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OPTIMAL PRODUCTION PLAN FOR A CONFECTIONERY FACTORY USING THE SIMPLEX METHOD

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Abstract :Simplex method – linear programming issues effective solution for used strong is an algorithm . Simplex schedule using iterative calculations done increased , optimal solution This is found in method resources distribution , production release planning and logistics in the fields wide is used . This in my article confectionery factory from resources effective use and maximum benefit to take issue linear programming and simplex method using analysis as I'm leaving .

Key words : Simplex method , linear programming , optimal plan , goal function , constraint conditions , pivot element , simplex table , production release optimization , resources distribution , maximum profit , mathematics modeling , linear equations , organization efficiency , economic optimization , product working production , confectionery factory , costs reduction , mathematics programming , executable iterations , business planning .

Introduction. Processes research and optimal management – decision acceptance to do and systems to optimize scientific fields oriented .

1-Process research resources effective distribution for mathematician models , linear programming , games theory and networks optimization such as from methods uses .

2- Optimal management systems the most good management strategies determination with He is engaged in his work . main methods Pontryagin's Maximum principle and Bellman's dynamic programming .

Literature analysis

Confectionery optimal factory operation release plan according to literature analysis working release processes optimization , resources effective distribution and profit maximum to the level to deliver according to various methods to determine help gives . L. Kantorovich's " Mathematical programming and economic analysis " (1959) working release optimal plan in processes to compose and resources distribution methods statement G. Dantzig " Linear programming and his/her in the book " Applications " (1963) simplex method and make it real release to the conditions application issues covered . R. Dorfman, P. Samuelson and R. Solow " Linear programming and economic analysis " (1958) optimal planning , constraints and goal function based on decision acceptance to do discussion IG Bashmakov's "Optimal production " release systems " (2005) modern working release processes to optimize related theoretical and practical approaches showing Also , GN

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Nemchinov 's " Linear economic models " (1972) book economic in systems linear programming and analysis methods to use dedicated .

Research methodology

This research confectionery optimal factory operation release plan to compose according to linear programming methods to apply Research methodology empirical and theoretical analysis own inside Research during literature analysis optimal performance through release plan formation according to there is scientific sources is studied . Various mathematician modeling methods , including simplex method , graphic method and dual method using working release processes optimization opportunities analysis Comparative analysis through various economic models compared and their confectionery products working release to the process compatibility is determined . In this working release resources limited , product types benefit level and demand conditions into account is obtained . Experimental analysis and theoretical basically of the optimal plan formulated to practice implementation to be completed to study aimed at to be , to work release size increase and expenses reduce according to recommendations working Qualitative analysis methodological aspects , work release process conditions and the results quality in terms of to evaluate is based on . Research methodology working release plan thorough planning , resources effective distribution and maximum benefit to take for scientific approaches to determine These methods are aimed at using working release process further improvement and economic efficiency increase possible .

Analyses and results

Simplex method general if the borders equations and goal of functions equations canonical to look has if not optimization linear issues solution for is used . In this case equations system 's appearance as follows .

$$
\begin{aligned}
a_{11} x_1 + a_{12} x_2 + \ldots + a_{1n} x_n &= b_1 \\
a_{21} x_1 + a_{22} x_2 + \ldots + a_{2n} x_n &= b_2 \\
a_{m1} x_1 + a_{m2} x_2 + \ldots + a_{mn} x_n &= b_m \\
c_1 x_1 + c_2 x_2 + \ldots + c_n x_n - z &= 0
\end{aligned}
\qquad (1)
$$

Simplex (method) in 2 steps is divided .

Stage 1 - Delimiter equations and goal functions canonical to look to bring

Stage 2 - Optimization of the objective function obtained as a result of stage 1 using the simplex algorithm .

Step 1 we build .

Artificial in stage 1 changes input way with , such as variables all to equations are entered , equations to the system canonical appearance is given . Basis in character variables was equations in the system and goal in functions uncommon variables and has a coefficient of 1 was coefficients , from this exception . In addition, the system will not allow all artificial of variables from the sum consists of was additional equations is entered .

Then system of equations following to look has will be .

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$$\begin{aligned}
a_{11}\ x_1 + a_{12}\ x_2 + \ldots + a_{1n}\ x_n + x_{n+1} &= b_1 \\
a_{21}\ x_1 + a_{22}\ x_2 + \ldots + a_{2n}\ x_n + x_{n+2} &= b_2 \\
a_{m1}\ x_1 + a_{m2}\ x_2 + \ldots + a_{mn}\ x_n + x_{n+m} &= b_m \\
c_1\ x_1 + c_2\ x_2 + \ldots + c_n\ x_n - z &= 0 \\
x_{n+1} + x_{n+2} + \ldots + x_{n++m} - W &= 0
\end{aligned}$$

here:

xn_{+1}, xn_{+2}, … , x_{n+m} - artificial variables ;

$W = x_{n+1} + x_{n+2} + \ldots + x_{n+m}$ - their collection

All sizes non-negative to be need .

To do this, if necessary, add the left -hand side of the equation of variables gestures change must be . x_{n+1}, x_{n+2}, … , x_{n+m} variables last entered into the equation (W) for harvest was system solution canonical to look has not . They disappearance for - last to the equation the first m equation will be added and the sum last from the equation is subtracted . This results in the following system of equations.

$$\begin{aligned}
a_{11}\ x_1 + a_{12}\ x_2 + \ldots + a_{1n}\ x_n + x_{n+1} &= b_1 \\
a_{21}\ x_1 + a_{22}\ x_2 + \ldots + a_{2n}\ x_n + x_{n+2} &= b_2 \\
a_{m1}\ x_1 + a_{m2}\ x_2 + \ldots + a_{mn}\ x_n + x_{n+m} &= b_m \\
c_1\ x_1 + c_2\ x_2 + \ldots + c_n\ x_n - z &= 0
\end{aligned}$$

$$-\sum_{i=1}^{m} a_{i1}\ x_1 + -\sum_{i=1}^{m} a_{i2}\ x_2 + \ldots + -\sum_{i=1}^{m} a_{mn}\ x_n - W = -\sum_{i=1}^{m} b_i$$

$d_i = \sum_{i=1}^{m} a_{ij}$ and $W_0 = \sum_{i=1}^{m} b_i$ designation we enter .

In that case, the final system of equations for the start of the 1st stage of the Simplex method is:

$$\begin{aligned}
a_{11}\ x_1 + a_{12}\ x_2 + \ldots + a_{1n}\ x_n + x_{n+1} &= b_1 \\
a_{21}\ x_1 + a_{22}\ x_2 + \ldots + a_{2n}\ x_n + x_{n+2} &= b_2 \\
a_{m1}\ x_1 + a_{m2}\ x_2 + \ldots + a_{mn}\ x_n + x_{n+m} &= b_m \\
c_1\ x_1 + c_2\ x_2 + \ldots + c_n\ x_n - z &= 0
\end{aligned}$$

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$d_1 x_1 + d_2 x_2 + \ldots + d_n x_n - W = - W_0$

the simplex method , the function W corresponding to z is minimized using the usual simplex algorithm . The purpose of this minimization is as follows:

1) d_j -2 values is found if all sizes negative If W is minimize possible not , if W>0 , the path placed solution possibility no .

If the sizes some $d_j<0$ if so , of the unknown $d_s=\min(d_j)d_s<0$ condition according to to the base incoming S - index is selected .

2) Then from the base $b_r / a_{rs}=\min(b_i / a_{is})a_{is}>0$ condition according to from the base The index of the unknown IV to be extracted is found.

3) 2nd system all equations is changed . In this d_j and W_0 those of change additional functions service It turns out : for all columns except r , $d_j=d_j-d_s a_{rj}/a_{rs}$, for column r , $d_r^* =-d_s/a_{rs}$ $W_0=W_0+ds\, b_r/a_{rs}$

Then 13 points all sizes non-negative unless until repeated .

4) W is defined , if W=0 , then it is clear that all artificial variables 0 g a equals . Then equations (2) from the system last equation and all artificial variables The system is rewritten with (2) lost . The result made system canonical to look has If W<0 , the solution is no .

Stage 2 obtained in Stage 1 The system is optimized using the algorithm.

Below simplex method structural structure scheme shown :

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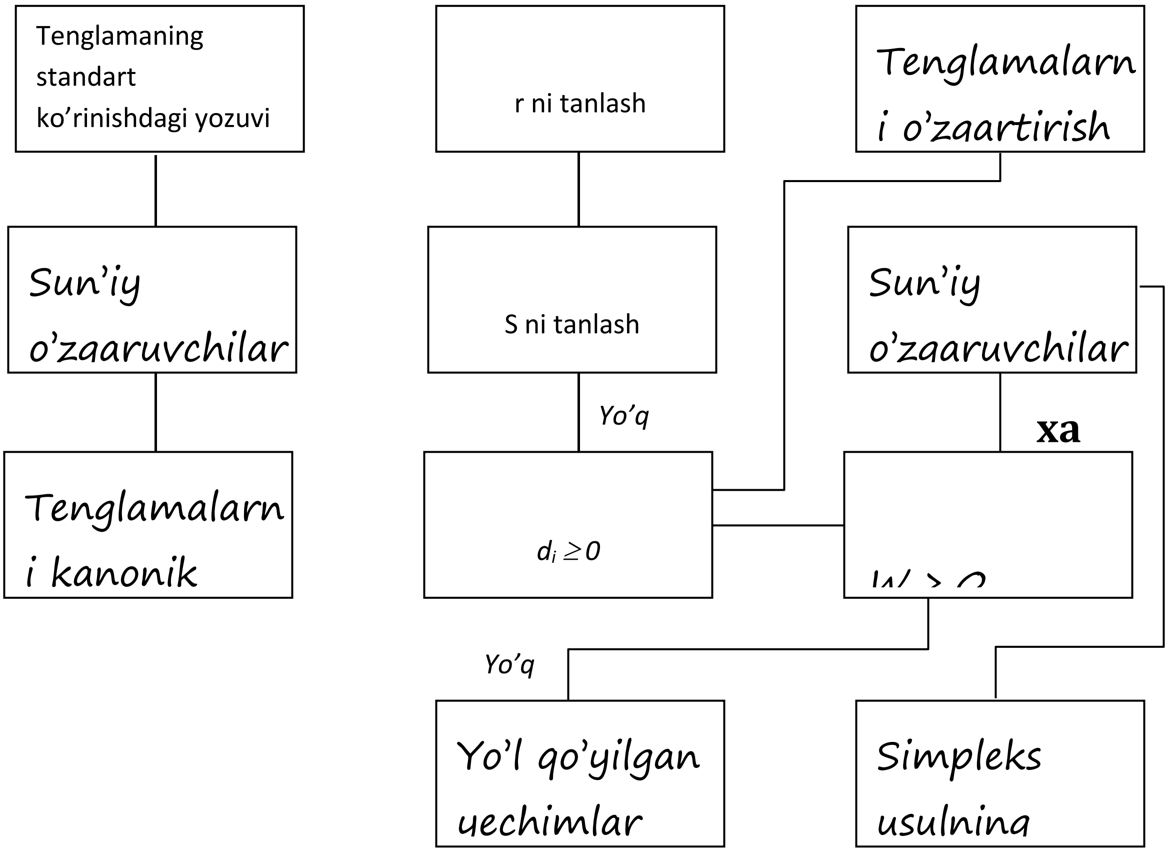

Issue: Confectionery optimal production plan of the factory

A confectionery factory produces 4 different products - Cake (A), Pie (B), Biscuits (C), Sweet Bread (D) . Production release flour , sugar , butter and worker power with limited . The enterprise purpose maximum benefit to take .

Given information :

Product	Profit (mln) soum)	Flour requirement (kg)	Sugar demand (kg)	Butter demand (kg)	Labor force (hours)
Cake (A)	8	3	2	2	4
Cake (B)	6	2	3	1	3
Cookies (C)	5	4	1	2	2
Sweet bread (D)	7	5	2	3	5

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The enterprise's resources are limited as follows:

1. Flour: not more than 40 kg.
2. Sugar: not more than 25 kg.
3. Butter : not more than 20 kg.
4. Worker Power : not more than 50 hours .

Linear programming model :

Variables :

x_1-Cake maker release number

x_2- Cake working release number

x_3- Cookies working release number

x_4-Make sweet bread release number

1. Formulation of the issue

$$\max Z=8x_1+6x_2+5x_3+7x_4$$

Limitations :

$$3x_1+2x_2+4x_3+5x_4=40$$

$$2x_1+3x_2+x_3+2x_4=25$$

$$2x_1+x_2+2x_3+3x_4=20$$

$$4x_1+3x_2+2x_3+5x_4=50$$

Elementary Simplex table

Bazis	x_1	x_2	x_3	x_4	Right side
x_5	3	2	4	5	40
x_6	2	3	1	2	25
x_7	2	1	2	3	20
x_8	4	3	2	5	50

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Z	-8	-6	-5	-7	0

←

↑

Pivot column choice module according to best **big negative value selectively we will get** x_1 **(** most big negative value -8) **.**

Free numbers support column to the elements let's be and the most the youngest we will get

Pivot element = **2** (row 3, column 1)

Now and simplex table to compose we will get

Score doer column and lines place will be replaced .

Simplex table	x_7	x_2	x_3	x_4	Right side	
x_5	0	-1	0	2.5	1 0	
x_6	0	2	- 1	0	5	←
x_1	1	0.5	1	1.5	10	
x_8	0	1	0	-1	10	
Z	0	-2	3	5	80	

↑

Pivot column choice module according to best **big negative value selectively we will get i.e. the only negative the value was -2 for learn we will get**

Free numbers support column to the elements let's be and the most the youngest we will get

Pivot element = **2** (row 2, column 2)

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Score doer column and lines place will be replaced .

Simplex table	x_7	x_6	x_3	x_4	Right side
x_5	0	0	-1.5	-2.5	12.5
x_2	0	1	-0.5	0	2. 5
x_1	1	0	1.25	1.5	8.75
x_8	0	0	0.5	-1	7.5
Z	0	0	2	5	85

Pivot column my choice for the most big negative value there is This is not the optimal solution . that indicates

$$x_1 = 8.75 \quad x_2 = 2.5 \quad x_3 = 0 \quad x_4 = 0$$

$$Z_{max} = 85$$

That is, optimal performance release plan

x_1-Cake maker release quantity - 8.75 pieces

x_2- Cake working release quantity -2.5 pieces

x_3- Cookies working release quantity -0 pieces

x_4-Make sweet bread release quantity – 0 pieces

Maximum profit -85 million soums

Confectionery factory for Simplex method optimal performance through release plan

General Conclusion

This issue is linear. programming from the methods one was Simplex method through confectionery factory working release plan to optimize Factory cake (x_1), pastry (x_2), cookies (x_3) and sweet bread (x_4) such as products working produces . release resources limited divided into flour , sugar , butter and worker from the strength consists of .

Each product how much benefit to bring and him/her working release for how much resource requirement indicated . Purpose profit maximum to do happened for goal function written . Resources limitedness restriction equations through expressed . Equations additional variables with strengthened , initial table was formed . Each pivot

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element in step selected , table transformation done . Maximum benefit to take for which from products how much working release need clearly was given .

Simplex method from resources the most effective use and maximum profit to take the optimal strategy for to find help This method not only confectionery factory , maybe logistics , production release and business planning such as also used in other fields possible . In real business such optimization methods expenses reduce and working release efficiency to increase service does .

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