期末考试 part 2

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1. python题
    i. 函数 find-name-value 功能描述

> 该函数实现了将一个起“字典”作用的字符串folder_name分割成（名称name，值value）的元组。其中返回的
> 如果值是负数，那么在folder_name中，数字后面会加一个n。

    ii. 请设计至少 10 个测试用例，其中包括正常输入、异常输入、边界输入等，并给出测试结果。根据测试结果，分析该函数的功能是否正确。如果有找到 bug，试着修复它。
    测试代码及结果：

```
find_name_value('abc123')
```

```
find_name_value('abcn123n')
```

```
find_name_value('abcs123s')
```

```
find_name_value('abc')
```

```
find_name_value('123')
```

```
find_name_value('123n')
```

```
find_name_value('')
```

```
find_name_value('phi0.1_xN14.2_kappa0.5n')
```

```
find_name_value('123abc')
```

```
find_name_value('abc!123')
```

运行结果分别为：

```
('abc', 123.0)
('abcn', -123.0)
('abcs', 123.0)
('abc', None)
('', 123.0)
('', -123.0)
('', None)
('phi', 0.1)
('', 123.0)
('abc!', 123.0)
```

可知该函数对于单名称-值对有很好的分隔作用，但是不能对一个字符串内多对名称-值对进行识别与分割。

3. 现对代码进行以下修改，以使其能够完成对多名称-值对的分割：

```
import re

 def find_multiple_name_values(folder_name):
     '''Split the names and values from a combined directory name into a dictionary.

     The format of ``folder_name``:
         <name><value>[_<name><value>]...

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

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

     Returns:
         dict: a dictionary where keys are variable names and values are their correspo
 '''

     # Regex pattern to capture name-value pairs
     pattern = r'([a-zA-Z]+)(-?\d*\.?\d+)(n?)'
     matches = re.findall(pattern, folder_name)  # Find all matches

     result = {}
     for match in matches:
         name = match[0]  # Variable name
         value_str = match[1]  # Value string
         negative_suffix = match[2]  # 'n' suffix if present

         # Convert the value string to float
         value = float(value_str)

         # Adjust the value if the negative suffix 'n' was found
         if negative_suffix == 'n':
             value = -value

         result[name] = value  # Add to result dictionary

     return result

 # 测试代码
```

```
folder_name1 = "phi0.1_xN14.2_kappa0.5n"
folder_name2 = "a1_b14n_n0_c0.2"

result1 = find_multiple_name_values(folder_name1)
result2 = find_multiple_name_values(folder_name2)

print(result1)
print(result2)
```

测试结果：

```
{'phi': 0.1, 'xN': 14.2, 'kappa': -0.5}
{'a': 1.0, 'b': -14.0, 'n': 0.0, 'c': 0.2}
```

2. Matlab 作图

```
% 定义参数
R = 3; % 大半径
r = 1; % 小半径

% 生成角度网格
theta = linspace(0, 2*pi, 30); % θ 的范围
phi = linspace(0, 2*pi, 30); % ϕ 的范围
[Theta, Phi] = meshgrid(theta, phi); % 生成网格

% 计算 x, y, z 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; % 创建新图形窗口
surf(X, Y, Z); % 使用 surf 函数绘制
shading interp; % 插值着色，使得表面更光滑
axis equal; % 使轴比例相等
xlabel('X轴'); % X轴标签
ylabel('Y轴'); % Y轴标签
zlabel('Z轴'); % Z轴标签
title('环面 (Torus) 的三维图像'); % 图标题
grid on; % 网格开启
```

作图如下：

1. Mathematica
    i. 求无穷级数和

```
Sum[1/(n^3 + n^2), {n, 1, \[Infinity]}]
```

```
Out[1]=-1 + \[Pi]^2/6
```

    ii. 求定积分

```
Integrate[Sqrt[x] Log[x]/(x + 1)^2, {x, 0, \[Infinity]}]
```

```
Out[2]=[Pi]
```

2. 用Markdown编写文档

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:

$$x_1^2 + x_2^2 = 1$$
$$Ax_1 + Bx_2 + C = 0$$

We reformulate the equations in a parametric form:

$$|\boldsymbol{x}|^2 = 1$$
$$\boldsymbol{x}(t) = \boldsymbol{a} + t\boldsymbol{b}$$

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

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

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

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