MOD PIZZA LABOR MODEL

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1. Project Introduction
   Problem Statement
   Improve MOD Pizza's ability to optimally schedule their employees given a specific demand

   Our project will provide MOD with the amount of labor hours needed to serve a forecasted number of entrees that balances customer wait times, employee utilization, and labor costs.

   Real Life Example
   Given the forecasted demand distribution X for Store 1 on Monday, Store 1 needs Y amount of customer facing labor hours and Z amount of non customer facing hours during Period III to optimally meet demand.

2. Current Model
   Model:
   Some functions of the current model worked on a few assumed parameters mentioned below:
   - Entree sales in a Customer Facing hour to earn one employee
   - Entree sales in a Non-Customer Facing hour to earn one employee
   - Minimum staffing of 2 employees

   The excel model graphs the required Customer Facing and Non-Customer Facing needs for employees based on the projected demand for different stores. The managers, using their experience, schedule employees using the graph generated.

   Objective:
   Update the above mentioned assumed parameters, except Minimum staffing, to optimal numbers.

3. Project Strategy
   Simulation Model → Customer Facing
   - Closing Time
   - Opening Time
   - Non-Customer Facing variable time

   Integer Programming Model → Optimal Scheduling Model

4. Customer Facing Time
   Simulation Model
   Current State:
   MOD does not have a precise number for the amount of Variable Customer Facing Hours they need.

   Objective:
   Develop a Simulation Model that can be used to find how many Customer Facing employees are needed for projected entrée sales in an hour.

   Assumptions:
   - One person does not work both sauce and point at one time.
   - The time to move between stations is factored into the utilization.

   Model:
   Pictured above are a 3D and 2D picture of the final model. The model was built using data from both our own findings and MOD's internal numbers.

   Output:

5. Non-Customer Facing Time
   Objective:
   Capture the labor time needed to do all of the non-
   customer facing related work.

   Fixed Non-Customer Facing:
   - Opening
   - Closing
   - Dishwashing (Fixed)

   Use a combination of time study of more than 6 MOD locations and surveys with 15 responses to find the average fix non-customer facing time

   Dishwashing 17%
   Closing 50%

   Variable Non-Customer Facing:
   - Food Preparation Time
   - Box Folding Time
   - Dishwashing (Variable)

   Use food usage frequency, percentage of food that go to waste, average usage, preparation time for each can of the food, % of boxes needed for different amount of entree, dishwasher counts base on entree to create an Adjustable Excel model that let the users change constraints specifically for their location and needs.

6. Integer Programming
   Objective
   The goal of the integer program was to provide the store managers for each MOD location a recommendation for how many employees to staff for a 2 hour period given demand of employees in 15 minute intervals.

   Assumptions:
   - We assumed that the optimal shift length was 2 hours
   - We assume that the earliest opening time was 8:00am and the latest closing time was at midnight
   - We assumed that the shift lengths all had to be the same length
   - We assumed that all employees have the same level of skills

   Model
   Parameters:
   param c1;  # cost of overstaffing
   param c2;  # cost of understaffing
   param s;  # number of 15 min intervals
   param w;  # number of 2 hour shifts
   param d[i, j];  # cost for employees in 15 minutes interval i in shift j, i = 1,…s, j = 1,…w

   Variables:
   var x[i, j] ≥ 0 integer;  # number of employees for shift i, j = 1, w
   var y[i, j] = { 1, if x[i, j] ≥ d[i, j] , 0, if x[i, j] ≤ d[i, j] } , i = 1,…s, j = 1,…w;
   # 1 if overstaffing for 15 minutes interval i in shift j
   # 0 if understaffing for 15 minutes interval i in shift j

   Objective Function:
   minimize \( \sum \frac{d[i, j]}{12} ) x[i, j] \times ((1 - y[i, j]) \times c1 + c2 \times y[i, j]) \times i = 1, w

   Constraints:
   subject to x[i] ≥ 2, i = 1,…w
   # minimum staffing of 2 employees for shift i

7. Impact
   All of this work was compiled to present all of the goals of our project strategy to MOD. It should help them staff more effectively given projected entrée count and have a much greater understanding of how long their processes take.

8. Acknowledgement
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