complete the standard of 8 binary digits.

Given: 1011001_2

128	64	32	16	8	4	2	1
	1	**0**	**1**	**1**	**0**	**0**	**1**

OR

128	64	32	16	8	4	2	1
0	**1**	**0**	**1**	**1**	**0**	**0**	**1**

4. Lastly add the table values with a binary digit of 1 in the table.

128	64	32	16	8	4	2	1
	1	**0**	**1**	**1**	**0**	**0**	**1**

64 + 16 + 8 + 1 = 89
The decimal value of **1011001_2 = $\underline{89_{10}}$**

Steps in Converting Decimal to Binary Number System (Table Method)

Given: **89_{10} =** _____ **$_2$**

1. **First step is to create a binary table.** Follow the 1st and 2nd procedure indicated in the steps in converting binary to decimal number system.

128	64	32	16	8	4	2	1

2. **Subtract the given number to the table values indicated in the binary table from left to right.** If the table values can be subtracted to the given decimal value then write 1 on the column where the subtracted number is located otherwise write 0. Do this procedure until the difference becomes 0.

Note: **The table values are seen in the binary table.*
**If the table value can be subtracted from the given decimal number, the difference will be use for the next process (see the illustration below).*

The table values with a circle indicate that they have been subtracted to the given decimal value that is why the value in the table is 1.

89 − 128 cannot be; 89 − 64 = 25; 25 − 32 cannot be; 25 − 16 = 9; 9 − 8 = 1; 1 − 4 cannot be; 1 − 2 cannot be; 1 − 1 = 0

128	64	32	16	8	4	2	1
0	**1**	**0**	**1**	**1**	**0**	**0**	**1**

3. Once the difference becomes zero (0), it means that there is no left value in the given decimal number so the process ends here.

Note: *In the case that some table values have not yet been subtracted to the decimal values because the difference is already in zero (0) you may write 0 value on those table values.*

Steps in Converting Decimal to Binary Number System (Division Method)

Given: **89_{10} = _____ $_2$**

1. Divide the given decimal number into the base of binary which is 2. Then continue dividing into 2 using the quotient of the previous division process that takes place until the quotient becomes 0. See the example below.

$2\overline{)89}$ 44, −8, 09, −8, 1 ; $2\overline{)44}$ 22, −4, 04, −4, 0 ; $2\overline{)22}$ 11, −2, 02, −2, 0 ; $2\overline{)11}$ 05, −0, 11, −10, 1 ; $2\overline{)5}$ 2, −4, 1 ; $2\overline{)2}$ 1, −2, 0 ; $2\overline{)1}$ 0, −0, 1

2. Copy all the remainders (encircled numbers) from right to left then write it from left to right.

$2\overline{)89}$ 44, −8, 09, −8, (1) ; $2\overline{)44}$ 22, −4, 04, −4, (0) ; $2\overline{)22}$ 11, −2, 02, −2, (0) ; $2\overline{)11}$ 05, −0, 11, −10, (1) ; $2\overline{)5}$ 2, −4, (1) ; $2\overline{)2}$ 1, −2, (0) ; $2\overline{)1}$ 0, −0, (1)

Answer: $\underline{1011001_2}$

Note: *If your answer doesn't have 8 bits (binary digits), just add zero/s in the left part of your answer until it has 8 bits. It doesn't change the value of your answer.* ***For example:*** $\underline{1011001_2}$ = $\underline{01011001_2}$

Steps in Converting ASCII Code to Binary Digits

Given: **TVE 8 = _____ $_2$**

1. Find the decimal value of the given ASCII code. Use standard & extended ASCII table.

T	V	E	sp(space)	8
84	86	69	32	56

→ Given ASCII code
Decimal number based on ASCII table

Note: *Numbers 0-255 indicates decimal number and the characters at the right side of it are ASCII codes.*

2. Convert decimal number to binary digits. You may use any of the method (table or division method). Write your answer in the table illustrated below.

In this sample, it uses the table method in converting decimal to binary number system. Solutions are shown below the table.

ASCII code	Decimal value	Binary Table							
		128	64	32	16	8	4	2	1
T	**84**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**0**
V	**86**	**0**	**1**	**0**	**1**	**0**	**1**	**1**	**0**
E	**69**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**1**
Sp(space)	**32**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
8	**56**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**0**

Solutions:

- T = 84_{10} = 84 − 128 cannot be; 84 − 64 = 20; 20 − 32 cannot be; 20 − 16 = 4; 4 − 8 cannot be; 4 − 4 = 0
- V = 86_{10} = 86 − 128 cannot be; 86 − 64 = 22; 22 − 32 cannot be; 22 − 16 = 6; 6 − 8 cannot be; 6 − 4 = 2; 2 − 2 = 0
- E = 69_{10} = 69 − 128 cannot be; 69 − 64 = 5; 5 − 32 cannot be; 5 − 16 cannot be; 5 − 8 cannot be; 5 − 4 = 1; 1 − 2 cannot be; 1 − 1 = 0
- sp(space) = 32_{10} = 32 − 128 cannot be; 32 − 64 cannot be; 32 − 32 = 0
- 8 = 56_{10} = 56 − 128 cannot be; 56 − 64 cannot be; 56 − 32 = 24; 24 − 16 = 8; 8 − 8 = 0

IV. Activities:

Activity 1
Binary to Decimal Conversion

Directions: Convert binary values into decimal value. Show your solution and answer on a separate sheet of paper.

1. **00110011_2** = _____$_{10}$
2. **00111111_2** = _____$_{10}$
3. **01010101_2** = _____$_{10}$
4. **01010101_2** = _____$_{10}$
5. **00110011_2** = _____$_{10}$

Activity 2
Decimal to Binary Conversion

Directions: Convert binary values into decimal value. Show your solution and answer on a separate sheet of paper.

1. **165_{10}** = _____$_2$
2. **65_{10}** = _____$_2$
3. **98_{10}** = _____$_2$
4. **111_{10}** = _____$_2$
5. **22_{10}** = _____$_2$

Activity 3
ASCII to Binary Conversion

Directions: Convert ASCII code into binary values. Follow the format below. Show your solution and answer on a separate sheet of paper.

1-5. Your First Name *(Example: Zia Mae)*
6-10. Birth date *(Example: January 2, 1957)*
Format:

ASCII code	Decimal value	Binary Table							
		128	64	32	16	8	4	2	1

V. Assessment:

Directions: Write the letter of the correct answer on a separate sheet of paper.

1. Which of the following mathematical operation is used in converting binary to decimal number system?
   A. addition B. division C. multiplication D. subtraction
2. In converting decimal to binary number system, which of the following mathematical operation is NOT applied?
   A. addition B. division C. multiplication D. Subtraction
3. Using what you have learned in converting ASCII code to binary digits, what is the value of 164_{10} in binary number system?
   A. 11000000 B. 10100100 C. 10010000 D. 10001000
4. In converting decimal to binary number system, which of the following is the binary value of 72_{10}?
   A. 01010000 B. 01001000 C. 01000100 D. 01100000
5. Based on what you have learned in converting binary to decimal number system, what is the decimal value of 00011101
   A. 25 B. 27 C. 29 D. 31

VI. Reflection:

Directions: Answer the following questions briefly on a separate sheet of paper in paragraph form.

1. What is the most interesting or important things you have learned today and why?
2. What will be the benefits of this lesson in your daily life or in the future?
3. What do you want to learn more about binary conversion?
4. What problems did you encounter in answering the activities?

References:

- ASCII Codes and Table - ***https://tinyurl.com/y3hchfgk on 01/12/21***

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