ASSIGNMENT-1

Task-1:

Write a python program that calculates the factorial of a number without defining my functions

Code and Output:

```
def factorial(n):
    """Calculates the factorial of a non-negative integer."""
    if n == 0:
        return 1
    else:
        return n * factorial(n-1)

# Get input from the user
try:
    num = int(input("Enter a non-negative integer: "))
    if num < 0:
        print("Factorial is not defined for negative numbers.")
    else:
        print(f"The factorial of {num} is {factorial(num)}")
    except ValueError:
    print("Invalid input. Please enter an integer.")</pre>
Enter a non-negative integer: 5
The factorial of 5 is 120
```

Explanation:

```
    def factorial(n): Defines a function named factorial that takes one argument n.
    if n == 0: Checks if the input number n is 0.
    return 1: If n is 0, it returns 1 (factorial of 0 is 1).
    else: If n is not 0, it executes the following line.
    return n * factorial(n-1): Recursively calls itself with n-1 and multiplies the result by n.
    try:: Starts a block to handle potential errors during input.
    num = int(input("Enter a non-negative integer: ")): Prompts the user to enter an integer and converts the input to an integer.
    if num < 0: Checks if the entered number is negative.</li>
    print("Factorial is not defined..."): If negative, prints a message.
    print(f"The factorial of {num} is {factorial(num)}"): If non-negative, calculates and prints the factorial.
    except ValueError: Handles the case where the input is not a valid integer.
    print("Invalid input..."): Prints an error message for invalid input.
```

Task-2:

Write a python program that calculates the factorial of a number with function and without function.

Code and Output:

With function:

```
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# Calculate factorial using a function
    def factorial_with_function(n):
      """Calculates the factorial of a non-negative integer using a function."""
      if n == 0:
        return 1
      else:
        return n * factorial_with_function(n-1)
    # Get input from the user
      num_func = int(input("Enter a non-negative integer for function calculation: "))
      if num_func < 0:
        print("Factorial is not defined for negative numbers.")
       print(f"The factorial of {num_func} using a function is {factorial_with_function(num_func)
    except ValueError:
      print("Invalid input. Please enter an integer.")
Fr Enter a non-negative integer for function calculation: 6
    The factorial of 6 using a function is 720
```

Without function:

```
try:
    num_no_func = int(input("Enter a non-negative integer for calculation without a function: ");
    if num_no_func < 0:
        print("Factorial is not defined for negative numbers.")
    else:
        factorial_result = 1
        for i in range(1, num_no_func + 1):
            factorial_result *= i
             print(f"The factorial of {num_no_func} without a function is {factorial_result}")
    except ValueError:
    print("Invalid input. Please enter an integer.")</pre>
```

Enter a non-negative integer for calculation without a function: 6
The factorial of 6 without a function is 720

Explanation:

```
    def factorial_with_function(n): Defines a recursive function factorial_with_function to calculate factorial.
    if n == 0: Base case for the recursion: if n is 0, return 1.
```

- 3. **return n * factorial_with_function(n-1)**: Recursive step: multiply (n) by the factorial of (n-1).
- 4. (try: Starts a block to handle potential errors during input for the function method.
- 5. (num_func = int(input(...)): Prompts user for input and converts it to an integer.
- if num_func < 0: Checks for negative input.
- 7. print(...): Prints the result of the factorial calculated by the function or an error message.
- 8. try:: Starts a block to handle potential errors during input for the non-function method.
- 9. num_no_func = int(input(...)): Prompts user for input and converts it to an integer.
- 10. factorial_result = 1: Initializes a variable to store the factorial result for the non-function method.
- 11. for i in range(1, num_no_func + 1): Loops from 1 up to the input number.
- 12. factorial_result *= i): Multiplies the factorial_result by the current number in the loop.
- 13. print(...): Prints the result of the factorial calculated without a function or an error message.
- 14. except ValueError: : Handles invalid input for both methods.
- 15. (print("Invalid input..."): Prints an error message for invalid input.

Task-3:

Write a python program that calculates the factorial using both iterative and recursive functions.

Code and Output:

```
[1] def factorial_iterative(n):
           """Calculates the factorial of a number iteratively."""
              return "Factorial is not defined for negative numbers"
           result = 1
           for i in range(1, n + 1):
               result *= i
           return result
       def factorial_recursive(n):
           """Calculates the factorial of a number recursively."""
               return "Factorial is not defined for negative numbers"
          if n == 0:
              return 1
          else:
               return n * factorial_recursive(n - 1)
       # Example usage:
       num = 5
       print(f"Factorial of {num} (iterative): {factorial_iterative(num)}")
       print(f"Factorial of {num} (recursive): {factorial_recursive(num)}")
  Factorial of 5 (iterative): 120
       Factorial of 5 (recursive): 120
```

Explanation:

1. Iterative Function: factorial_iterative(n)

- · Checks for negative input, returning an error message.
- Initializes result to 1.
- Uses a for loop from 1 to n to multiply result by each number in the range.
- · Returns the final calculated factorial.

2. Recursive Function: factorial_recursive(n)

- Checks for negative input, returning an error message.
- Defines the base case: factorial of 0 is 1.
- For n > 0, it calls itself with n-1 and multiplies the result by n.

Both functions are demonstrated with an example input num = 5. The output shows that both methods correctly calculate the factorial of 5 as 120.