**Sorori Shinzaemon problem**

**【Problem 1] Number of grains of rice on the 100th day**

# Initialize variables

days = 100

daily\_rice = 1

total\_rice = 0

daily\_rice\_list = []

cumulative\_rice\_list = []

# Calculate rice grains for 100 days

for day in range(1, days + 1):

    daily\_rice\_list.append(daily\_rice)

    total\_rice += daily\_rice

    cumulative\_rice\_list.append(total\_rice)

    daily\_rice \*= 2

print("Rice grains on Day 100: {:,}".format(daily\_rice\_list[-1]))

print("Total rice grains after 100 days: {:,}".format(total\_rice))

**OUTPUT**

Rice grains on Day 100: 633,825,300,114,114,700,748,351,602,688

Total rice grains after 100 days: 1,267,650,600,228,229,401,496,703,205,375

# Plot the transition

plt.figure(figsize=(12, 6))

# Daily rice grains received

plt.subplot(1, 2, 1)

plt.plot(range(1, days + 1), daily\_rice\_list, color='blue', label='Daily Rice Grains')

plt.title("Daily Rice Grains", fontsize=14)

plt.xlabel("Day", fontsize=12)

plt.ylabel("Rice Grains", fontsize=12)

plt.yscale('log')

plt.legend()

plt.grid(True)

# Cumulative rice grains

plt.subplot(1, 2, 2)

plt.plot(range(1, days + 1), cumulative\_rice\_list, color='green', label='Cumulative Rice Grains')

plt.title("Cumulative Rice Grains", fontsize=14)

plt.xlabel("Day", fontsize=12)

plt.ylabel("Rice Grains", fontsize=12)

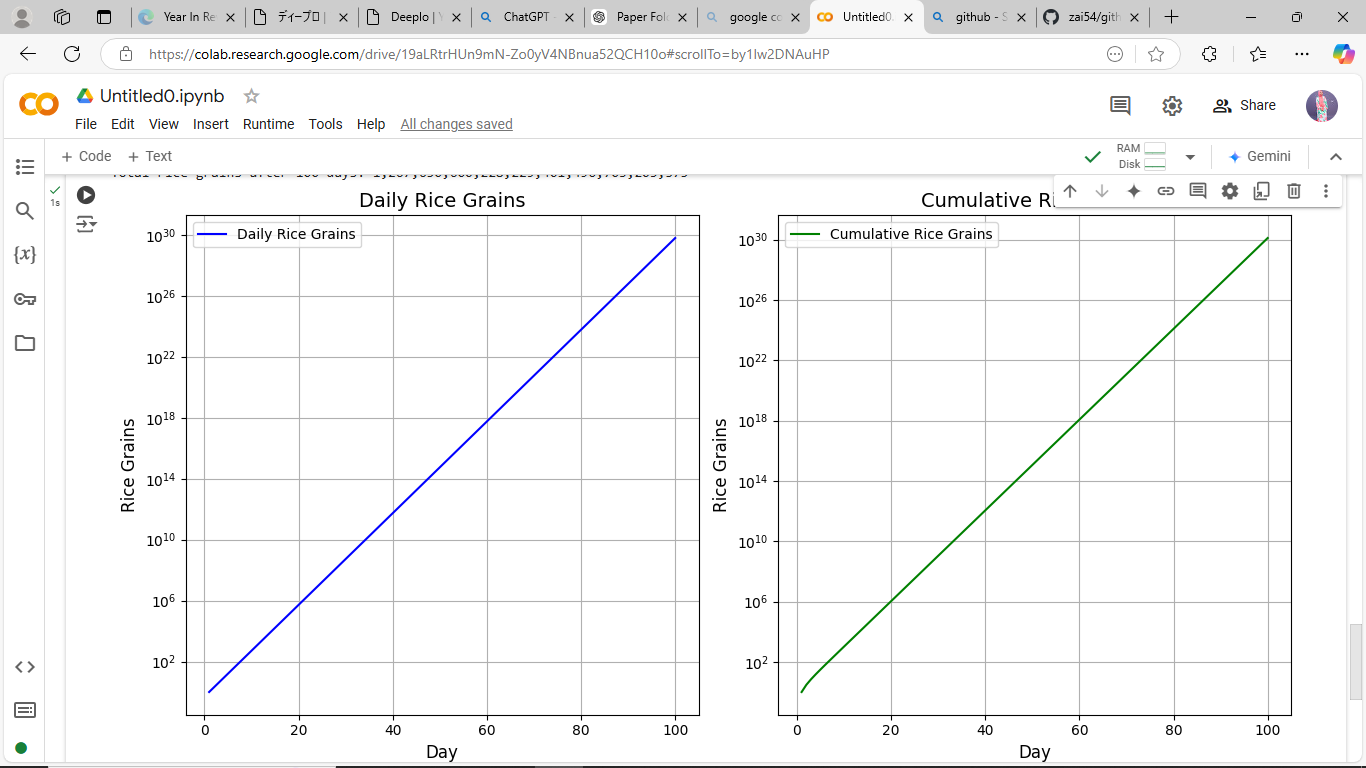
plt.yscale('log')

plt.legend()

plt.grid(True)

plt.tight\_layout()

plt.show()



【**Problem 2] Number of rice grains outside of the 100th day**

import matplotlib.pyplot as plt

def compute\_sorori\_shinzaemon(n\_days=100):

    daily\_rice = 1

    total\_rice = 0

    list\_n\_grains = []

    list\_total\_grains = []

    # Calculate rice grains for the given number of days

    for day in range(n\_days):

        list\_n\_grains.append(daily\_rice)

        total\_rice += daily\_rice

        list\_total\_grains.append(total\_rice        daily\_rice \*= 2

    return list\_n\_grains, list\_total\_grains

n\_days = 81

list\_n\_grains, list\_total\_grains = compute\_sorori\_shinzaemon(n\_days=n\_days)

print("Rice grains on Day {}: {:,}".format(n\_days, list\_n\_grains[-1]))

print("Total rice grains after {} days: {:,}".format(n\_days, list\_total\_grains[-1]))

**OUTPUT**

Rice grains on Day 81: 1,208,925,819,614,629,174,706,176

Total rice grains after 81 days: 2,417,851,639,229,258,349,412,351

# Plot the transition

plt.figure(figsize=(12, 6))

# Daily rice grains received

plt.subplot(1, 2, 1)

plt.plot(range(1, n\_days + 1), list\_n\_grains, color='blue', label='Daily Rice Grains')

plt.title(f"Daily Rice Grains (Up to {n\_days} Days)", fontsize=14)

plt.xlabel("Day", fontsize=12)

plt.ylabel("Rice Grains", fontsize=12)

plt.yscale('log')

plt.legend()

plt.grid(True)

# Cumulative rice grains

plt.subplot(1, 2, 2)

plt.plot(range(1, n\_days + 1), list\_total\_grains, color='green', label='Cumulative Rice Grains')

plt.title(f"Cumulative Rice Grains (Up to {n\_days} Days)", fontsize=14)

plt.xlabel("Day", fontsize=12)

plt.ylabel("Rice Grains", fontsize=12)

plt.yscale('log')

plt.legend()

plt.grid(True)

plt.tight\_layout()

plt.show()

