

Module 08 – Scheduling Problem

Exploratory Data Analysis

In this section, you should perform some data analysis on the data provided to you. Please format your findings in a visually pleasing way and please be sure to include these cuts:

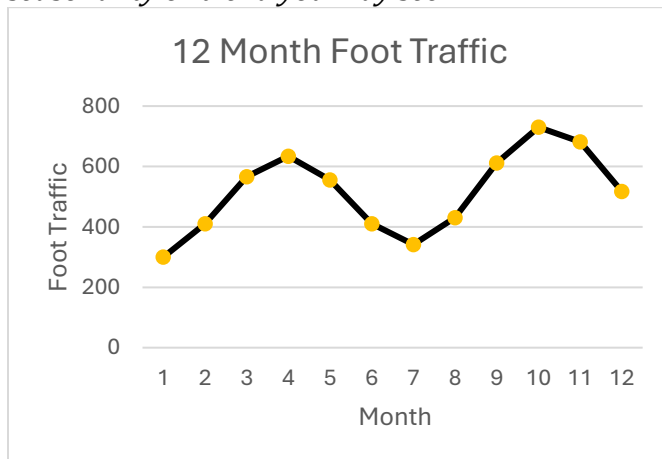
- *Make a table (similar to the textbook example) showing the temporary agency data*

Agency	Months off	Monthly Salary
Fudge & Frolic	Mar-Dec	7659
Bonbon Boulevard	Jul-Mar	8483
Snickerdoodle Street	Apr-Jan	6738
Tootie Fruity Trading Co.	Oct-Jul	7944
The Gummy Gazette	Oct-Jun	9382
The Jelly Jubilee	Jan-Sep	9181

- *Run summary statistics on the sample of Full-Time employee salaries. Record the Mean to use in our model*

Full-Time	Month	Year
Mean	6449.002	77388.02
Max	8741.71	104900.5
Min	4313.47	51761.64

- *Make a line graph showing foot traffic over the next 12 months. Call out any seasonality or trend you may see.*



Model Formulation

Write the formulation of the model into here prior to implementing it in your Excel model. Be explicit with the definition of the decision variables, objective function, and constraints.

$$\text{Min} = 77388.02X_1 + 15318X_2 + 25449X_3 + 13476X_4 + 15888X_5 + 28146X_6 + 27543X_7$$

$$\begin{aligned} 1X_1 + 1X_2 + 0X_3 + 0X_4 + 0X_5 + 0X_6 + 0X_7 &\geq 300 \text{ } \{ \text{January} \\ 1X_1 + 1X_2 + 0X_3 + 1X_4 + 0X_5 + 0X_6 + 0X_7 &\geq 410 \text{ } \{ \text{February} \\ 1X_1 + 0X_2 + 0X_3 + 1X_4 + 0X_5 + 0X_6 + 0X_7 &\geq 566 \text{ } \{ \text{March} \\ 1X_1 + 0X_2 + 1X_3 + 0X_4 + 0X_5 + 0X_6 + 0X_7 &\geq 634 \text{ } \{ \text{April} \\ 1X_1 + 0X_2 + 1X_3 + 0X_4 + 0X_5 + 0X_6 + 0X_7 &\geq 556 \text{ } \{ \text{May} \\ 1X_1 + 0X_2 + 1X_3 + 0X_4 + 0X_5 + 0X_6 + 0X_7 &\geq 410 \text{ } \{ \text{June} \\ 1X_1 + 0X_2 + 0X_3 + 0X_4 + 0X_5 + 1X_6 + 0X_7 &\geq 342 \text{ } \{ \text{July} \\ 1X_1 + 0X_2 + 0X_3 + 0X_4 + 1X_5 + 1X_6 + 0X_7 &\geq 431 \text{ } \{ \text{August} \\ 1X_1 + 0X_2 + 0X_3 + 0X_4 + 1X_5 + 1X_6 + 0X_7 &\geq 612 \text{ } \{ \text{September} \\ 1X_1 + 0X_2 + 0X_3 + 0X_4 + 0X_5 + 0X_6 + 1X_7 &\geq 730 \text{ } \{ \text{October} \\ 1X_1 + 0X_2 + 0X_3 + 0X_4 + 0X_5 + 0X_6 + 1X_7 &\geq 682 \text{ } \{ \text{November} \\ 1X_1 + 0X_2 + 0X_3 + 0X_4 + 0X_5 + 0X_6 + 1X_7 &\geq 518 \text{ } \{ \text{December} \end{aligned}$$

Model Optimized for Min Costs to Cover Store Foot Traffic

Implement your formulation into Excel and be sure to make it neat. This section should include:

- A screenshot of your optimized final model (formatted nicely, of course)
- A text explanation of what your model is recommending

Workers	January	February	March	April	May	June	July	August	September	October	November	December	Workers Schedule	Full & Temp
Fulltime	1	1	1	1	1	1	1	1	1	1	1	1	566	\$ 77,388.02
Fudge & Frolic	1	1	0	0	0	0	0	0	0	0	0	0	0	\$ 15,318.00
Bonbon Boulevard	0	0	0	1	1	1	0	0	0	0	0	0	68	\$ 25,449.00
Snickerdoodle Street	0	1	1	0	0	0	0	0	0	0	0	0	0	\$ 13,476.00
Tootie Fruity Trading Co.	0	0	0	0	0	0	0	1	1	0	0	0	46	\$ 15,888.00
The Gummy Gazette	0	0	0	0	0	0	1	1	1	0	0	0	0	\$ 28,146.00
The Jelly Jubilee	0	0	0	0	0	0	0	0	0	1	1	1	164	\$ 27,543.00
Available	566	566	566	634	634	634	566	612	612	730	730	730		
Required	300	410	566	634	556	410	342	431	612	730	682	518	Total	\$ 50,780,052.74

The model recommends Bonbon Blvd., Tootie Fruity Trading Co., and The Jelly Jubilee for temp workers. Full time workers will take up 67.06% of the schedule, with the temp agencies filling the remaining 32.94%.

Model with Stipulation

Please copy the tab of your original model before continuing with the next part to avoid messing up your original solution.

Please do both of the following:

1. Unfortunately, leadership wishes to have a reduction in workforce. While the monthly salary for full time employees is cheaper than temporary workers, there are other costs associated with full time employees that they wish to cut. Add a constraint to your model that takes your first model's recommended number of full-time employees and

constrains it to be only 80% of it. Add a text explanation of the change in the optimal value as well as any other changes noticed between the models.

Workers	January	February	March	April	May	June	July	August	September	October	November	December	Workers Schedule	Full & Temp	
Fulltime	1	1	1	1	1	1	1	1	1	1	1	1	452	\$ 77,388.02	\$ 452.80
Fudge & Frolic	1	1	0	0	0	0	0	0	0	0	0	0	0	\$ 15,318.00	
Bonbon Boulevard	0	0	0	1	1	1	0	0	0	0	0	0	182	\$ 25,449.00	
Snickerdoodle Street	0	1	1	0	0	0	0	0	0	0	0	0	114	\$ 13,476.00	
Tootie Fruity Trading Co	0	0	0	0	0	0	0	1	1	0	0	0	160	\$ 15,888.00	
The Gummy Gazette	0	0	0	0	0	0	1	1	1	0	0	0	0	\$ 28,146.00	
The Jelly Jubilee	0	0	0	0	0	0	0	0	0	1	1	1	278	\$ 27,543.00	
Available	452	566	566	634	634	634	452	612	612	730	730	730			
Required	300	410	566	634	556	410	342	431	612	730	682	518		Total	\$ 51,346,402.17

The model now suggests the use of Bonbon Boulevard in addition to the temp agencies already contracted. It also raises the total by \$566,349.44 because the temp agencies come at a higher premium than the Full-Time Workers.

- Alternatively, leadership would like to see what the average monthly salary for an employee would need to be to cut out all temporary workers as they believe that will help negate excess spending. Convert your model (or do the math out yourself) to figure out what monthly salary you would need to pay your full-time employees to only have full-time workers at the same optimal cost as the original model.

\$6,449.00	\$ 5,796.81
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- Considering trends and seasonality of this business, what would you recommend leadership to do? Feel free to play with the model and recommend something else. \ They would need to drop the monthly salary by roughly 750 dollars, which would affect morale negatively, but it would increase team cohesion because it would be the same people the whole year and not a revolving door of employees. This would probably increase efficiency as well because there would be no learning curve for new employees.