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*

| Month | Required Workers | Available Temp Workers | Surplus/Deficit |
| --- | --- | --- | --- |
| 1 | 212 | 366 | +154 |
| 2 | 290 | 448 | +158 |
| 3 | 401 | 448 | +47 |
| 4 | 448 | 448 | 0 |
| 5 | 393 | 393 | 0 |
| 6 | 290 | 698 | +408 |
| 7 | 242 | 698 | +456 |
| 8 | 305 | 305 | 0 |
| 9 | 433 | 516 | +83 |
| 10 | 516 | 516 | 0 |
| 11 | 483 | 516 | +33 |
| 12 | 366 | 366 | 0 |

Observation: Temporary staffing appears sufficient overall, with significant surpluses in summer months (June–August), possibly anticipating peak demand or vacation periods.

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

| *Shift* | *Wages per Worker ($)* |
| --- | --- |
| *Caramel Caper* | *14,016* |
| *The Candy Cauldron* | *9,943* |
| *Tootie Fruity Trading* | *18,744* |
| *Sweetie Spell* | *19,403* |
| *The Gooey Guild* | *9,682* |
| *Bubbly Bear Co.* | *12,236* |

*Summary Statistics:*

* *Mean Salary:  
  14,016+9,943+18,744+19,403+9,682+12,2366=14,670.67\frac{14,016 + 9,943 + 18,744 + 19,403 + 9,682 + 12,236}{6} = 14,670.67614,016+9,943+18,744+19,403+9,682+12,236​=14,670.67*
* *Min Salary: 9,682*
* *Max Salary: 19,403*
* *Median Salary: 13,126 (midpoint between 12,236 and 14,016)*

*Mean Salary to Use in Model: $14,670.67*

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

*I DID IT USING VISUAL STUDIOS*

A screen shot of a graph

AI-generated content may be incorrect.

* Trend: Generally increasing foot traffic from January → October.
* Seasonality:
  + Lows: January, July
  + Highs: October, November
  + Dip in Summer: July is the lowest, which is interesting and may suggest off-peak or vacation periods.
  + Peak in Fall (Oct–Nov): Possibly due to seasonal events or holidays (e.g., Halloween, Thanksgiving prep?).

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.*

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 screenshot of a graph

  AI-generated content may be incorrect.*
* *A text explanation of what your model is recommending*

The model recommends a lean full-time workforce with flexible shift assignments and relies on temporary staffing to meet fluctuating seasonal demands. This approach minimizes wage costs while ensuring all required staffing levels are met throughout the year.

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.*

reduced full-time staff to 80% of original (0.8 × 2,028) ≈ 1,622 workers. The rest of the required demand is filled using additional temporary workers.

| Metric | Original | Reduced Workforce (80%) |
| --- | --- | --- |
| Full-Time Workers | 2,028 | 1,622 |
| Full-Time Cost | $70,051 | $56,041 |
| Temporary Worker Usage | Limited to gaps | Increased to meet deficits |
| Total Cost | $24,202,954 | $25,478,560 (estimated) |

Explanation: Cutting full-time workers by 20% increases dependence on more expensive temp labor. While direct full-time wages are lower, the overall cost increases by ~$1.3M due to higher temp usage.

1. *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.*

Target total cost=$24,202,954 Monthly Salary=24,202,954410×12≈$4,918\text{Monthly Salary} = \frac{24,202,954}{410 \times 12} ≈ \boxed{\$4,918}Monthly Salary=410×1224,202,954​≈$4,918​

Answer: You would need to pay each full-time worker approximately $4,918/month to eliminate temps and maintain the original total cost.

1. *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.*

Based on Seasonality & Cost Trade-offs:

* Peak demand occurs in October–November, with valleys in January and July
* Full-time employees are cheaper per month, but less flexible
* Temporary workers give seasonal adaptability at a premium