Day 10 of Python Assignment Answers -

29. Write a Python Program to Find the Sum of Natural Numbers?

```python
def sum_of_natural_numbers(n : int) -> int:
    """
    Calculates the sum of natural numbers up to a given input number.

    Args:
        n (int): The input number up to which to calculate the sum.

    Returns:
        int: The sum of natural numbers up to `n`.
    """
    # initialize sum and counter
    sum = 0
    i = 1

    while i <= n:
        sum += i
        i += 1

    # return the result
    return sum
```

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This function takes one input argument n which is the positive integer up to which the sum of natural numbers is to be calculated.

It initializes the variables sum and i, and then uses a while loop to iterate over the natural numbers from 1 up to n.

Within the loop, the current value of i is added to the current value of sum, and the loop counter i is incremented by 1.

When the loop terminates, the value of sum represents the sum of the natural numbers up to n. Finally, the function returns the result.

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30. Write a Python Program to Find LCM?

```python
def lcm(a: int, b: int) -> int:
    """
    Calculates the LCM (Least Common Multiple) of two numbers.

    Args:
        a (int): The first number.
        b (int): The second number.

    Returns:
        int: The LCM of `a` and `b`.
    """
    # Find the greater number
    if a > b:
        greater = a
    else:
        greater = b

    while True:
        if greater % a == 0 and greater % b == 0:
            lcm = greater
            break
        greater += 1

    return lcm
```

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This function takes two integer arguments a and b, and returns the LCM of those two numbers.

The function first finds the greater number between a and b.

It then starts a loop that keeps increasing a counter variable greater by 1 until it finds a number that is divisible by both a and b.

When it finds such a number, it calculates the LCM by assigning the value of greater to the variable lcm and then breaking out of the loop. Finally, the function returns the value of lcm.

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31. Write a Python Program to Find HCF?

```python
def find_hcf(a: int, b: int) -> int:
    """
    This function takes two integers and returns their HCF (Highest Common Factor).

    Args:
    a (int): The first integer.
    b (int): The second integer.

    Returns:
    int: The HCF of the two integers.
    """

    # find the smaller number
    if a < b:
        smaller = a
    else:
        smaller = b

    hcf = 1

    # iterate from 1 to the smaller number
    for i in range(1, smaller+1):
        if (a % i == 0) and (b % i == 0):
            hcf = i

    return hcf
```

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In this function, we take two integer arguments, a and b, and then find the smaller of the two using a simple conditional statement.

We then iterate from 1 to the smaller integer, checking each number to see if it is a factor of both a and b.

If it is, we update the hcf variable to that number.

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Using Euclidean Algorithm :

```python
def find_hcf(a: int, b: int) -> int:
    """
    This function takes two integers and returns their HCF (Highest Common Factor)
    using the Euclidean algorithm.

    Args:
    a (int): The first integer.
    b (int): The second integer.

    Returns:
    int: The HCF of the two integers.
    """

    # ensure a is greater than or equal to b
    if b > a:
        a, b = b, a

    while b != 0:
        # calculate remainder
        r = a % b

        # update a and b
        a = b
        b = r

    return a
```

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In this function, we take two integer arguments, a and b, and then use the Euclidean algorithm to find their HCF.

The algorithm works by repeatedly calculating the remainder of a divided by b, and then updating a to b and b to the remainder.

This process is repeated until b becomes 0, at which point the value of a is the HCF of the two integers.

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32. Write a Python Program to Convert Decimal to Binary, Octal and Hexadecimal?

```python
def convert_base(decimal_num: int) -> dict:
    """
    This function takes a decimal number and returns its binary, octal,
    and hexadecimal equivalents in a dictionary.

    Args:
    decimal_num (int): The decimal number to be converted.

    Returns:
    dict: A dictionary containing the binary, octal, and hexadecimal
    equivalents of the decimal number.
    """

    # convert decimal to binary, octal, and hexadecimal
    binary = bin(decimal_num)[2:]
    octal = oct(decimal_num)[2:]
    hexadecimal = hex(decimal_num)[2:].upper()

    # create dictionary to store results
    results = {
        'binary': binary,
        'octal': octal,
        'hexadecimal': hexadecimal
    }

    return results
```

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The function convert_base, which takes a single input argument decimal_num of type int and returns a dictionary.

The built-in bin(), oct(), and hex() functions to convert the input decimal number to its binary, octal, and hexadecimal equivalents, respectively.

Note that we use [2:] to remove the prefix that is added to the converted numbers by these functions (i.e., '0b' for binary, '0o' for octal, and '0x' for hexadecimal).

We also use .upper() to convert the hexadecimal string to uppercase.

Next create a dictionary called results and populate it with the converted values

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