Student Information

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Homework 4 - Short Report

In order to conduct a Monte Carlo study, we should determine study size. We can use Normal Approximation as given in the text. For that purpose have used the formula from the textbook page 116.

$$N \geq 0.25(\frac{z_{\alpha/2}}{\varepsilon})^2$$

Again from the same page, we can use the formula $z_\alpha = \Phi^{-1}(1-\alpha)$. Therefore, if we take $\alpha = 0.02$ and $\varepsilon = 0.008$ as mentioned in the text, and both the reverse of the formula $= \Phi(z_\alpha) = 1-\alpha$ and the table A4 from the textbook, we can take $z_{\alpha/2} = 2.3263$.

$$N \geq 0.25(\frac{2.32363}{0.008})^2$$
$$N \geq 21139.34254$$

Thus, we can take N as 21140.

```
Bino_n = 50;                %
Bino_p = 0.62;              % These are the given values in question text.
TotalWeight = zeros(N,1);   %
```

We first generate the total weight of the plastics producedby the factory in a week of five workdays by using sampling from binomial distribution.

```
U = rand(5*Bino_n, 1);
i = sum(U < Bino_p);
Y = i;
weight = 0;

s = 0; t = 8; m = 0.22; % These are our boundaries for rejection sampling.
```

This is where rejection sampling occurs.

```
for f=1:Y;                          % We sample Y number of fish.
  CX = 0; CY = m; F = 0;            % Initial coordinates.
  while (CY > F);                   % When it's under the curve, we accept it
.
    U = rand; V = rand;
    CX = s+(t-s)*U; CY = m*V;
    if CX <= 2
      F = 0.07*CX;
    elseif CX <=5
      F = -0.02*(CX-4)^2 + 0.22;
                    elseif CX <=7
      F = 0.08*(5-CX) + 0.2;
    else
      F = -0.04*CX + 0.32;
    end
  end;
  weight = weight + CX;  % Generated weight is added to the total weight.
end;
TotalWeight(k) = weight; % We maintain accumulate these weights.
```

a)

I have used `mean` function to estimate the probability that the total weight of the plastics producedby the factory in a week of five workdays exceeds 640 tons. In this case, it is `mean(TotalWeight>640)`. The result can be found below.

$$\text{Estimated probability} = 0.127389$$

b)

In this part, I have used `mean` function to estimate the total weight of the plastics produced in five days. In this case, it's `mean(TotalWeight)`.

$$\text{Expected weight} = 599.275894$$

c)

To calculate standart deviation, we can simply use `std` function as `std(TotalWeight)`. Since our expected weight is close to 599 and standard deviation is around 35, estimated probability is not a surprise. Therefore, we can say that our estimator is accurate.

$$\text{Standard deviation} = 35.736913$$