

Use of the Simplex Algorithm and Linear Systems for Theatrical Purposes

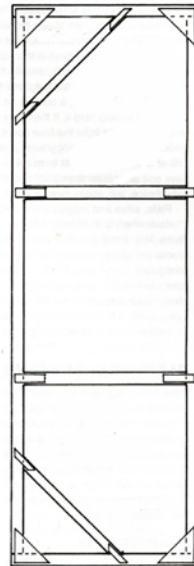
By Royal Marty

Problem

- Much time is spent trying to anticipate the costs materials for shows, this process usually involves a person counting the amount of materials would be used in each piece of scenery.
- This process is often time consuming and mundane.
- Because a person is counting the amount of lumber to be used in each piece of scenery the accuracy is dependent on the person performing the count.
- The budgeting process often requires the person performing the operation to be skilled, thus pulling them away from other tasks that need to be executed.

What is a Flat?

- A Flat is a wall that is constructed for theatrical purposes only.
- There are different styles of flats, constructed with different materials depending on theater and geographical location.
- Below is an example of one style of flat used in theater.



Why Should There Be a System for Budgeting Flats?

- Save an abundance of time, by allowing the user to input information as opposed to counting the information, leading to miscalculations.
- Anybody can input the information into the system, as opposed to a trained person manually calculating the information.
- System can be adapted for many different applications in the theater industry, such as platform construction and door construction.

What is the Simplex Algorithm?

- The Simplex Method is the earliest solution algorithm for solving Linear Programming problems. It is an efficient system of solving numerous Linear Programs in one system.
- The simplex algorithm is used as part of the simplex method to solve linear programming problems. The algorithm is applied to a linear programming problem that is in canonical form.
 - A mathematical object is said to be canonical if it arises in a natural way without introducing any additional objects.
- The simplex algorithm takes the equations of the constraints and solves them simultaneously to find the nodes. It then works out whether that node maximizes the objective function.

History Behind The Simplex Algorithm

- Created by George Dantzig in 1947. Dantzig created the algorithm while searching for methods for solving optimization problems.
- When Dantzig created the algorithm he used a primitive version of a computer to solve the system.
- Since Dantzig's creation many mathematicians have adapted the algorithm for their needs.
- The Simplex Method is modeled after the Simplex Algorithm, as it is a numerical method for optimizing many-dimensional unconstrained problems

Using the Simplex Algorithm To Budget Flats

- A problem was devised of how trying to compare the cost of flats through different construction techniques. The different techniques include different materials and different styles.
- Through the Simplex Algorithm the problem is laid out in table form (also called tableau).
- The table is laid out with a column for each material, inside the column the material amount is already accounted for.

	1 x 4	¼" Lauan	¼" Plywood	Muslin	Other Materials Needed	Amount Budgeted
Standard- ¼" Lauan	16.8	13.6			3.43	200
Hollywood- ¼" Lauan	16.8	13.6				200
Standard- Muslin Covered	16.8			12.2	6.43	200
Standard- ¼" Plywood	16.8		27.5		3.43	200
Hollywood- ¼" Plywood	16.8		27.5			200

Using the Simplex Algorithm To Budget Flats, continued

- Once the tableau is laid out the user can begin formulating the equations, another tableau is then constructed to help with the creation of the equations.

<i>v</i>	<i>w</i>	<i>x</i>	<i>y</i>	<i>z</i>	-1	
16.8	13.6			3.43	200	= - <i>p</i>
16.8	13.6				200	= - <i>q</i>
16.8			12.2	6.43	200	= - <i>r</i>
16.8		27.5		3.43	200	= - <i>s</i>
16.8		27.5			200	= <i>f</i>

- Once this tableau is constructed the creation of the equation becomes simple as the formulas are created in a linear fashion.

Using the Simplex Algorithm To Budget Flats, continued

<i>v</i>	<i>w</i>	<i>x</i>	<i>y</i>	<i>z</i>	-1	
16.8	13.6			3.43	200	= - <i>p</i>
16.8	13.6				200	= - <i>q</i>
16.8			12.2	6.43	200	= - <i>r</i>
16.8		27.5		3.43	200	= - <i>s</i>
16.8		27.5			200	= <i>f</i>

- The first equation is:

$$16.8v + 13.6w + 3.43z - 200 = -p$$

- After simplification the equation then becomes:

$$16.8v + 13.6w + 3.43z + p = 200$$

- After the equations are simplified to this process, the user can then solve all of the equations together algebraically.

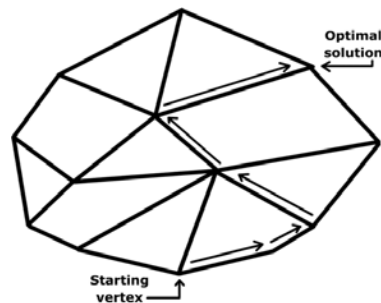
How to Display Data

- The data computed from the simplex algorithm can be displayed in a number of different techniques. Such as:

- Tableau

P	x	y	s	t	k	Eqn
1	-2	-1	0	0	0	①
0	1	2	1	0	6	②
0	1	1	0	1	5	③

- Graph
- Polytope



Other Similar Uses

- Similar Uses Include:
 - Construction Budgeting/ Optimization
 - Manufacturing
 - Dieting- Optimizing Calories
 - Advertising Optimization
 - Shipping Optimization
 - Chemistry

Sources

Questions?