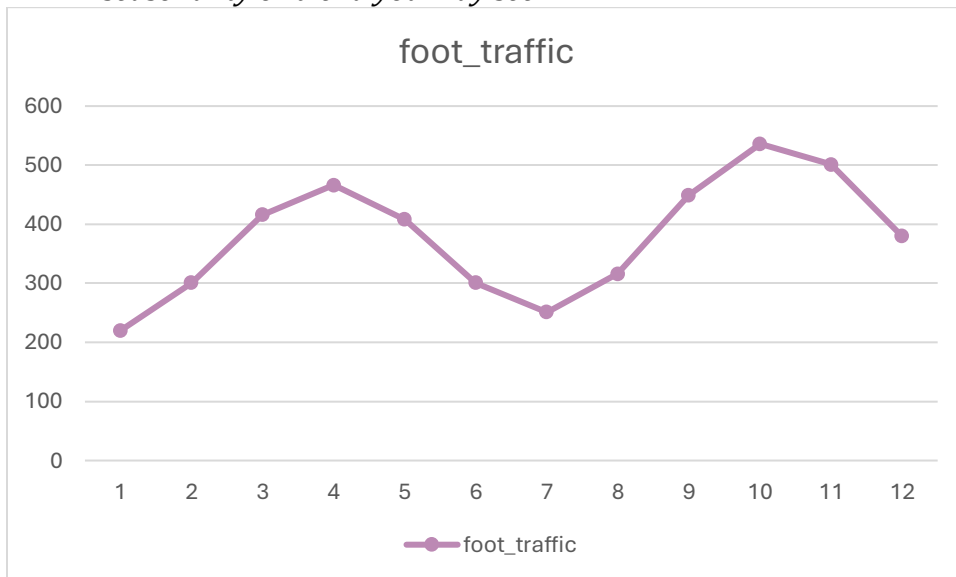


# Module 08 – Scheduling Problem

## 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*
- *Run summary statistics on the sample of Full-Time employee salaries. Record the Mean to use in our model*
- *Make a line graph showing foot traffic over the next 12 months. Call out any seasonality or trend you may see.*



Shift	Days Off	Wage
WigglePop Wonders	1-5,9-12	\$ 23,862.00
The Jellybean Treasury	(1-9)	\$ 22,503.00
PopRocks & PixieDust	1-3,7-12	\$ 19,875.00
Gumdrops & Giggles	1-7,10-12	\$ 16,292.00
Cocoa Quirk	(4-12)	\$ 21,303.00

## 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.

**Minimize  $Z = 680X_1 + 705X_2 + 705X_3 + 705X_4 + 705X_5 + 680X_6 + 655X_7$**

**Sunday:**  $X_2 + X_3 + X_4 + X_5 + X_7 \geq 18$

**Monday:**  $X_1 + X_3 + X_4 + X_5 + X_6 + X_7 \geq 27$

**Tuesday:**  $X_1 + X_2 + X_4 + X_5 + X_6 + X_7 \geq 22$

**Wednesday:**  $X_1 + X_2 + X_3 + X_5 + X_6 + X_7 \geq 26$

**Thursday:**  $X_1 + X_2 + X_3 + X_4 + X_6 + X_7 \geq 25$

**Friday:**  $X_1 + X_2 + X_3 + X_4 + X_5 + X_7 \geq 21$

**Saturday:**  $X_2 + X_3 + X_4 + X_5 + X_6 \geq 19X$

## 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

Shift	Days On = 1, Days Off = 0												Workers Schedule	Wages per Worker			
	1	2	3	4	5	6	7	8	9	10	11	12					
WigglePop	0	0	0	0	0	1	1	1	0	0	0	0	0	\$ 23,862.00	3	\$	7,954.00
The Jellybe	0	0	0	0	0	0	0	0	0	1	1	1	1	\$ 22,503.00	3	\$	7,501.00
PopRocks	0	0	0	1	1	1	0	0	0	0	0	0	0	\$ 19,875.00	3	\$	6,625.00
Gumdrops	0	0	0	0	0	0	0	1	1	0	0	0	0	\$ 16,292.00	2	\$	8,146.00
Cocoa Qui	1	1	1	0	0	0	0	0	0	0	0	0	0	\$ 21,303.00	3	\$	7,101.00
Full Time	1	1	1	1	1	1	1	1	1	1	1	1	1	\$ 72,360.00	416		
Available	416	416	416	466	466	466	416	446	446	536	536	536					
Required	220	301	416	466	408	301	251	316	446	536	501	380	Total ->	\$ 34,284,630			

## 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.

Leadership wants to lower the number of full-time workers to 80% of what it had at first. This means instead of 416 full-time employees, there will only be 333. To make up for it, they'll need to hire more temporary workers to get the job done. This will probably cost more overall because temporary workers usually get paid more. Even though it gives the company more flexibility, it might make schedules less consistent, and things might not run as smoothly.

2. *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.*

In the second scenario, leadership is thinking about only using full-time workers but keeping the same total cost. If they replace the 202 temporary workers with full-time ones, the total number of employees would go up to 618. To stay within the original budget of \$34,284,630, the monthly pay for each full-time worker would need to drop to about \$55,480.42. This way, they could stop using temporary workers without spending more money.

A hybrid strategy makes the most sense, especially since demand goes up a lot on days 10 to 12. Keeping 333 full-time workers and only bringing in temporary help during busy times would help balance cost and flexibility. To make this work, full-time employees need to be scheduled smartly so they're working during the busiest days.

3. *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.*

Another idea for the company is to use seasonal or part time contracts. This would give them more flexibility without having to pay full-time wages all year. Also, teaching employees how to do more than one job can help lower the total number of workers needed and make sure there's enough coverage during the busiest times.