HW3

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1 Answers

1. (a) derivative of x(x-1) at x=1 using definition with delta = 0.01 is 1.010000000000001; derivative of x(x-1) at x=1 analytically is 1. The difference is -0.0100000000000009; (b) for different delta:[0.01, 0.0001, 1e-06, 1e-08, 1e-10, 1e-12, 1e-14], the difference between actual value is [1.00000000e-02 9.99999999e-05 9.99917733e-07 3.92252875e-09 8.28403710e-08 8.89005833e-05 -7.99277837e-04]. At first when the delta is decreasing, the difference starts to decrease, however at about 1e-10, the difference starts to increase. This may due to the fact that the precision of the computer is limited, and so when the delta is too small, there may be rounding error occurs.

2. the figure 1 below shows the time for 5 different sizes of matrix multiplication using explicit method, namely, size [10,30,100,300,1000]. clearly, the time is proportional to the cube of the size. Using dot() method, the computational time is drastically reduced. The exact time for each size when using explicit method is: [5.72919846e-04 1.44171715e-02 4.97361898e-01 1.34161708e+01 5.05462780e+02]; the time for each size when using dot() is: [2.09808350e-05 1.69277191e-05 2.12907791e-04 1.58119202e-03 2.74429321e-02].

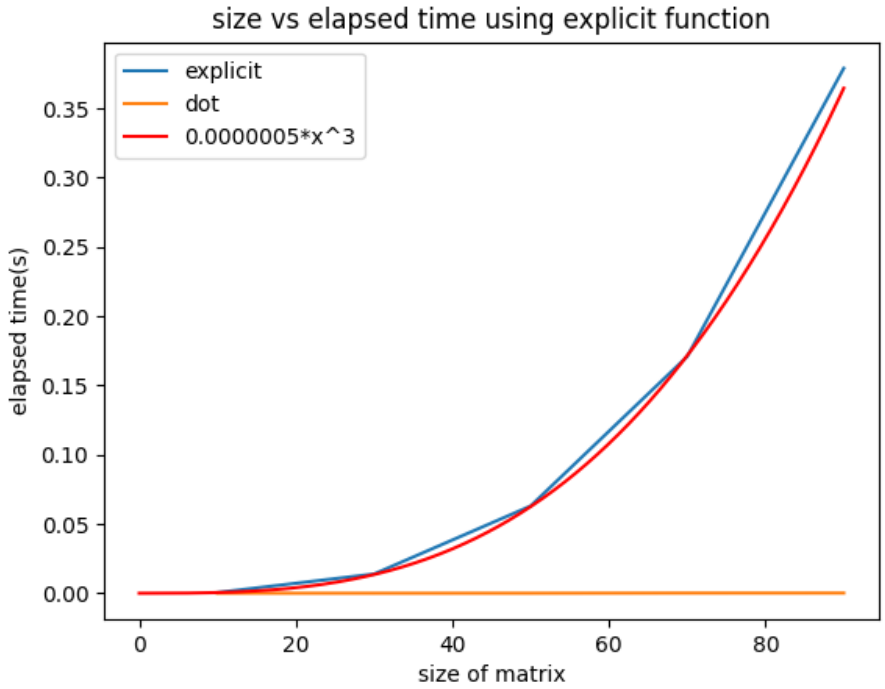

Figure 1: Computation time using explicit method in blue, function y = $0.0000005x^3$ in red

3. See figure 2 below.

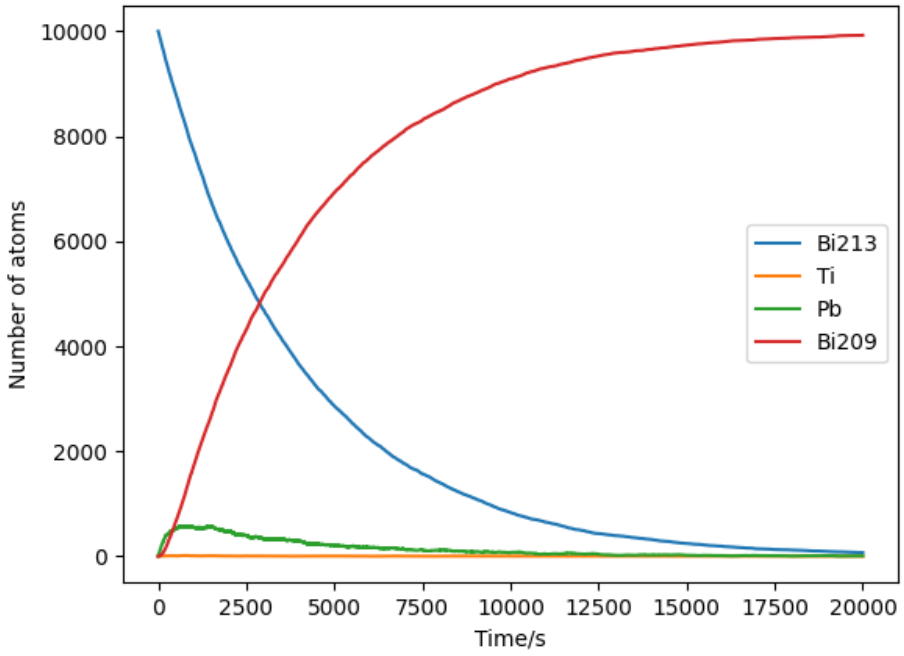

Figure 2: Radioactive decay chain, numbers of atoms for each element as function of time

4. See figure 3, using nonuniform distribution to re-scale the time distribution.

2 Github

Github Account: robertXi6

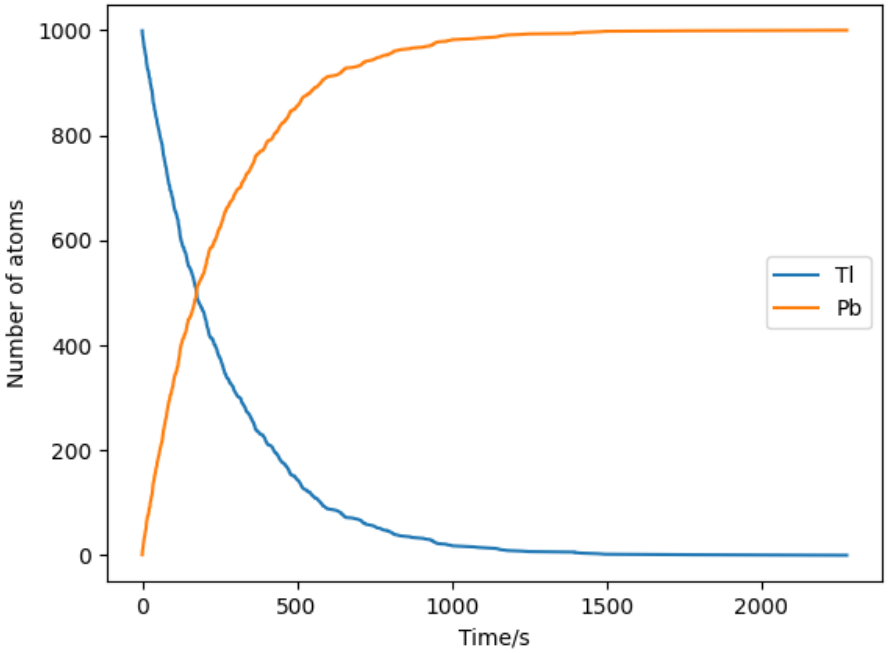

Figure 3: Radioactive decay simulation using faster nonuniform distribution method, numbers of atoms for each element as function of time