

SF2565 Assignment 4 Report - Group 1

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Task I

The results for the serial implementation of the Euler-Maruyama scheme with $M = 1e4$ are presented in figure 1. The survival probability behaves like an exponential distribution, with b acting as the exponential parameter. Larger death rates result in a shorter extinction time.

$$\text{CDF: } F(t; b) = 1 - e^{-bt}$$

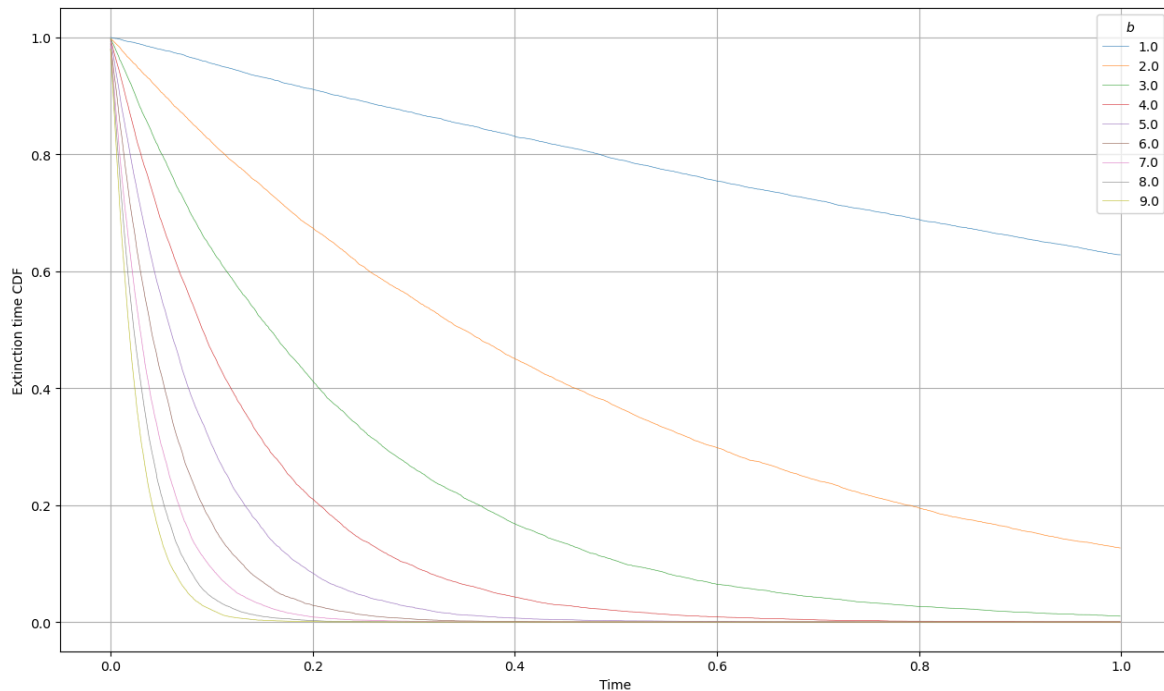


Figure 1 - Population evolution for different values of b

Task II

The parallel implementation was implemented using the Taskflow library. The vector of M initial conditions used to generate the CDF was split into windows which were then fed to parallel jobs. The results were subsequently joined to produce the final vector of extinction times, therefore avoiding the need for a mutex.

The results for $M = 2e5$ and 1000 total jobs and 10 threads are presented in Figure 2. Table 1 depicts the time to calculate for various numbers of threads ranging from 1 to 256.

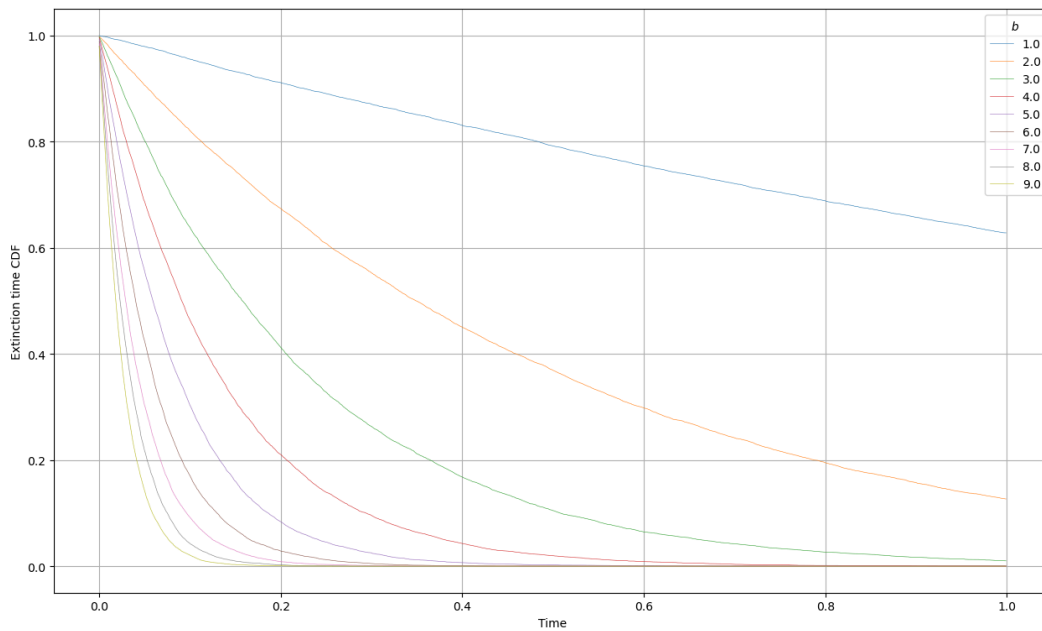
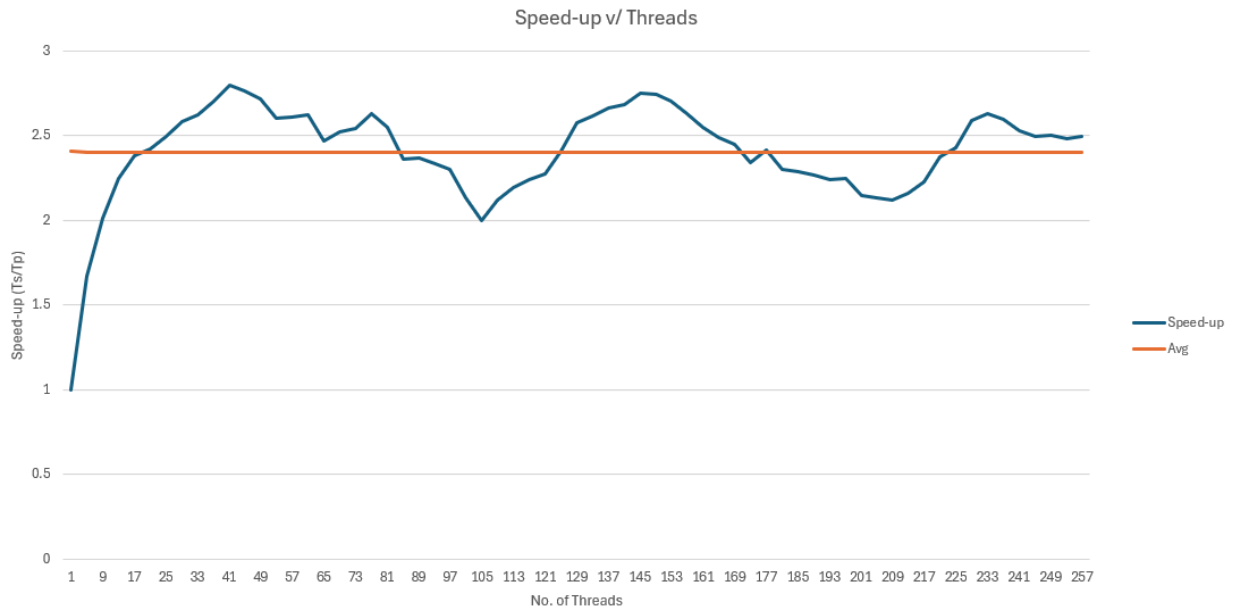


Figure 2 - Results of parallelisation with 10 threads

Table 1 - Execution times vs number of threads

Number of threads	Performance (sec)
1	104.1
16	44.56
64	44.47
128	37.6
256	40.8

Figure 3 - Speed-up vs No. of threads



Notes: Speedup shows consistent oscillations with an average of **2.4**. Possibly due to how the VM is running or even processor overload due to other tasks running on the computer.

The above graph was generated by taking the speed up and performing a moving average of 5 recordings.

Using this average, the portion of the code that can be sped up is calculated based on the Amdahl formula resulting in a **f = 0.5839**.

Appendix - code listing

Attached below are the main code file descriptions :

1. main.cpp - Main code for tasks
2. plot.py - Python script written to plot b values