**Task two simulation**

**the newspaper seller problem**

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**- Problem formulation** :

(revenue from sales) – (cost of newspapers) – (lost profit from excess demand) + (salvage from sale of scrap papers).

**- Problem objective :**

the main objective of the project is to determine the optimal number of bundles to buy to increase the profit and we can simulate this by making multiple runs through the simulation program and analyzing the results to see how changing the parameters is going to affect the final profit result.

**Declaration of the system components:**

**The entity:**

We learn the entity is object of interest in the system. So in this case our object of interest is the newspaper bundles.

**The attributes**:

An attribute is a property of an entity. So in this case, the attribute Of our entity is the state of the newspaper whether it's good fair excellent or poor, the amount of newspaper purchased by the seller and the amount of sold as scrap

**Activity:**

The activity represents a time period of specified length so in that Case in our problem the activity is done through a period of a 10 days calendar.

Purchasing newspaper bundles.

**State:**

The variable that describes our state of this system The profit. that's because it describes if the system is profitable or not.

**Events:**

The events that might occur to change the state of our system is the operation of selling the newspaper it's what defines if the system is profitable or not and changes our variable of interest.

**experimental parameters and its analysis:**

**Revenue from sales :**

The revenue from sales is calculated by multiplying the quantity of purchase the newspaper times the selling price of the one newspaper

**The cost of purchasing newspapers :**

the cost of purchasing newspaper is calculated by multiplying the quantity of purchased newspaper times the cost of purchasing the newspaper which is in this case equals to $0.50.

**The lost profits due to excess demands:**

It's calculated Only when demands are bigger than the amount of purchased newspaper and it equals subtraction of them times the profit of selling one news paper

**The salvage from selling as scrap:**

It only happens when the demand is less than the quantity purchased by the seller and it's calculated by multiplying the result of subtracting the demand from the quantity purchased times $0.15.

**The demand:**

To assign the proper random variables for the demand we first need to calculate the commutative probability distribution get the ranges in which to assign the random variables from. so you can see in the table below we determined the commutative probability hence we can determine the ranges in which to assign the random variables from.

A screenshot of a computer

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After calculating these variables in the program we were ready to construct the calendar that describes our 10 days profit as shown below we constructed 4 calendars the first calendar is calculated using a quantity of 40 newspaper purchased by the seller and the second one was calculated using a quantity of 60 newspaper the third was calculated using 80 and the 4th and final one was calculated using 100 newspaper quantity as shown below in these tables:

RUN1: Quantity of 40

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RUN2: Quantity of 60

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Run3 : quantity of 80

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Run4: quantity of 100

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As shown in the tables above in order to determine the optimal number of purchased newspaper we need to calculate the average profit in each run and then detect the maximum average profit and the amount of newspaper purchase that makes that maximum is the optimal amount of newspaper purchased by the seller.

But four runs are not enough to determine the optimal number of purchased newspaper we need to buy so in order to make it clearer for the seller we need to check the line plot shown below.

Average profit

Chart, line chart

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Quantity

As you can see the maximum value is achieved in the point of 80 . to make sure that actually 100% true we are gonna plot three other graphs to make sure that this is the actual optimal value.

Chart, line chart

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Average profit

Quantity

Quantity

Average profit

Average profit

Quantity

As you saw in three out of four runs the optimal amount of purchased newspaper is 80 as it always makes the maximum average profit.