Tarea N°6

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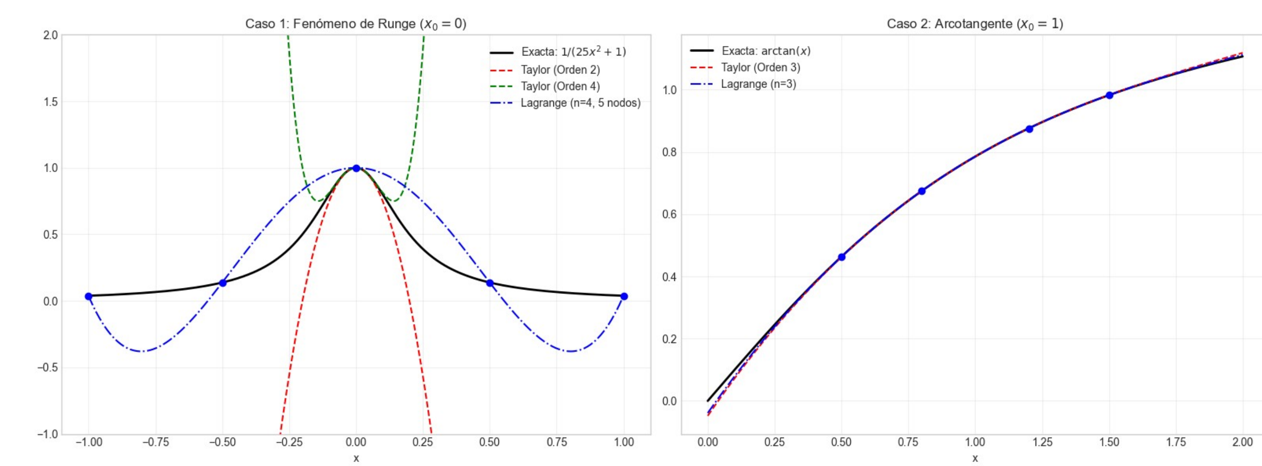
Determine el orden de la mejor aproximación para las siguientes funciones, usando la Serie de Taylor y el Polinomio de Lagrange:

- $1/(25 * x^2 + 1), x0 = 0$
- $arctan(x), x0 = 1$

```
import numpy as np
import matplotlib.pyplot as plt
from scipy.interpolate import lagrange

plt.style.use('seaborn-v0_8-whitegrid')

def plot_comparison():
    fig, (ax1, ax2) = plt.subplots(1, 2, figsize=(16, 6))

    x = np.linspace(-1, 1, 400)
    y_exact = 1 / (25 * x**2 + 1)


    y_taylor_2 = 1 - 25 * x**2
    y_taylor_4 = 1 - 25 * x**2 + 625 * x**4


    x_nodes = np.linspace(-1, 1, 5)
    y_nodes = 1 / (25 * x_nodes**2 + 1)
    poly_lagrange = lagrange(x_nodes, y_nodes)
    y_lagrange = poly_lagrange(x)

    ax1.plot(x, y_exact, 'k-', linewidth=2, label='Exacta:
$1/(25x^2+1)$')
    ax1.plot(x, y_taylor_2, 'r--', label='Taylor (Orden 2)')
    ax1.plot(x, y_taylor_4, 'g--', label='Taylor (Orden 4)')
    ax1.plot(x, y_lagrange, 'b-.', label='Lagrange (n=4, 5 nodos)')
    ax1.scatter(x_nodes, y_nodes, color='blue', zorder=5) #


    ax1.set_ylim(-1, 2)
    ax1.set_title('Caso 1: Fenómeno de Runge ($x_0=0$)')
    ax1.set_xlabel('x')
    ax1.legend()
    ax1.grid(True, alpha=0.3)

    x2 = np.linspace(0, 2, 400)
```

```python
    y2_exact = np.arctan(x2)

    u = x2 - 1
    y2_taylor = (np.pi/4) + (0.5 * u) - (0.25 * u**2) + ((1/12) * u**3)


    x2_nodes = np.array([0.5, 0.8, 1.2, 1.5])
    y2_nodes = np.arctan(x2_nodes)
    poly_lagrange_2 = lagrange(x2_nodes, y2_nodes)
    y2_lagrange = poly_lagrange_2(x2)

    # Graficar Caso 2
    ax2.plot(x2, y2_exact, 'k-', linewidth=2, label='Exacta: $\\arctan(x)$')
    ax2.plot(x2, y2_taylor, 'r--', label='Taylor (Orden 3)')
    ax2.plot(x2, y2_lagrange, 'b-.', label='Lagrange (n=3)')
    ax2.scatter(x2_nodes, y2_nodes, color='blue', zorder=5)

    ax2.set_title('Caso 2: Arcotangente ($x_0=1$)')
    ax2.set_xlabel('x')
    ax2.legend()
    ax2.grid(True, alpha=0.3)

    plt.tight_layout()
    plt.show()

if __name__ == "__main__":
    plot_comparison()
```



Link del repositorio: https://github.com/RommelRam/Metodos-Numericos