ZJU Computational Physics: Homework #1

Due on Monday, October 18, 2024

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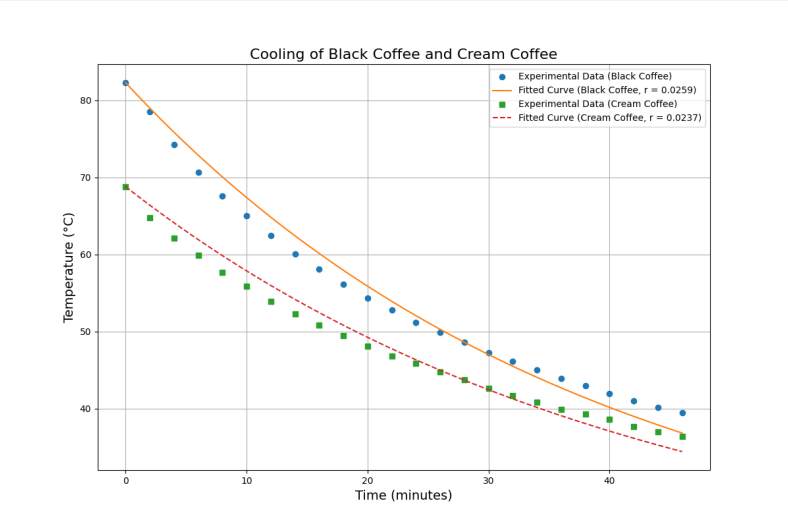
Question 1

The cooling coffee.

a. 计算方法采用两种：第一种是简单地对每一个 Δt 求 r 值，之后对所有 r 值求均值；第二种是将所有数据在牛顿冷却函数下做最小二乘法拟合。由于时间间隔 2min 并不是一个足够小的值，所以第一种方法的误差会偏大，而采用最小二乘法拟合会更加精准。
通过代码计算（参见/1/a.py）可得，由第一种方法计算得到的黑咖啡 r 值为 0.0232min^{-1}，奶咖啡为 0.0214min^{-1}；由第二种方法得到的黑咖啡 r 值为 0.0259min^{-1}，奶咖啡为 0.0237min^{-1}。之后的计算都采用第二种方法得到的结果。

b. 参见/1/b.py，图像中可见仍然存在一定的与实际值的误差。



c. 设置两个新的步长 4min 和 1min，其中 4min 步长通过直接取数据中的每个 4min 时间间隔即可，1min 步长通过差值实现。

d. 降温到 49 度需要 27.54min，降温到 33 度需要 54.30 分钟，降温到 25 度需要 81.06 分钟。这说明物体与周围环境温差越小降温越慢。

e. 牛顿冷却定律并不完全适合这个问题，还存在液体的蒸发所带走的热量，以及液体表面积和与环境接触材质的影响，需要考虑物体与环境的热传导系数、物体的传热方式来进行优化。

Question 2 continued on next page...

Question 2

How much wood would a woodchuck chuck if a woodchuck could chuck wood?

(a) Suppose "chuck" implies throwing.

According to the Associated Press (1988), a New York Fish and Wildlife technician named Richard Thomas calculated the volume of dirt in a typical 25–30 foot (7.6–9.1 m) long woodchuck burrow and had determined that if the woodchuck had moved an equivalent volume of wood, it could move "about **700 pounds (320 kg)** on a good day, with the wind at his back".

(b) Suppose "chuck" implies vomiting.

A woodchuck can ingest 361.92 cm^3 (22.09 cu in) of wood per day. Assuming immediate expulsion on ingestion with a 5% retainment rate, a woodchuck could chuck **343.82 cm^3** of wood per day.

Question 3

Identify the author of Equation 1 below and briefly describe it in English.

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)} \tag{1}$$

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BONUS QUESTIONS

Question 4

The table below shows the nutritional consistencies of two sausage types. Explain their relative differences given what you know about daily adult nutritional recommendations.

Per 50g	Pork	Soy
Energy	760kJ	538kJ
Protein	7.0g	9.3g
Carbohydrate	0.0g	4.9g
Fat	16.8g	9.1g
Sodium	0.4g	0.4g
Fibre	0.0g	1.4g

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Question 5

Listing 1: Luftballons Perl Script

```
#!/usr/bin/perl

use strict;
use warnings;

for (1..99) { print $_." Luftballons\n"; }

# This is a commented line

my $string = "Hello World!";

print $string."\n\n";

```

Question 5 continued on next page...

```
14 $string =~ s/Hello/Goodbye Cruel/;
15
16 print $string."\n\n";
17
18 finale();
19
20 exit;
21
22 sub finale { print "Fin.\n"; }
```

(a) How many luftballons will be output by the Listing 1 above?

> 99 luftballons.

(b) Identify the regular expression in Listing 1 and explain how it relates to the anti-war sentiments found in the rest of the script.

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