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DepED
DEPARTMENT OF EDUCATION

Lesson Exemplar for TLE

Quarter 1
Lesson
3

Lesson Exemplar for TLE Grade 7
Quarter 1: Lesson 3 (Week 3)
SY 2024-2025

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TLE/QUARTER 1/ GRADE 7

I. CURRICULUM CONTENT, STANDARDS, AND LESSON COMPETENCIES	
A. Content Standards	The learners will ● demonstrate an understanding of the computer number systems. ● demonstrate an understanding of conversion of computer number systems.
B. Performance Standards	The learners convert number systems in practical scenarios.
C. Learning Competencies and Objectives	**Learning Competencies:** ● differentiate the various computer number systems ● apply conversion of computer number systems **Learning Objectives:** At the end of the lesson, the learners shall be able to: 1. Explain the basics of number systems and their significance in computing. 2. Identify the steps in the conversion of Decimal to Binary. 3. Convert Decimal to Binary 4. Identify steps in the conversion of binary to decimal. 5. Convert Binary to Decimal. 6. Identify steps in the conversion of Decimal to Octal. 7. Convert Decimal to Octal. 8. Identify steps in the conversion of Octal to Decimal. 9. Convert Octal to Decimal
D. Content	Computer Number Systems ● binary ● octal ● decimal ● hexadecimal Conversion of Computer Number Systems ● binary ● octal ● decimal ● hexadecimal

E. Integration	**SDG 4:** Quality Education **SGD 9:** Industry, Innovation and Infrastructure

II. LEARNING RESOURCES

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III. TEACHING AND LEARNING PROCEDURE		NOTES TO TEACHERS
A. Activating Prior Knowledge	**DAY 1** **1. Short Review** In the world of computers, numbers are represented using different systems. The most common system is the binary system, which uses only the digits 0 and 1 to represent all numbers and data. Each digit in a binary number is called a bit. Another important system is the hexadecimal system, which uses the digits 0-9 and letters A-F to represent numbers. Computers also use the octal system, which uses digits 0-7.	

	A **number system** is a method of representing numbers using specific rules. It provides a consistent way to express numerical values. In mathematics, we use various number systems to represent and manipulate numbers. Here are the four most common types: **Decimal Number System (Base-10)**: · The decimal system uses ten digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. · Each position to the left of the decimal point represents powers of 10 (units, tens, hundreds, thousands, etc.). **Binary Number System (Base-2)**: · The binary system uses only two digits: 0 and 1. · It is widely used in computer science and digital electronics. **Octal Number System (Base-8)**: · The octal system uses eight digits: 0, 1, 2, 3, 4, 5, 6, and 7. · It is less common but still used in some contexts. **Hexadecimal Number System (Base-16)**: · The hexadecimal system uses sixteen digits: 0–9 and A–F (where A represents 10, B represents 11, and so on). · It is commonly used in computer programming and memory addressing. **2. Feedback (Optional)**	
B. Establishing Lesson Purpose	**1. Lesson Purpose** The **number system** plays a crucial role in mathematics and our daily lives. 1. **Representation of Quantities**: ✧ A number system provides a way to represent quantities. Whether it's counting objects, measuring distances, or calculating time, numbers allow us to express these concepts precisely. ✧ For example, when you count the number of apples in a basket or measure the length of a room, you're using the number system. 2. **Foundation for Mathematical Concepts**: ✧ All mathematical concepts and formulas are based on the number system. Whether you're solving equations, working with geometry, or analyzing data, numbers are fundamental.	

✧ From basic arithmetic operations (addition, subtraction, multiplication, division) to advanced calculus and algebra, numbers underpin mathematical reasoning.

3. **Types of Numbers**:
   ✧ The number system encompasses various types of numbers:
   1. **Counting Numbers**: These start with 1 and continue indefinitely (1, 2, 3, ...).
   2. **Whole Numbers**: Include all counting numbers along with zero (0, 1, 2, ...).
   3. **Integers**: Positive and negative whole numbers, including zero (-3, -2, -1, 0, 1, 2, 3, ...).
   4. **Rational Numbers**: Expressible as fractions (e.g., 3/4, -2/5).
   5. **Irrational Numbers**: Cannot be expressed as fractions (e.g., √2, π).
   6. **Real Numbers**: Encompass both rational and irrational numbers.
   7. **Even Numbers**: Divisible by 2 (e.g., 2, 4, 6, ...).
   8. **Odd Numbers**: Not divisible by 2 (e.g., 3, 5, 7, ...).
   9. **Prime Numbers**: Divisible only by 1 and themselves (e.g., 5, 7, 13).
   10. **Composite Numbers**: Have multiple factors (e.g., 10, 15, 28).
4. **Digital Systems and Data Representation**:
   ✧ Understanding number systems is essential for digital systems (like computers) because they process data using binary representation (base-2).
   ✧ Computers use bits (0s and 1s) to represent information, and this binary system relies on the principles of the number system.
   The number system is not only a mathematical tool but also a fundamental aspect of our everyday interactions with the world. It allows us to quantify, calculate, and communicate effectively.

2. Unlocking Content Area Vocabulary

- **Number system -** is a mathematical way of representing a set of values using digits or symbols.
- **Decimal -** is a number that consists of a whole part and a fractional part separated by a decimal point.
- **Binary -** is a number expressed in the base-2 numeral system, in this system, we use only two symbols: typically, "0" (zero) and "1" (one).
- **Octal -** is a type of numeral system that uses a base of eight, in this system, the digits range from 0 to 7.

	• **Hexadecimal** - is a base-16 numeral system. Unlike our everyday decimal system (base 10), which uses ten symbols (0-9), hexadecimal employs sixteen symbols. These symbols represent values from 0 to 15.	
C. Developing and Deepening Understanding	**SUB-TOPIC 1: Binary Numbers** **1. Explicitation** The **binary number system** is a fundamental concept in computer science and digital electronics. It uses a base-2 numeral system, which means it only employs two distinct symbols: **0** (zero) and **1** (one). Here are the key points about binary numbers: **Representation:** 10. In binary, each digit is called a **bit**. 11. The binary system is used internally by almost all modern computers and electronic devices because it directly maps to electronic circuits using logic gates. 12. Unlike our everyday decimal system (base 10), which uses ten symbols (0-9), binary uses only two symbols (0 and 1). **Conversion:** 13. To convert a decimal number to binary, follow these steps: 14. Divide the decimal number by 2. 15. Use the integer quotient obtained as the dividend for the next step. 16. Continue dividing until the quotient becomes 0. 17. Write down the remainders in reverse order to get the binary representation. **Example: Convert 4 to Binary:** 18. Let's convert the decimal number 4 to binary: Step 1: Divide 4 by 2. Quotient: 2, Remainder: 0 Step 2: Divide 2 by 2. Quotient: 1, Remainder: 0 Step 3: Divide 1 by 2. Quotient: 0, Remainder: 1 Reverse the remainders: 100 19. Therefore, 4 in binary is **100**. **Bit in Binary Number:** 20. A single binary digit is called a **bit**. Examples: 21. 10101 is a five-bit binary number.	Engage students in a discussion about everyday number systems (e.g., counting in base 10) and introduce the concept of different bases. Use visual aids (charts, diagrams in a powerpoint presentation) to illustrate binary, octal, and hexadecimal representations.

	22. 101 is a three-bit binary number. 23. 100001 is a six-bit binary number. The teacher will ask the following questions to gain specific details, opinions, or experiences from the learners: 1. How many different digits are used in the binary number system? 2. Can you explain the concept of place value in binary numbers? 3. Why is the binary number system important in computing and digital technology? **2. Worked Example** Ask the learners to identify what type of the number system. Identify what type of number system is the following. 24. 78 - _____ 25. 100112 - _____ 26. F - _____ 27. 328 - _____ 28. 1110102 - _____ **3. Lesson Activity** **(See worksheet activity no. 1 for students to accomplish.)** 1. **Decimal Number System**: o Explain its base-10 structure and usage in everyday life. 2. **Binary Number System**: o Discuss its base-2 structure and significance in computer processing. o Practice converting binary to decimal and vice versa. 3. **Octal Number System**: o Describe its base-8 structure and where it's used. o Convert octal numbers to binary and decimal. 4. **Hexadecimal Number System**: o Explain its base-16 structure and usage in memory addressing. o Practice converting hexadecimal to binary and decimal. **Day 2** **SUB-TOPIC 2: Octal Numbers** **1. Explicitation** The **octal number system** is a base-8 system that uses digits from 0 to 7 to represent any number. It is similar to other number systems like binary and hexadecimal. Here are some key points about octal numbers:	The teacher will guide the students in performing the sample number system conversion.

Base and Digits:

29. The base of the octal system is 8.
30. It uses the digits 0, 1, 2, 3, 4, 5, 6, and 7.

Representation:

31. Octal numbers are usually represented by binary numbers when grouped in pairs of three.
32. For example, the octal number 128 is expressed as 0010102 in binary, where 1 is equivalent to 001 and 2 is equivalent to 010.

Conversion:

33. To convert decimal numbers to octal, we use the octal dabble method.
34. For example, to convert 56010 to octal:
35. 560 ÷ 8 = 70 with a remainder of 0
36. 70 ÷ 8 = 8 with a remainder of 6
37. 8 ÷ 8 = 1 with a remainder of 0
38. 1 ÷ 8 = 0 with a remainder of 1
39. So, the octal representation is 10608.

Table of Octal Digits:

40. We use only 3 bits to represent octal numbers.
41. Each group has a distinct value between 000 and 111.
42. Octal digits range from 0 to 7.

Octal Digit	Binary Equivalent	Octal Digit	Binary Equivalent
0	000	4	100
1	001	5	101
2	010	6	110
3	011	7	111

Applications:

43. Octal numbers are commonly used in computer programming because they provide a compact way to represent binary numbers (each octal digit corresponds to three binary digits).

The teacher will ask the following questions to gain specific details, opinions, or experiences from the learners:

1. How many symbols are used in octal numbering system?
2. Can you explain the concept of place value in octal numbers?

3. Why are octal numbers often used in computer programming?

2. Worked Example

44. Explain the purpose of dividing the decimal number by 8 in the conversion process.
45. Describe how the remainders of the divisions are used to form the octal number.
46. Why is it important to write the digits of the octal number in reverse order?

3. Lesson Activity

(See worksheet activity no. 2 for students to accomplish.)

Begin with an explanation of why binary numbers are essential in computing. Introduce the concept of place values in the decimal system and how it differs in the binary system.

Lesson Development:

1. Understanding Binary Place Values:

- Explain the binary place values (1, 2, 4, 8, 16, etc.) and how they relate to the decimal system.

2. The Conversion Process:

- Demonstrate the process of converting a decimal number to binary using the division-by-2 method.
- Work through several examples as a class, converting simple decimal numbers to binary.
  - Hand out worksheets with decimal numbers for students to convert to binary.
  - Pair students up to check each other's work and discuss any discrepancies.

Day 3

SUB-TOPIC 3: Decimal Numbers

1. Explicitation

A **decimal number** is a number that consists of a whole number and a fractional part separated by a point (often called the **decimal point**).

Whole Number Part: The whole number part represents the integral value of the quantity. It can be any positive or negative integer.

For example:

- In the decimal number 42.85, the whole number part is 42.
- In the decimal number -123.456, the whole number part is -123.

Fractional Part: The fractional part represents a value smaller than one. It appears after the decimal point.

For example:

- In the decimal number 42.85, the fractional part is 0.85.
- In the decimal number -123.456, the fractional part is 0.456.

Decimal Point: The decimal point separates the whole number part from the fractional part. It serves as a visual indicator that we are dealing with a decimal.

For example:

47. The decimal point in 42.85 separates 42 (whole) from 85 (fractional).
48. The decimal point in -123.456 separates -123 (whole) from 456 (fractional).

Decimal numbers allow us to express quantities that are whole plus some part of a whole. They are commonly encountered in everyday situations, such as grocery shopping, measurements, and financial calculations.

The teacher will ask the following questions to gain specific details, opinions, or experiences from the learners:

1. What is the definition of a decimal number?
2. Can you explain how decimal numbers are different from whole numbers?
3. How are decimal numbers represented on a number line?

2. Worked Example

Decimal numbers are an important part of mathematics and are used in many everyday situations. They represent values that are between whole numbers, allowing for more precise measurements and calculations. In this worksheet, you will practice working with decimal numbers through an activity.

Answer the following questions in complete sentences:

1. Explain the difference between a whole number and a decimal number.
2. Describe the steps to round a decimal number to the nearest hundredth.
3. How would you add two decimal numbers with different numbers of digits to the right of the decimal point?

3. Lesson Activity

(See Worksheet Activity no. 3 for students to accomplish.)

Start with an overview of different number systems, emphasizing the decimal and octal systems. Explain the base-10 nature of the decimal system and the base-8 nature of the octal system.

Lesson Development:

1. **Decimal Number System**:
   - Discuss the use of the decimal system in daily life and its base-10 structure.
2. **Octal Number System**:
   - Introduce the octal system, explaining its base-8 structure and usage in computing.
3. **Conversion Process**:
   - Teach the steps to convert a decimal number to its octal equivalent:

DAY 4

SUB-TOPIC 4: Hexadecimal Number

1. Explicitation

The **hexadecimal number system** often simply called "hex," is a base-16 numeral system. Unlike our familiar base-10 (decimal) system, which uses ten symbols (0 to 9) to represent numbers, hexadecimal employs sixteen symbols. These symbols include the numerals 0 to 9 and the letters A to F. Each digit in a hexadecimal number corresponds to a specific value, allowing us to express quantities in a compact and efficient manner.

Base-16 Representation:

- Hexadecimal uses a base value of 16. This means that each column in a hexadecimal number represents a power of 16.
- The sixteen symbols used in hexadecimal are: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F.
- For example, the hexadecimal number "1A" represents $1 \times 16 + 10 = 26$ in decimal.

Conversion to Other Systems:

- Hexadecimal numbers can be converted to other number systems:
- To decimal (base-10): Each digit is multiplied by the corresponding power of 16 and summed.
- To binary (base-2): Each hexadecimal digit corresponds to a 4-bit binary representation.
- To octal (base-8): First convert to decimal, then to octal.
- These conversions are essential in computer science and digital systems.

Hexadecimal provides a convenient way to work with binary data and efficiently represent values in various contexts.

2. Worked Example

The teacher will ask the following questions to gain specific details, opinions, or experiences from the learners:

1. What is the base of a hexadecimal number system?
2. How many unique symbols are used in hexadecimal numbers?
3. Can you explain why hexadecimal numbers are commonly used in computer science and digital systems?

Example: Convert the decimal number 456 to hexadecimal

1. Divide the decimal number by 16 and record the quotient and remainder.
2. Repeat the division using the quotient from the previous step until the quotient is zero.
3. The hexadecimal number is formed by the remainders read from bottom to top.

Steps:

1. Initial Number: 456
2. First Division:
    - Divide 456 by 16.
    - Quotient: 456÷16=28456 \div 16 = 28456÷16=28 (integer part)
    - Remainder: 456 mod 16=8456 \mod 16 = 8456mod16=8
3. So, 456 divided by 16 gives a quotient of 28 and a remainder of 8.
4. Second Division:
    - Now divide the quotient from the first division (28) by 16.
    - Quotient: 28÷16=128 \div 16 = 128÷16=1 (integer part)
    - Remainder: 28 mod 16=1228 \mod 16 = 1228mod16=12
5. So, 28 divided by 16 gives a quotient of 1 and a remainder of 12. Note that in hexadecimal, 12 is represented as 'C'.
6. Third Division:
    - Now divide the quotient from the second division (1) by 16.
    - Quotient: 1÷16=01 \div 16 = 01÷16=0 (integer part)
    - Remainder: 1mod 16=11 \mod 16 = 11mod16=1
7. So, 1 divided by 16 gives a quotient of 0 and a remainder of 1.
8. Construct the Hexadecimal Number:
    - Write the remainders from the last to the first.
    - The remainders are 1, 12 (C in hexadecimal), and 8.
9. Therefore, the hexadecimal representation of the decimal number 456 is 1C8.

Summary

- Divide the decimal number by 16.
- Write down the remainder.
- Use the quotient for the next division.
- Repeat until the quotient is zero.

	• The hexadecimal number is the remainders read from bottom to top. The steps above show the conversion process clearly. This method can be used for any decimal number to convert it to hexadecimal. **(See Worksheet Activity no. 4 for students to accomplish.)** **3. Lesson Activity** **Directions:** Converting Decimal Numbers to Hexadecimal and Hexadecimal to Decimal. 1. What is the hexadecimal equivalent of the decimal number 27? a. 1B b. 1F c. 23 d. 2E 2. Which of the following is a correct hexadecimal representation of the decimal number 50? a. 30 b. 32 c. 35 d. 38 3. If the hexadecimal number 3D is converted to decimal, what is the result? a. 53 b. 61 c. 57 d. 59 4. What is the decimal value of the hexadecimal number A4? a. 161 b. 164 c. 166 d. 168 5. Convert the decimal number 95 to hexadecimal. a. 5D b. 60 c. 61 d. 65	**Answer key:** 1. a. 1B 2. b. 32 3. d. 59 4. c. 166 5. a. 5D
D. Making Generalizations	**1. Learners' Takeaways** The teacher will ask the learners: • Teachers will emphasize the importance of the different computer number systems. • The teacher will ask the learners to expound or recap the concept of the different computer number systems and the conversion of decimal number to binary, octal, and hexadecimal. • The teacher will process their answers and let the students again create a single generalization. **2. Reflection on Learning** The teacher will ask the learner this question: How do you find today's lesson? Was it hard? Which part of the lesson do you find difficult?	

IV. EVALUATING LEARNING: FORMATIVE ASSESSMENT AND TEACHER'S REFLECTION		**NOTES TO TEACHERS**
A. Evaluating Learning	**DAY 4** **1. Formative Assessment** **Multiple Choice Questions:**	

	Choose the correct answer from the choices for each question. 1. Which of the following best describes the binary number system? a) A number system that uses 0-9 b) A number system that uses 0-7 c) A number system that uses 0-1 d) A number system that uses o-F 2. What is the first step in converting a decimal number to octal? a) Divide the decimal number by 8 b) Write the decimal number in reverse order c) Multiply the decimal number by 8 d) Add 8 to the decimal number 3. What do you do with the remainder of each division step? a) Discard it b) Add it to the next division c) Use it to form the octal number d) Multiply it by 8 4. How do you determine the digits of the octal number? a) The quotients of the divisions b) The remainders of the divisions c) The sum of the divisions d) The difference between the divisions 5. What happens when the divisor becomes 0? a) The process is complete b) You start over with a new decimal number c) You add 8 to the octal number d) You multiply the octal number by 8 6. In what order should the digits of the octal number be written? a) In the order they were generated b) In reverse order c) From largest to smallest d) From smallest to large 7. How many unique digits are used in the octal number system? a) 2 b) 8 c) 10 d) 16	**Answer key:** 1. b 2. a 3. c 4. b 5. a 6. b 7. b 8. c 9. a 10. d

<table>
<tr><td></td><td colspan="3">8. What is the decimal equivalent of the binary number 1010?
a) 5 b) 8
c) 10 d) 15
9. Which of the following is the hexadecimal representation of the decimal number 27?
a) 1B b) 1F
c) 1A d) 1C
10. What is the octal equivalent of the binary number 101011?
a) 43 b) 53
c) 63 d) 73

2. Homework (Optional)</td><td></td></tr>
<tr><td rowspan="5">B. Teacher's Remarks</td><td>Note observations on any of the following areas:</td><td>Effective Practices</td><td>Problems Encountered</td><td rowspan="5">The teacher may take note of some observations related to the effective practices and problems encountered after utilizing the different strategies, materials used, learner engagement and other related stuff.

Teachers may also suggest ways to improve the different activities explored/ lesson exemplar.</td></tr>
<tr><td>strategies explored</td><td></td><td></td></tr>
<tr><td>materials used</td><td></td><td></td></tr>
<tr><td>learner engagement/ interaction</td><td></td><td></td></tr>
<tr><td>others</td><td></td><td></td></tr>
<tr><td>C. Teacher's Reflection</td><td colspan="3">Reflection guide or prompt can be on:
▪ <u>principles behind the teaching</u>
What principles and beliefs informed my lesson?
Why did I teach the lesson the way I did?
▪ <u>students</u>
What roles did my students play in my lesson?
What did my students learn? How did they learn?
▪ <u>ways forward</u>
What could I have done differently?
What can I explore in the next lesson?</td><td>Teacher's reflection in every lesson conducted/ facilitated is essential and necessary to improve practice. You may also consider this as an input for the LAC/Collab sessions.</td></tr>
</table>