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	beginning_month_of_service	duration_of_service	monthly_salary
Crackleberry Confections	1	3	7904
Puff & Pop Confectionery	7	3	8124
Treat Parade	7	3	6129
Sticky Fingers & Co.	3	3	7964
The Sweetsmith Society	10	3	7590
Truffle Shuffle	4	3	6086

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

Mean=$5,611

- *Make a line graph showing foot traffic over the next 12 months. Call out any seasonality or trend you may see.*
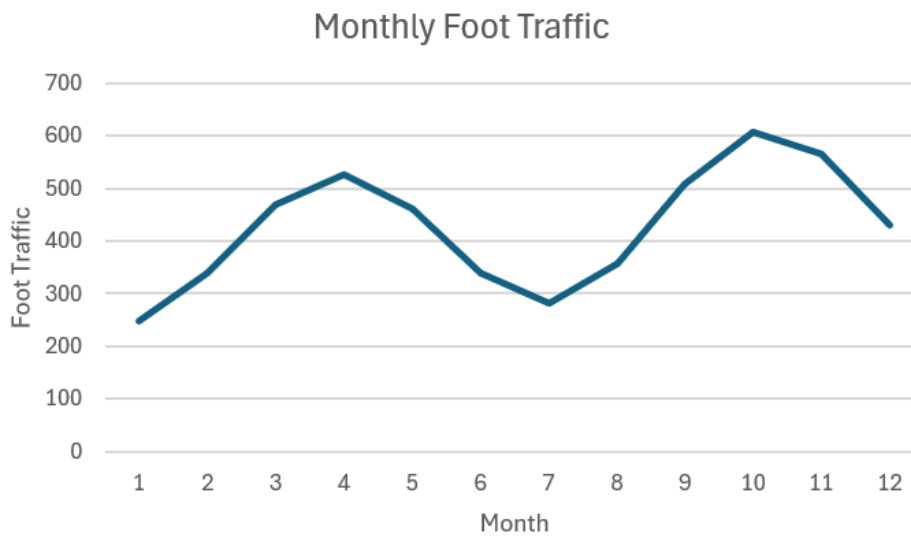
There is a high amount of foot traffic during April and at the end of the year with lows during the summer and the beginning of the year.

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.

Decision variables:
X_1= number of workers assigned to the shift at crackleberry confections
X_2= number of workers assigned to the shift at puff & pop confectionery
X_3= number of workers assigned to the shift at treat parade
X_4= number of workers assigned to the shift at sticky fingers & co.
X_5= number of workers assigned to the shift at the sweetsmith society
X_6= number of workers assigned to the shift at truffle shuffle
X_7= number of workers assigned to the shift at full time

Objective function: MIN = 23,712X_1 + 24,372X_2 + 18,387X_3 + 23,892X_4 + 22,770X_5 + 18,258X_6 + 67,332X_7

Constraints:
1X_1+0X_2+0X_3+0X_4+0X_5+0X_6_1X_7>=249
1X_1+0X_2+0X_3+0X_4+0X_5+0X_6_1X_7>=340
1X_1+0X_2+0X_3+1X_4+0X_5+0X_6_1X_7>=470
0X_1+0X_2+0X_3+1X_4+0X_5+1X_6_1X_7>=526
0X_1+0X_2+0X_3+1X_4+0X_5+1X_6_1X_7>=461
0X_1+0X_2+0X_3+0X_4+0X_5+1X_6_1X_7>=340
0X_1+1X_2+1X_3+0X_4+0X_5+0X_6_1X_7>=283
0X_1+1X_2+1X_3+0X_4+0X_5+0X_6_1X_7>=357
0X_1+1X_2+1X_3+0X_4+0X_5+0X_6_1X_7>=508
0X_1+0X_2+0X_3+0X_4+1X_5+0X_6_1X_7>=606
0X_1+0X_2+0X_3+0X_4+1X_5+0X_6_1X_7>=566
0X_1+0X_2+0X_3+0X_4+1X_5+0X_6_1X_7>=430

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	1	2	3	4	5	6	7	8	9	10	11	12	Workers Schedule	Wages per Worker
Crackleberry Confections	1	1	1	0	0	0	0	0	0	0	0	0	0	$ 23,712
Puff & Pop Confectionery	0	0	0	0	0	0	1	1	1	0	0	0	0	$ 24,372
Treat Parade	0	0	0	0	0	0	1	1	1	0	0	0	168	$ 18,387
Sticky Fingers & Co.	0	0	1	1	1	0	0	0	0	0	0	0	130	$ 23,892
The Sweetsmith Society	0	0	0	0	0	0	0	0	0	1	1	1	266	$ 22,770
Truffle Shuffle	0	0	0	1	1	1	0	0	0	0	0	0	56	$ 18,258
Full Time	1	1	1	1	1	1	1	1	1	1	1	1	340	$ 67,332
Available	340	340	470	526	526	396	508	508	508	606	606	606		
Required	249	340	470	526	461	340	283	357	508	606	566	430	Total ->	$ 36,167,124

My model is recommending that 168 workers are scheduled at the treat parade, 130 workers at stick fingers, 256 at sweetsmith society, 56 at truffle shuffle, and 340 employees full time to minimize costs for the best foot traffic for a total of $36,167,124 in wages.

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.*

   The total cost of wages went up to $37,241,184 and the workers scheduled shifted around as well with workers now scheduled at crackleberry confections.

Shift	1	2	3	4	5	6	7	8	9	10	11	12	Workers Schedule	Wages per Worker
Crackleberry Confections	1	1	1	0	0	0	0	0	0	0	0	0	68	$ 23,712
Puff & Pop Confectionery	0	0	0	0	0	0	1	1	1	0	0	0	0	$ 24,372
Treat Parade	0	0	0	0	0	0	1	1	1	0	0	0	236	$ 18,387
Sticky Fingers & Co.	0	0	1	1	1	0	0	0	0	0	0	0	130	$ 23,892
The Sweetsmith Society	0	0	0	0	0	0	0	0	0	1	1	1	334	$ 22,770
Truffle Shuffle	0	0	0	1	1	1	0	0	0	0	0	0	124	$ 18,258
Full Time	1	1	1	1	1	1	1	1	1	1	1	1	272	$ 67,332
Available	340	340	470	526	526	396	508	508	508	606	606	606		
Required	249	340	470	526	461	340	283	357	508	606	566	430	Total ->	$ 37,241,184

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.*
   $106,374/yr per worker
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.*

I would recommend they focus on mainly Q4 with the sweetsmith society as well as fulltime workers to get the best optimization for foot traffic while spending the least.