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Profit Maximization in a Bakery - Application of Linear Programming Problem

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ABSTRACT

This research paper Explores the practical application of the linear Programming problem (LPP) model to streamline the productivity of a bakery shop. The goal is to distinguish the ideal creation amounts and evaluating techniques that boost income and limit costs, at last prompting expanded benefit.

Through the investigation of the bakery shop's tasks and the use of the LPP model, this research paper expects to give significant bits of knowledge and proposals on the most proficient method to optimize the profit. By utilizing the mathematical concept, pastry shop organizations can improve their dynamic cycles and can achieve profitability.

The primary data is gathered and linear programming model is framed. Two methods namely the graphical method and simplex method using excel solver are used to find the optimal solution to the LPP.

Keywords: Liner programming problem, Bakery, excel solver, simplex method, Profit maximization, Production, cakes, Time, Pricing strategies, Graphical method, optimal solution.

Introduction

The linear Programming problem (LPP) model is a strong mathematical procedure that has acquired huge consideration in different enterprises for upgrading dynamic cycles. With regards to the pastry shop industry, the LPP model offers a deliberate way to deal with expand productivity by considering numerous elements, for example, fixing costs, creation limit, request, and estimating. By forming a LPP model intended for the bread shop's activities, proprietors and chiefs can go with informed choices that lead to expanded income and decreased costs.

The LPP model gives a structure to distinguishing the ideal portion of resources, including the amounts of various items to deliver and the relating valuing techniques. By taking into account the requirements and objectives of the bakery shop, the LPP model considers the distinguishing proof of the most beneficial creation and estimating systems.

This research work expects to investigate the use of the LPP model in optimizing the productivity of a pastry shop. By examining the bakery shop's activities and using the LPP model, we try to distinguish the optimal production pricing strategies and evaluating methodologies that maximize the profit.

For this research work I have chosen our nearby bakery that is PB bake House is a renowned bakery shop situated in Bangalore, India. With its obligation to quality and development, PB Prepare House has secured itself as a well-known objective for delectable baked products. The pastry shop invests wide in its large variety of items, catering to the assorted preferences and inclinations of its clients. The bakery shop's bread choice incorporates an assortment of distinctive portions, going from exemplary white and entire wheat bread to specialty choices like multigrain, sourdough, and crusty bread. These breads are known for their delicate surface, rich Flavors, and healthy fixings.

Not with only cakes, PB Prepare House offers an alluring combination of baked goods and cakes. From exemplary top picks like croissants, biscuits, and Danish cakes to liberal deals with like chocolate truffle cake, red velvet cake, and natural product tarts, the pastry kitchen guarantees there is something for everybody's taste buds.

Objectives:

Profit Maximization:

- In my linear programming problem (LPP), the main objective is to find out the optimal amount of black forest and almond cakes that can make us achieve maximum profit.

- To achieve the highest profit by determining the ideal quantities for each type of cake.

Literature Review

(Sivakumar, (2016))

The low-carbon inventory network is one of the transcendent subjects towards a green economy and it lays out the chance to decrease fossil fuel byproducts across the item esteem chain. This paper centres around reusing and improved obtaining in the paper business as a case organization. The principal objective is to draw for the situation organization with their provider organizations to decrease the ozone harming substances (GHG) outflows and cost in their creation cycle. It proposes a model to help the choice of the best green provider and a designation of request among the possible providers.

(Nagi, 2017)

This paper presents an incorporated numerical programming definition of the assembling cell arrangement issue presented by Nagi et al. The definition consolidates basic creation arranging issues that incorporate long haul projected creation prerequisites, asset limit imperatives, practically indistinguishable machines and elective cycle plans in the phone development issue, with a typical goal of limiting the subsequent between cell material taking care of exertion.

(Imran Ali Chaudhry, 07 August 2015)

Over the most recent 25 years, broad exploration has been completed tending to the adaptable work shop planning (JSS) issue. Various procedures going from definite strategies to cross breed methods have been utilized in this examination. The paper targets introducing the improvement of adaptable JSS and a combined review of different strategies that have been utilized beginning around 1990 for issue goal. The paper contains assessment of distributions and exploration strategies utilized in different examination papers. At last, ends are drawn in view of performed review results.

(Dimitris Bertsimas, 1 Feb 2000)

We foster a numerical programming approach for the old style PSPACE-hard fretful desperado issue in stochastic enhancement. We present a pecking order of N (where N is the quantity of outlaws) progressively more grounded direct programming relaxations, the remainder of which is definite and relates to the (dramatic size) detailing of the issue as a Markov choice chain, while different relaxations give limits and are productively processed. We likewise propose a need record heuristic planning strategy from the answer for the firstorder unwinding, where the files are characterized regarding ideal double factors. In this manner we propose a strategy and a suboptimality ensure.

(Woubante, (2017))

Modern improvement methodology is described by the proficient utilization of assets at each creation stage. The examination and productive usage of assets are settled on practical by successful administration choice making methods utilized in the business. A quantitative dynamic device called straight programming can be utilized for the streamlining issue of item blend. Understanding the idea driving the improvement issue of item blend is crucial for the progress of the business for addressing client needs, deciding its picture, zeroing in on its centre business, and stock administration.

(Mahajan, 2020)

Activity Exploration (OR) is strategies and techniques use to settle on better choice. Activity research is use to find ideal or close ideal answers for complex dynamic issue. Straight Writing computer programs is a numerical procedure for expanding or limiting a direct capability of a few factors, like result or cost. This paper shows the application area of activity research and various systems used to take care of direct programming issue (LPP). Direct writing computer programs are fundamentally used to streamline the arrangement.

(Hu, 2015)

Rice assortment distinguishing proof is significant for hereditary rearing characterization and harvest yield assessment. Conventional ID techniques are tedious and incorrect. This paper proposes a strategy for rice assortment ID in view of the hyperspectral qualities of leaves. The trial results show that the recognizable proof pace of 10 assortments of early rice was viewed as 91.67% and the ID pace of 10 assortments of late rice was 97.33%.

(Vaidyanathan, 2018)

In this paper, we foster new details for the linear programming issue (LPP) which is one of the main railroad advancement issues. The goal of the LPP is to relegate a comprise to each train in a pre-arranged train plan to give adequate ability to pull the trains from their starting points to their particular objections at negligible expense. This task plan ought to be repeatable consistently. In a prior paper, we fostered a definition for train arranging and proposed an original two-stage arrangement approach utilizing straight, whole number, and organization programming. Nonetheless, that plan didn't integrate every one of this present reality imperatives expected to create a completely implementable arrangement. In this paper, we broaden that methodology on a few aspects by adding new requirements to the arranging issue wanted by train chiefs, and by fostering extra details important to progress arrangements of our models to rehearse. We propose two plans for this summed up LPP: comprise definition, and cross breed detailing.

(Ching, 2016)

In this paper, we foster new details for the straight programming issue (LPP) which is one of the main railroad advancement issues. The goal of the LPP is to relegate a comprise to each train in a pre-arranged train plan to give adequate ability to pull the trains from their starting points to their particular objections at negligible expense. This task plan ought to be repeatable consistently. In a prior paper, we fostered a definition for train arranging and proposed an original two-stage arrangement approach utilizing straight, whole number, and organization programming.

(Csókás, 2011)

Impact expansion (IM) is a difficult combinatorial enhancement issue on (interpersonal organizations) given a dispersion model and restricted decision for starting seed hubs. In this paper, by thorough examination, we demonstrate the way that the proposed calculation can stall out in locally ideal arrangement or couldn't in fact begin specific information diagrams.

(Pelegrín, 2014)

We consider the office area issue for an extending chain which rivals different chains offering similar merchandise or administration in a topographical region. Clients should choose the office with most extreme utility to be served and offices in the extending chain might have various proprietors. We first utilize the weighted technique to foster a whole number direct programming model to get Pareto ideal areas connected with the internal rivalry between the proprietors of the old offices and the proprietors of the new offices.

(Kong, 2022 december)

Under the tensions of fossil energy consumption and the "Carbon pinnacle and non-partisanship" focus on, the improvement of clean energies, for example, hydropower and hydrogen has gotten far and wide consideration. In any case, irregular vacillations in market power costs, water stream and electric burden genuinely impede the complementarity of water and hydrogen, thwarting the procurement of the above benefits. To this end, this paper proposes a two-stage distributionally strong improvement model to settle the activity booking issue of the water-hydrogen integral framework under various vulnerabilities.

(Zhang, july 2021)

In the ongoing trash stream risk evaluation framework, there are still imperfections in the weight task process. This paper means to concentrate on every appraisal calculates weight task the gamble evaluation of garbage stream. In light of thorough numerical hypothesis deduction, the limit states of the not entirely set in stone by the equivalent weight technique, the logical progressive system process and the variety coefficient strategy. Besides, in view of the variable weight strategy, a direct programming trash stream risk evaluation model is laid out.

(Anwar, 2018)

The Present was finished to sort out the effectiveness of Nigerian makers to library thinking and work on during 2008 to 2013.the focuses of the survey was to set to reveal. The Parameters were set for this study consolidates to sort out repeat of appropriations, Makers participation, papers length, references, most referred to papers and most helpful makers. The results uncovered that outright number of papers has been contributed in LPP that is 226. The greatest number of assessment papers was circulated in 2010 with 76(33.62%) and least papers were disseminated in 2011 with 13(5.75%). 114(50.44%) were single authors and least number of papers were formed by different scholars with 1(0.44%).

(Gupta, 2011)

This paper revolves around the dismantling to-arrange (DTO) issue. End-of-life (EOL) items are bought from various providers to be dismantled into individual parts to fulfill the interest for determined quantities of parts. Nonetheless, there are a ton of vulnerabilities that entangles the interaction. Past work in the writing tackled the DTO issue under different vulnerabilities and a solitary goal. The principal objective was to track down the best blend of reclaim EOL items to be bought from each provider that would fulfill the interest and accomplish the yearning levels of different objectives. A model is considered to represent the model methodology.

(phanindra, 2023)

In our current reality where the bread kitchen industry endeavours to offset benefit augmentation with asset proficiency, this research paper investigates the viable utilization of Direct Programming (LP) to streamline cake creation. With an emphasis on Vanilla, and Dark Timberland cakes, the essential goal is to accomplish greatest productivity while taking advantage of assets. The paper digs into the pastry kitchen business, the underpinnings of LP, and the real-world use of LP methods to cake creation. That's what it exhibits, very much like in some other industry, the right numerical recipe can prompt an orchestra of progress. There were 2 strategies utilized which were graphical technique LPP and solver LP.

Research methodology

In this research paper I have done this with the primary data that is with the LPP method, the LPP method is that which helps to identify the best possible way to satisfy the given objective. In this, all the decision variables are non-negative and the RHS of each constraint is also non-negative, and we have taken objective function is to maximize the profit of the bakery store, and the steps that are to be followed as:

Here;

X= NO. OF BLACK FOREST CAKES PRODUCED PER DAY

Y= NO. OF ALMOND CAKES PRODUCED PER DAY

Decision variable - That is mentioning the gives items/products with the variables that is X&Y.

Forming the Constraints - These are forming the inequalities in which we mention the constraints i.e., time and flour as per the problem.

Objective function - According to the case we should mention either maximize or minimise, in this I have taken to maximise the profit of the bakery.

By using Graphical method:

In the similar way we can solve the LPP by using the graphical method, after plotting the graph we will get the feasible points. By substituting the feasible points in our objective function, we will choose the maximum value in the table and write the X, Y points.

DECISION VARIABLES

X= NO. OF BLACK FOREST CAKES PRODUCED PER DAY

Y= NO. OF ALMOND CAKES PRODUCED PER DAY

OBJECTIVE FUNCTION

Z=250X+320Y

The profits for black forest are Rs.250 and the profits for almond cake is Rs.320

Resource Flour constraints:

1.5X+3Y≤2

Flour for Black Forest cake:1.5kgs

Flour for Almond cake: 3kgs

Resource time constraints

2X+2Y≤20

Time for black forest cake: 2 hrs per cake

Time for almond cake: 2 hrs per cake

Linear programming problem is to maximize the profits

MAXIMIXE **Z=250X+320Y**

Subjected to:

1.5X+3Y ≤ 24(Flour constraint)

2X+2Y≤20(Time constraint)

X≥0 & Y≥0(Non negative constraint)

Data analysis and Interpretation

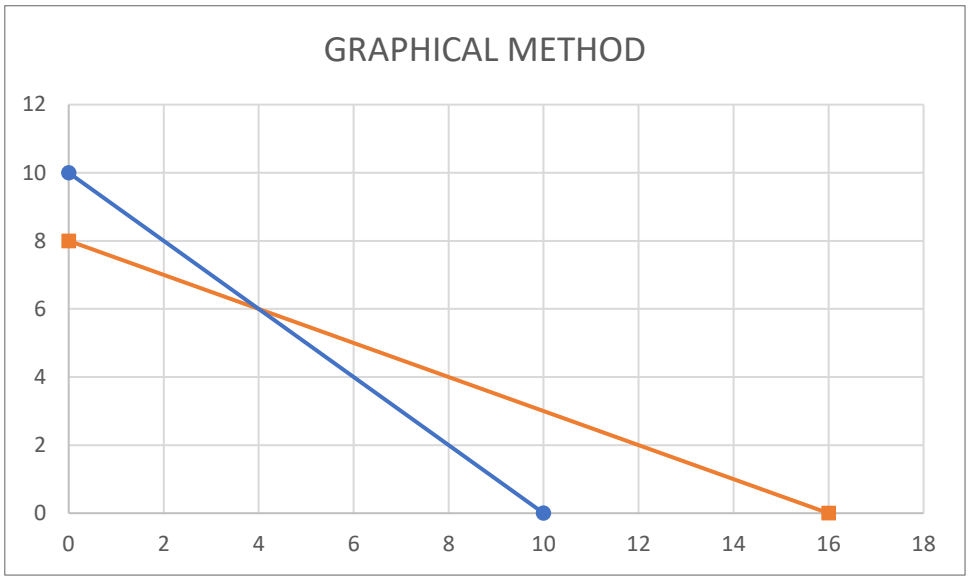
Solving the problem by the following 2 methods:

Step:1 Converting the inequalities into equalities and substituting the x and y and as zero.

C1(Flour)		
x	0	8
y	16	0

C2(Time)		
x	0	10
y	10	0

Method:1 Graphical method


GRAPHICAL METHOD
12
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