part2

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p1

1. 功能描述

函数功能描述:
`find_name_value` 函数用于将数据目录的名称拆分为一个元组 `(name, value)`。此函数解析以特定格式指定的文件夹名称，其中名称由字母和可选的前缀字符（如'xN'）构成，后面跟随一个浮点数值或整数，其可能为负数，后缀有时以 'n' 表示负值。该函数使用正则表达式提取名称和数值，并返回结果。

2. 测试用例设计与分析

以下是十个测试用例，包括正常输入、异常输入和边界输入：

测试用例编号	输入	预期输出	说明
1	"phi0.1"	('phi', 0.1)	正常输入
2	"xN14.2"	('xN', 14.2)	正常输入
3	"kappa0.5n"	('kappa', -0.5)	负值，有 'n' 后缀
4	"invalidInput"	('invalidInput', None)	输入不含数字
5	"t1.0"	('t', 1.0)	单个字符作为名称
6	"var-2.5"	('var', -2.5)	负数值，不带 'n'
7	"xN0"	('xN', 0.0)	零值
8	"value.999n"	('value', -0.999)	负小数值
9	""	('', None)	空字符串
10	"test-n1.3"	('test', -1.3)	含 'n'，负数前缀

```
输入: "phi0.1" => 输出: ('phi', 0.1)
输入: "xN14.2" => 输出: ('xN', 14.2)
输入: "kappa0.5n" => 输出: ('kappa', -0.5)
输入: "invalidInput" => 输出: ('invalidInput', None)
输入: "t1.0" => 输出: ('t', 1.0)
输入: "var-2.5" => 输出: ('var', -2.5)
输入: "xN0" => 输出: ('xN', 0.0)
输入: "value.999n" => 输出: ('value', -0.999)
输入: "" => 输出: ('', None)
输入: "test-n1.3" => 输出: ('test-n', 1.3)
```

3.测试结果

```
[('phi', 0.1), ('xN', 14.2), ('kappa', -0.5)]
[('c', 0.2)]
```

修改后的代码：

```
import re

def find_name_value(folder_name):
    '''Split the name of a data directory into a (name, value) tuple.

    The format of ``folder_name``:

        <name><value>

    If the value is negative, it should be followed by a 'n'.

    Args:
        folder_name (str): the name of a :term:`data directory`.

    Returns:
        tuple: a tuple contains:

            * name (str): variable name.
            * value (float): value of the variable.
    '''
    pattern = '([-+]?\d*\.\d+|[-+]?\d+)'
    rst = re.split(pattern, folder_name)
    if len(rst) < 2:
        return folder_name, None
    name = rst[0]
    valuestr = rst[1]
    sign_str = ''
    if len(rst) > 2:
        sign_str = rst[2]
    if sign_str == 'n':
        value = '-' + valuestr
    else:
        value = valuestr

    return name, float(value)

# 新增解析多个变量的函数
def parse_folder_names(folder_name):
    # 匹配多个变量，支持以下格式的变量提取
    # regex: 变量名+（正负数值） 可以为小数
    parts = re.findall(r'([a-zA-Z]+[-+]?\d*\.*\d*n?)', folder_name)
    results = []
    for part in parts:
        if part:  # 确保 part 不为空
            results.append(find_name_value(part))
    return results
```

```python
# 测试用例
folder_names = [
    "phi0.1",            # Test Case 1
    "xN14.2",            # Test Case 2
    "kappa0.5n",         # Test Case 3
    "a1_b14n_n0_c0.2"    # Test Case 4
]

# 输出结果
for folder_name in folder_names:
    result = parse_folder_names(folder_name)
    print(f'输入: "{folder_name}" => 输出: {result}')
```

结果:

```
输入: "phi0.1" => 输出: [('phi', 0.1)]
输入: "xN14.2" => 输出: [('xN', 14.2)]
输入: "kappa0.5n" => 输出: [('kappa', -0.5)]
输入: "a1_b14n_n0_c0.2" => 输出: [('a', 1.0), ('b', -14.0), ('n', 0.0), ('c',
0.2)]
```

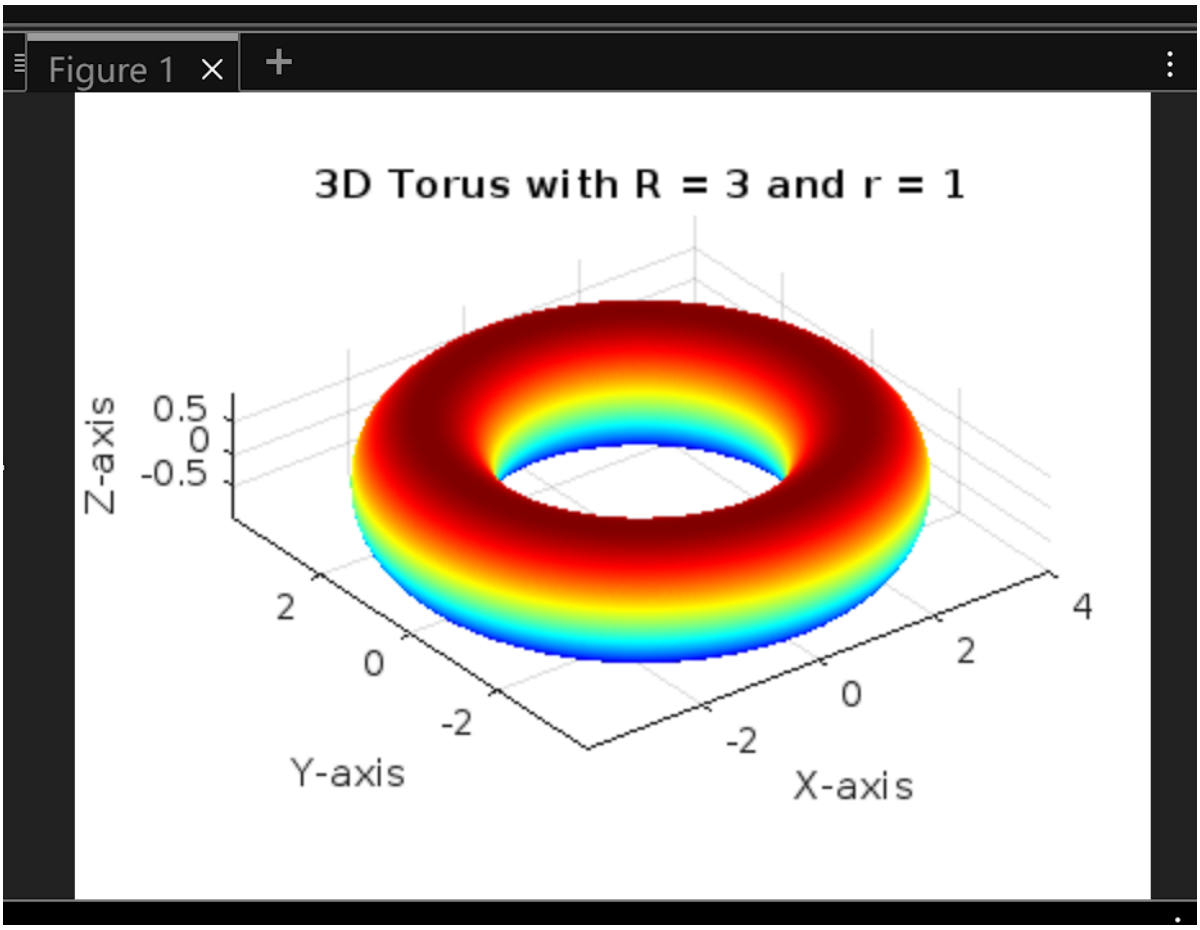
p2

代码:

```
% 定义参数范围
theta = linspace(0, 2*pi, 100);  % 用于环面圆周的角度
phi = linspace(0, 2*pi, 100);    % 用于环面其他方向的角度

% 创造网格
[theta, phi] = meshgrid(theta, phi);

% 定义环面参数
R = 3;  % 主半径
r = 1;  % 副半径

% 计算圆环的坐标
x = (R + r * cos(theta)) .* cos(phi);
y = (R + r * cos(theta)) .* sin(phi);
z = r * sin(theta);

% 绘制三维图像
figure;
surf(x, y, z);

% 添加图形标签
xlabel('X-axis');
ylabel('Y-axis');
zlabel('Z-axis');
title('3D Torus with R = 3 and r = 1');

% 设置图形效果
shading interp;             % 插值阴影
colormap jet;               % 设置颜色映射
```

```
axis equal;                    % 坐标轴等比例
grid on;                       % 打开网格
```

输出:

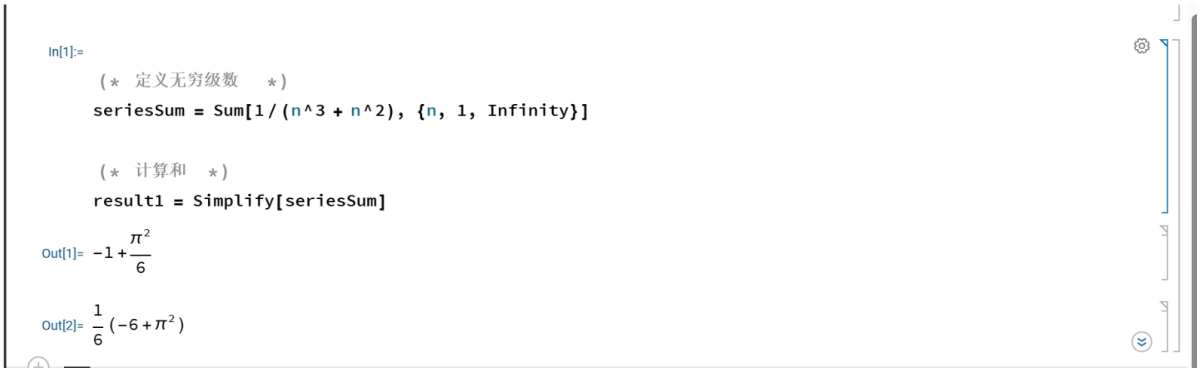


p3

text:

```
(* 定义无穷级数 *)
seriesSum = Sum[1/(n^3 + n^2), {n, 1, Infinity}]

(* 计算和 *)
result1 = Simplify[seriesSum]
```

结果:



```
(* 定义定积分 *)
integral = Integrate[Sqrt[x] Log[x]/((x + 1)^2), {x, 0, Infinity}, Assumptions ->
x > 0]

(* 计算并输出结果 *)
result = Simplify[integral]
```

结果：

```
In[6]:= (* 定义定积分 *)
integral = Integrate[Sqrt[x] Log[x] / ((x + 1)^2), {x, 0, Infinity}, Assumptions → x > 0]

(* 计算并输出结果 *)
result = Simplify[integral]
Out[6]= π

Out[7]= π
```

p4

源代码见附件p4.md

Q: Find the solution of the following equation with respect to θ:

$$A\cos\theta + B\sin\theta + C = 0$$

A:
Let $x_1 = \cos\theta$ and $x_2 = \sin\theta$, then the solution is given by the intersection of the circle and the line:

$$\begin{aligned} x_1^2 + x_2^2 &= 1 \\ Ax_1 + Bx_2 + C &= 0 \end{aligned}$$

We reformulate the equations in a parametric form:

$$\begin{aligned} |\mathbf{x}|^2 &= 1 \\ \mathbf{x}(t) &= \mathbf{a} + t\mathbf{b} \end{aligned}$$

where $\mathbf{x} = (x_1, x_2)$, $\mathbf{a} = (0, -C/B)$, $\mathbf{b} = (-C/A, C/B)$, and t is a parameter. The intersection points satisfy the following equation:

$$|\mathbf{a} + t\mathbf{b}|^2 = 1$$

which can be solved for t to find the intersection points:

$$t_{1,2} = \frac{-\mathbf{a}\cdot\mathbf{b} \pm \sqrt{(\mathbf{a}\cdot\mathbf{b})^2 - |\mathbf{b}|^2(|\mathbf{a}|^2 - 1)}}{|\mathbf{b}|^2}$$