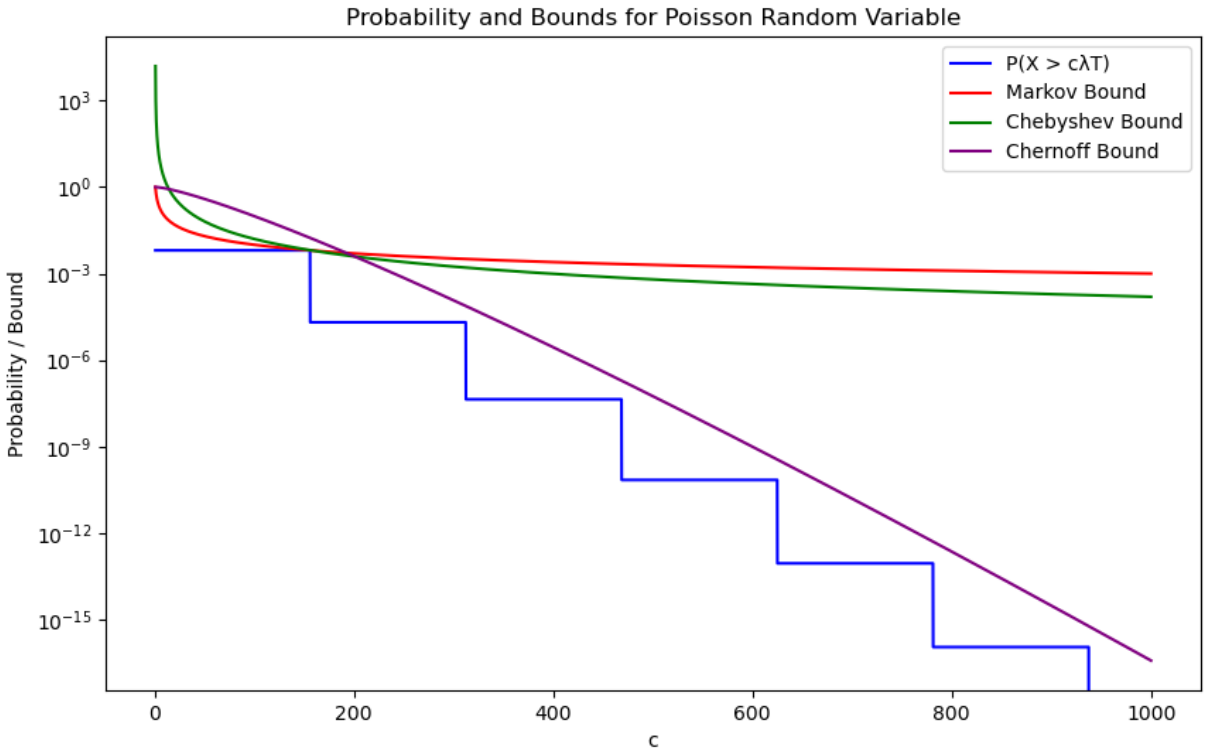
Problem 1-b

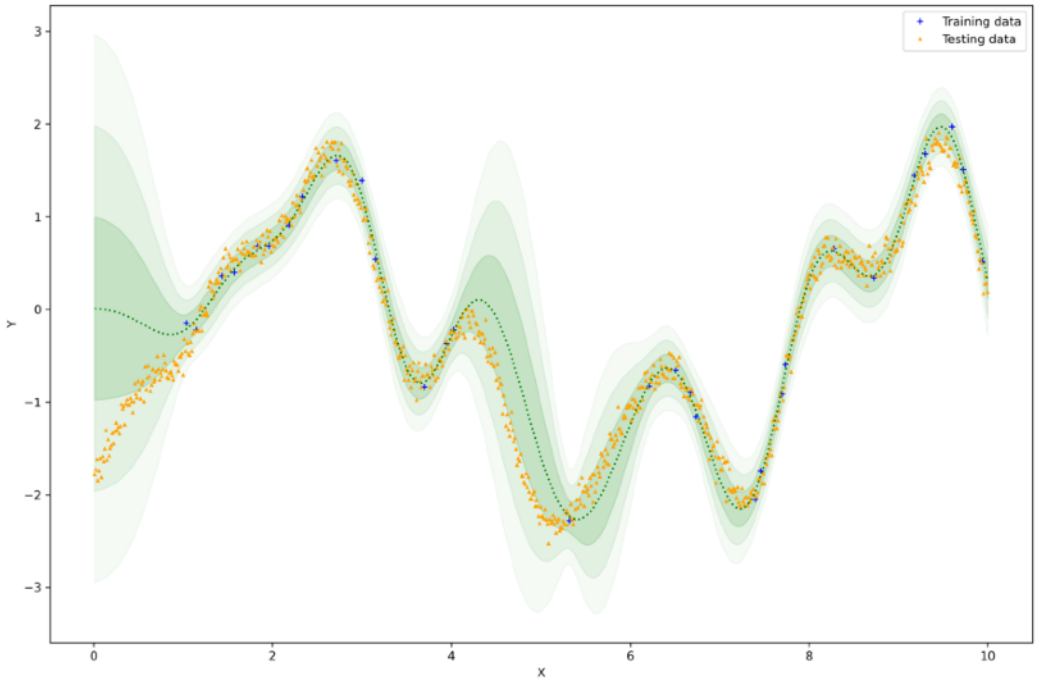
Result:



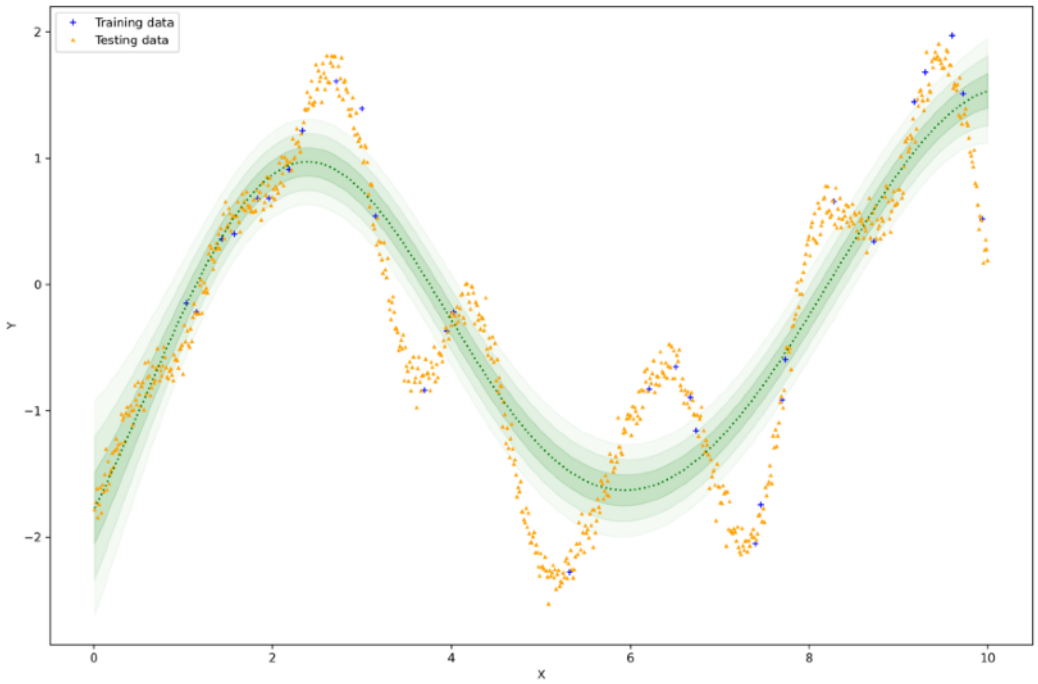

As we can see in the picture. Markov's bound (red line) is the least tight, meaning it's generally further away from the true probability. And Chebyshev's Bound (green line) is a little bit tighter than Markov's. Chernoff bound (purple line) is the tightest bound, which capture the decreasing rate of true probability.

## Problem 2-b

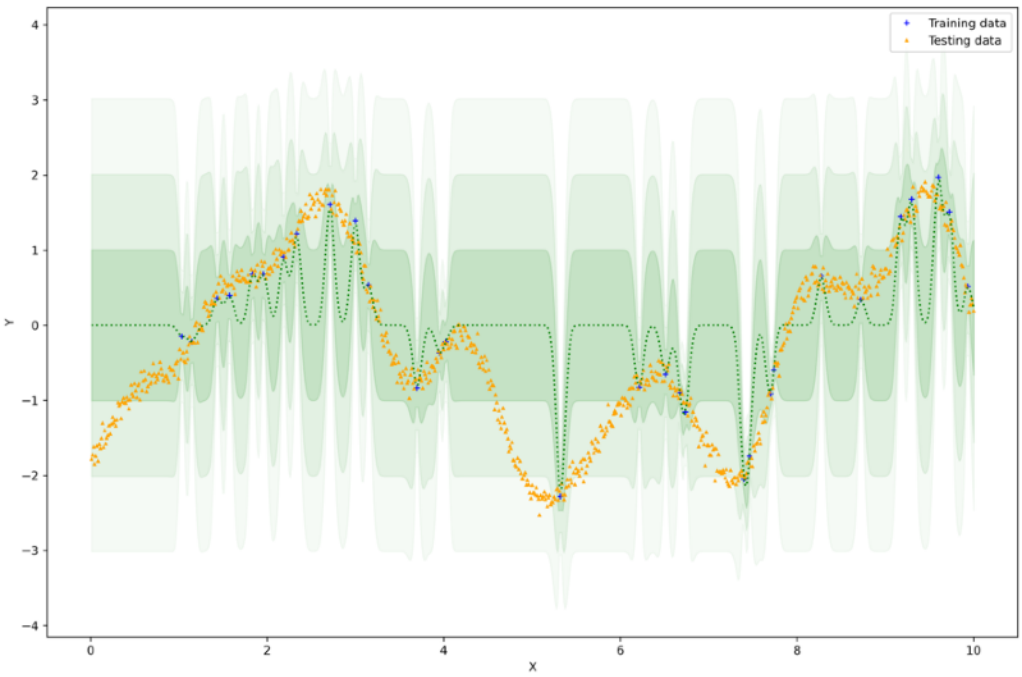
Result:




L = 0.5




L = 2.5

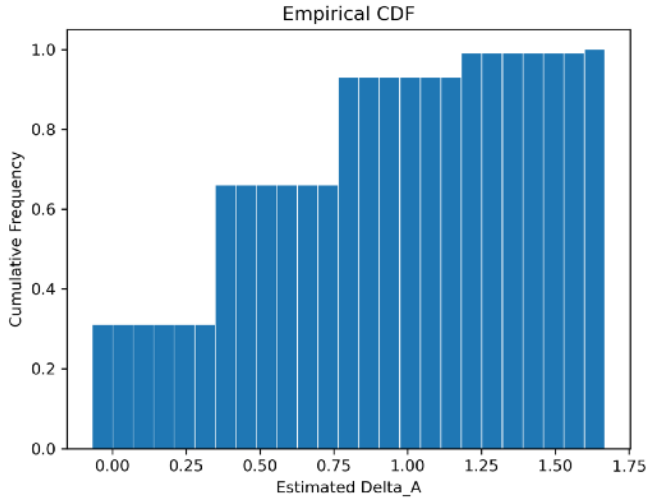



L = 0.05

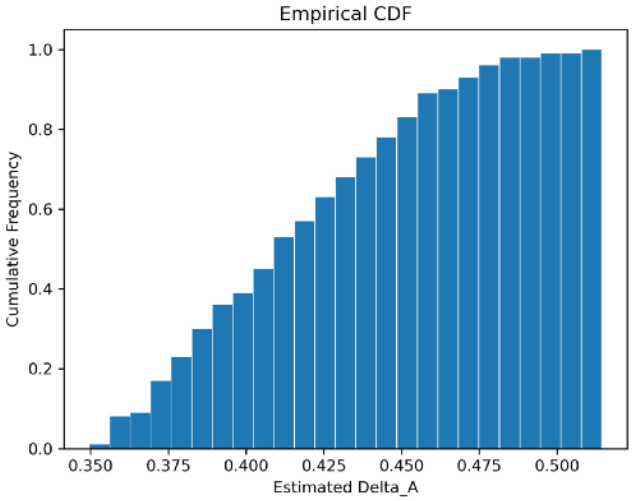
The prediction result of the testing dataset under $\sigma_f = 1$, $\sigma = 0.1$ , $l = 0.5, 2.5, 0.05$ is showing below. When $l = 0.5$, it seems like the predicate function is the closest to the testing datas, as every datas are within 3 of standard deviation. And when $x \in [0,1]$, it seems most uncertain to me. When $l = 2.5$, it generally follow the increasing and decreasing rate of testing datas, but not much precise compared to $l = 0.5$. When $l = 0.05$, the standard deviation is too large so it don't even capture the increasing and decreasing rate of testing datas.

## Problem 5

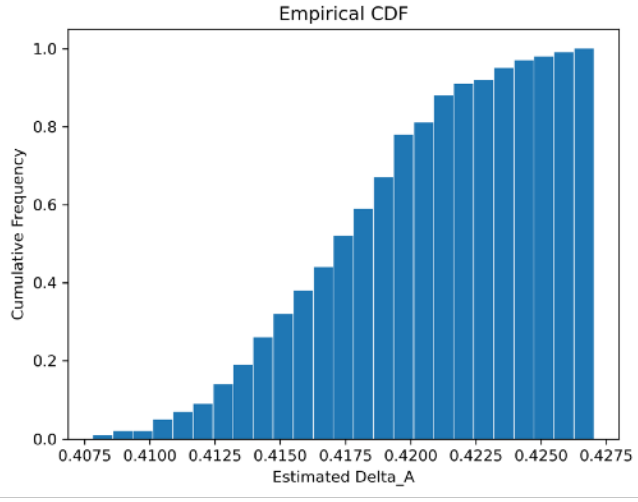
Result:



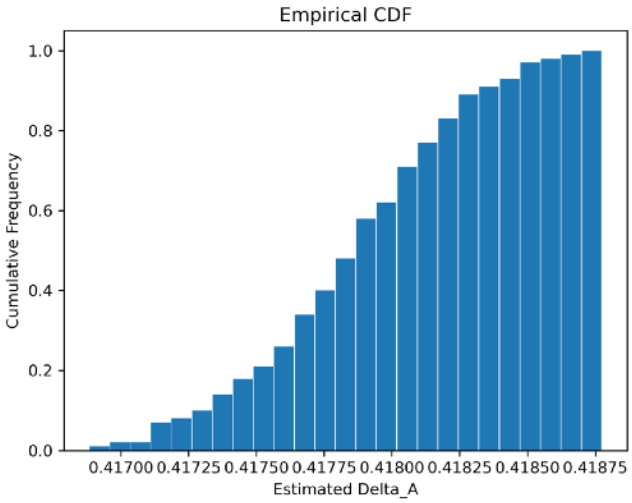

N=10^1




N=10^3




N=10^5




N=10^7

As we can see in the results, the possible values of delta_a under different N are showing below. When N = 10^1, the most possible value of delta_a is around 0.25 ~ 1.25. When N = 10^3, the most possible value of delta_a is around 0.35 ~ 0.475. When N = 10^5, the most possible value of delta_a

is around 0.415 ~ 0.4225.  When N = 10^7, the most possible value of delta_a is around 0.4175 ~ 0.41825.