Report:

First of all, we have to get the Number of Monte Carlo simulations that guarantee that we get the result i.e With probability 0.98, it does not differ from the true value by no more than 0.008. Therefore, We can use the following formula to get the Number of Monte Carlo simulations to perform:

$$\boxed{n \geq 0.25 \left(\frac{z_{\alpha/2}}{\Delta}\right)^2.}$$

with the desired margin = 0.008 and α = 1 - 0.98 = 0.02, therefore, we get $z_{\alpha/2}$ = 2.3263. Therefore, we get:

$$N \geqslant 0.25 \left(\frac{2.3263}{0.008}\right)^2$$

$$N \geqslant 21139.342$$

$$N \geqslant 21140$$

Which gives us a good enough value for Number of Simulations, perhaps, larger than we actually need.

Next, We simply initialise the Binomial random variable parameters with binom_n = 5n = 250 and binom_p = 0.62 because we need the number of plastics produced by the factory in a week of five workdays. Additionally, we define a vector to keep track of total weight of the plastics produced for each Monte Carlo run.

Then, we start our simulations, and **each** simulation we firstly generate a Sample Y, which tells us the number of plastic chunks produced in 5 days using sampling from Binomial.

We now proceed with using the rejection method to sample Y plastic chunks weights. We can note from the question that the weight of material per chunk is a continuous random variable in tons with a given probability density function. Using this function, we get the boundaries of our rejection sampling rectangle i.e **s = 0, t = 8, m = 0.22**.

We can now start sampling the Y plastic chunks' weights individually(meaning for each single chunk) using the rejection sampling with the while loop(We are also initialising coordinates for X(CX) and Y(CY) values as well as the value of the given probability density function at 0). Now getting the total weight, we can finally store this value of weight into the vector that keeps track of the total weight of the plastics produced for each Monte Carlo run.

When all the simulations are finished, we can use the vector TotalWeight to get the probability that the total weight of the plastics produced by the factory in a week of five workdays exceeds 640 tons. As well as the mean (estimated total weight of the plastics produced in five days) and standard deviation. We can safely estimate this because our size N(the number of Monte Carlo simulations) is big enough.

c) So to get the estimation of Std(X), we simply use std(TotalWeight) to get the standard deviation of the vector TotalWeight as seen in our code.

Now for the accuracy of our result, since we had in the start created a Monte Carlo study using simulation size N, which achieves for us the accuracy desired($\alpha = 0.02$ & $\varepsilon = 0.008$), In our study we have guaranteed that our Monte Carlo study does not have an error exceeding 0.008 with a very high probability (0.98) using our size N (the number of Monte Carlo simulations). Hence, we have derived an estimator of X with that certain accuracy.