OPTIMIZATION OF FOOD WASTAGE IN RESTAURANTS

Group 4

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Introduction

- Food wastage at large events is a growing concern.
- Over-preparation leads to unnecessary cost and environmental harm.
- This project addresses the challenge of minimizing food wastage at events by determining optimal food preparation quantities using Python-based optimization techniques.
- A linear programming model is used to minimize total food waste while ensuring that the minimum food requirement per guest is met and that the budget constraints per food type are not exceeded.
- Additionally, the project includes a sensitivity analysis module, which simulates different scenarios by varying:
    - Budget limits,
    - Guest attendance rates, and
    - Wastage rates.

Motivation

Food wastage is a pressing global issue with significant economic, environmental, and social implications. In the context of restaurants and large-scale events, over-preparation of food is a common practice intended to avoid shortages but often results in substantial waste. This not only leads to financial losses but also contributes to unnecessary resource consumption and environmental degradation.

Event planners and restaurant managers face challenges in accurately estimating food requirements due to fluctuating guest attendance, varying preferences, and strict budget constraints. Hence, there is a strong need for a data-driven, optimized approach to food preparation that ensures guest satisfaction while minimizing waste.

This project is motivated by the opportunity to leverage linear programming and sensitivity analysis to build a robust model that aids in making informed decisions about food quantities, ensuring efficiency, sustainability, and cost-effectiveness.

Problem Statement

How can restaurants and event planners minimize food wastage while ensuring that the food requirements of all guests are met within budget constraints?

Approach

To tackle this, the project develops a Python-based linear programming optimization model that:

- Minimizes total food wastage.
- Ensures a minimum quantity of food per guest.
- Adheres to budget limitations for each food type and event.
- Evaluates the impact of varying budget, attendance rates, and wastage rates through sensitivity analysis.

Optimization Process

Decision Variable:

- $i \in I$: Set of food items
- $j \in J$: Set of event types
- x_{ij}: Quantity of food item i to prepare for event type j
- w_{ij}: Wastage per unit of food i at event j
- c_{ij}: Cost per unit of food i at event j
- G_j: Registered guests for event j
- N_j: Planned guests at event j
- $b_{ij} = N_j \times c_{ij}$: Budget allocated for food i at event j
- $m_{ij} = 0.5 \times G_j$: Minimum quantity of food i for event j

Objective Function: Minimize the total food wastage.

$$\text{minimize} \sum w_{ij} \times x_{ij} \quad \text{over all } i \in I, j \in J$$

Constraints

- Budget constraint: Total cost of food must not exceed the budget.
- Budget Constraint (per event): $\sum p_{ij} \times x_{ij} \leq \sum N_j \times p_{ij} \quad \forall j \in J$
- Food quantity constraint: Each guest must receive at least 0.5 units of food.
- Minimum Food Requirement: $x_{ij} \geq 0.5 \times G_j \quad \forall i \in I, j \in J$
- Non-Negativity: $x_{ij} \geq 0 \quad \forall i \in I, j \in J$

The optimization uses the 'linprog' function from SciPy with the 'highs' method to solve this linear problem. If successful, the solution provides the optimal quantities of each food type to prepare. These results are saved in 'Optimal_Food_Preparation_Quantities.csv'.

Optimal Solution and Value

```
✓ # Food Wastage Optimization and Sensitivity Analysis ···

Optimal Wastage Value: 7642556.5
Optimal Food Preparation Quantities saved as 'Optimal_Food_Preparation_Quantities.csv'
Sensitivity Analysis Results saved as 'Sensitivity_Analysis_Results.csv'
```

The solver finds an optimal solution, it extracts the optimal quantities and the optimal value of the objective. And these values are combined with relevant food description columns to create a DataFrame, which is then saved to the CSV file "Optimal_Food_Preparation_Quantities.csv."

Sensitivity Analysis

Sensitivity analysis checks how the optimization solution behaves under different conditions. The scripts tests range of values for:

- Budget (from 300 to 1000)
- Guest attendance (20% to 100% of expected guests)
- Wastage rates (from 0.5x to 1.5x the original wastage)

For each scenario, the script recalculates and re-runs the optimization. The results show whether a valid solution was found and what the total wastage would be. These are saved in 'Sensitivity_Analysis_Results.csv'.

Limitations

- Assumed No-Show Rate: A fixed 10% no-show rate is applied to all events, which may not be accurate across different event types or regions.
- Fixed Minimum Food Requirement: The model assumes each guest needs 0.5 units of food, which may not suit every food type or meal type.
- Static Cost Mapping: Food pricing is categorized and assigned fixed values, not reflecting market variability or vendor pricing.
- Simplified Budgeting: Each food type has its own budget constraint instead of a flexible, shared total budget.
- Linear Model Assumptions: Real-world relationships (like satisfaction or waste) might not be strictly linear.
- No Satisfaction Metrics: The model optimizes waste and cost, but not guest experience or food quality.
- Scalability: The model may not scale efficiently with large datasets involving many event types or food options.

Future Work

- Dynamic No-Show Modeling: Use machine learning to predict guest attendance based on event attributes.
- Incorporate Guest Satisfaction: Add satisfaction scores or qualitative data to balance waste and guest happiness.
- More Sophisticated Cost Modeling: Reflect dynamic pricing, seasonal changes, and quantity discounts.
- Stochastic Optimization: Handle uncertainties in guest count and consumption using probability-based models.
- Non-Linear and Multi-Objective Models: Go beyond linear optimization to balance multiple conflicting goals.
- Integration with Real-Time Event Data: Adjust food preparation dynamically based on check-ins or live feedback.
- Visual Dashboards: Create interactive tools to help planners explore optimization results and sensitivity insights.

Managerial Insights

- The model leverages historical data (from reliable sources like Kaggle) to determine precise food quantities. This means management can replace gut-feelings with data-driven recommendations that balance supply with real-time demand.
- The integration of budget constraints into the optimization process ensures that food preparation aligns with financial goals.
- By varying guest attendance, budget limits, and wastage rates, sensitivity analysis equips managers with a clear picture of operational risks. They can understand how small changes in key parameters can lead to significant variations in wastage, allowing for proactive contingency planning.
- Reducing food wastage translates into lowering the overall environmental footprint of events. This aligns with broader corporate sustainability goals, potentially enhancing brand reputation and attracting a clientele that values eco-friendly practices.
- Presenting these managerial insights emphasizes that the optimization model is not just a technical exercise—it is a strategic tool that supports sustainable operations, precise cost management, and enhanced service quality. By integrating these insights into your decision-making process, management can turn data into an asset, ensuring that operations are both efficient and adaptable to the ever-changing dynamics of event planning.

Conclusion

This project uses optimization to support event planners in reducing food waste while meeting guest needs and staying within budget. It also evaluates how sensitive the model is to changes in key variables, which helps in planning under uncertainty.

APPENDIX

Code

```
import numpy as np
import pandas as pd
from scipy.optimize import linprog
import matplotlib.pyplot as plt

# Load the optimized data
file_path = "food_wastage_data.csv"
data = pd.read_csv(file_path)

# Define different no-show rates for each event type
no_show_rates = {
    'Wedding': 0.05,
    'Birthday': 0.10,
    'Corporate': 0.15,
    'Social Gathering': 0.20
}

# Apply no-show rates dynamically
data['No Show Guests'] = data.apply(lambda row: (row['Number of Guests'] * no_show_rates.get(row['Event Type'], 0.1)), axis=1)
data['Actual Guests Present'] = data['Number of Guests'] - data['No Show Guests']
data['Cost per Unit'] = data['Pricing'].map({'Low': 200, 'Moderate': 400, 'High': 600})

# Optimization Model
cost_vector = data['Cost per Unit'].values
wastage_vector = data['Wastage Food Amount'].values
min_food_constraints = data['Actual Guests Present'] * 0.5  # Assuming 0.5 units per guest minimum

# Constraint matrices
A_ub = np.vstack([
    np.eye(len(cost_vector)),       # Budget constraints
    -np.eye(len(cost_vector))       # Minimum food constraints
])

budget_limits = data['Cost per Unit'] * data['Number of Guests']
```

```
min_quantity_limits = -min_food_constraints.values

b_ub = np.hstack([budget_limits, min_quantity_limits])
c = wastage_vector

# Solve the optimization
result = linprog(c, A_ub=A_ub, b_ub=b_ub, method='highs')

# Handle result
if result.success:
    optimal_solution = result.x
    optimal_value = result.fun

    optimization_results = pd.DataFrame({
        'Type of Food': data['Type of Food'],
        'Event Type': data['Event Type'],
        'Optimal Quantity': optimal_solution.round(2),
        'Wastage Per Unit': wastage_vector,
        'Cost Per Unit': cost_vector
    })

    optimization_results.to_csv("Optimal_Food_Preparation_Quantities.csv", index=False)
    print(f"Optimal Wastage Value: {optimal_value}")
    print("Optimal Food Preparation Quantities saved as 'Optimal_Food_Preparation_Quantities.csv'")
else:
    print("Optimization failed.")
    print("Solver message:", result.message)

# Sensitivity Analysis with Event-Specific No-Show Rates
budget_range = np.arange(300, 1001, 100)
guest_factor_range = np.arange(0.2, 1.2, 0.2)
wastage_multiplier_range = np.arange(0.5, 1.6, 0.2)

sensitivity_results = []

for budget in budget_range:
    for guest_factor in guest_factor_range:  # New loop for each guest factor
        for wastage_factor in wastage_multiplier_range:
            for event_type, no_show_rate in no_show_rates.items():
```

```
            # Filter data for the current event type
            event_data = data[data['Event Type'] == event_type].copy()
            if event_data.empty:
                continue

            # Apply the guest factor as a scalar multiplication
            event_data['Adjusted Guests'] = (event_data['Actual Guests Present'] *
guest_factor).round().astype(int)
            event_data['Adjusted Wastage'] = (event_data['Wastage Food Amount'] *
wastage_factor).round().astype(int)
            min_food_constraints = event_data['Adjusted Guests'] * 0.5

            # Setup constraint matrices for the optimization problem
            A_budget = np.eye(len(event_data))
            A_min_quantity = -np.eye(len(event_data))
            A_ub = np.vstack([A_budget, A_min_quantity])
            b_ub = np.hstack([
                np.full(len(event_data), budget),
                -min_food_constraints.values
            ])

            # Define cost vector for the current adjusted wastage
            c = event_data['Adjusted Wastage'].values

            # Check if any NaN or infinity is present in inputs
            if np.any(np.isnan(c)) or np.any(np.isnan(A_ub)) or np.any(np.isnan(b_ub)):
                print(f"NaNs in input for {event_type} with Budget={budget}, Guest
Factor={guest_factor}, Wastage Factor={wastage_factor}; skipping scenario.")
                continue
            if np.any(np.isinf(c)) or np.any(np.isinf(A_ub)) or np.any(np.isinf(b_ub)):
                print(f"Infs in input for {event_type} with Budget={budget}, Guest
Factor={guest_factor}, Wastage Factor={wastage_factor}; skipping scenario.")
                continue

            result = linprog(c, A_ub=A_ub, b_ub=b_ub, method='highs')

            sensitivity_results.append({
                'Budget': budget,
                'Guest Factor': guest_factor,
                'Wastage Factor': wastage_factor,
```

```
            'Event Type': event_type,
            'Optimal Wastage': result.fun if result.success else np.nan,
            'Status': 'Optimal' if result.success else 'Infeasible'
        })

    # Save sensitivity analysis results
    sensitivity_df = pd.DataFrame(sensitivity_results)
    sensitivity_df.to_csv("Sensitivity_Analysis_Results.csv", index=False)
    print("Sensitivity Analysis Results saved as 'Sensitivity_Analysis_Results.csv'")
```

Output

```
✓ # Food Wastage Optimization and Sensitivity Analysis ···

Optimal Wastage Value: 7642556.5
Optimal Food Preparation Quantities saved as 'Optimal_Food_Preparation_Quantities.csv'
Sensitivity Analysis Results saved as 'Sensitivity_Analysis_Results.csv'
```

Optimal_Food_Preparation_Quantities.csv

Type of Food	Event Type	Optimal Quant	Wastage Per U	Cost Per U
Meat	Corporate	131.75	25	200
Meat	Corporate	127.5	25	400
Fruits	Corporate	136	45	600
Meat	Corporate	170	40	600
Fruits	Corporate	113.48	24	200
Meat	Corporate	93.5	30	400
Vegetables	Corporate	93.5	15	200
Meat	Corporate	148.75	35	600
Baked Goods	Corporate	136	35	600
Meat	Corporate	161.5	25	400
Meat	Corporate	186.15	35	400
Fruits	Corporate	148.75	20	200
Meat	Corporate	93.5	15	400
Fruits	Corporate	93.5	15	400
Meat	Corporate	93.5	15	400
Meat	Corporate	127.5	35	600
Dairy Products	Corporate	186.58	39	200
Fruits	Corporate	102	20	200
Fruits	Corporate	119	20	400
Fruits	Corporate	127.5	15	400
Baked Goods	Corporate	161.5	35	600
Vegetables	Corporate	148.75	35	600
Vegetables	Corporate	119	20	400
Dairy Products	Corporate	148.75	30	600
Fruits	Corporate	136	35	600
Fruits	Corporate	186.15	35	400
Baked Goods	Corporate	131.75	35	600
Dairy Products	Corporate	170	25	200
Vegetables	Corporate	106.25	20	400
Fruits	Corporate	148.75	45	600
Dairy Products	Corporate	127.5	40	600
Fruits	Corporate	148.75	25	400
Baked Goods	Corporate	161.5	35	600
Dairy Products	Corporate	106.25	20	200
Baked Goods	Corporate	127.5	25	400
Dairy Products	Corporate	119	20	400

Type of Food	Event Type	Optimal Quant	Wastage Per U	Cost Per U
Meat	Birthday	180	40	600
Vegetables	Birthday	135.9	27	200
Meat	Birthday	220.95	32	600
Meat	Birthday	135.9	27	200
Meat	Birthday	135.9	27	200
Fruits	Birthday	135	20	200
Fruits	Birthday	135	25	200
Meat	Birthday	180	40	600
Meat	Birthday	126	20	400
Fruits	Birthday	180	50	600
Meat	Birthday	112.5	20	400
Baked Goods	Birthday	135	20	200
Fruits	Birthday	195.3	36	200
Dairy Products	Birthday	135	20	200
Baked Goods	Birthday	144	20	400
Vegetables	Birthday	126	20	400
Meat	Birthday	171	30	400
Meat	Birthday	144	30	600
Vegetables	Birthday	144	40	600
Baked Goods	Birthday	202.5	30	600
Baked Goods	Birthday	144	25	400
Baked Goods	Birthday	112.5	35	600
Fruits	Birthday	135	15	400
Baked Goods	Birthday	126	20	400
Dairy Products	Birthday	108	20	200
Baked Goods	Birthday	144	25	400
Baked Goods	Birthday	112.5	20	400
Fruits	Birthday	130.5	27	200
Fruits	Birthday	112.5	30	600
Vegetables	Birthday	139.5	35	600
Meat	Birthday	112.5	40	600
Meat	Birthday	180	45	600
Meat	Birthday	135	20	200
Meat	Birthday	112.5	20	400
Vegetables	Birthday	126	15	200
Baked Goods	Birthday	157.5	30	400
Dairy Products	Birthday	197.55	39	200

Type of Food	Event Type	Optimal Quant	Wastage Per U	Cost Per U
Meat	Social Gathering	100	10	200
Meat	Social Gathering	88	10	200
Vegetables	Social Gathering	112	20	200
Meat	Social Gathering	160	30	400
Fruits	Social Gathering	116	27	200
Meat	Social Gathering	128	40	600
Meat	Social Gathering	160	45	600
Fruits	Social Gathering	100	10	200
Dairy Products	Social Gathering	100	10	200
Vegetables	Social Gathering	124	35	600
Fruits	Social Gathering	128	30	600
Meat	Social Gathering	160	50	600
Meat	Social Gathering	112	20	400
Meat	Social Gathering	140	40	600
Baked Goods	Social Gathering	120.8	27	200
Dairy Products	Social Gathering	128	40	600
Dairy Products	Social Gathering	120	30	600
Fruits	Social Gathering	160	40	600
Meat	Social Gathering	120	40	600
Fruits	Social Gathering	140	45	600
Fruits	Social Gathering	152	35	600
Vegetables	Social Gathering	160	30	600
Baked Goods	Social Gathering	120	15	400
Baked Goods	Social Gathering	140	35	600
Dairy Products	Social Gathering	100	20	400
Vegetables	Social Gathering	160	40	600
Vegetables	Social Gathering	116	27	200
Dairy Products	Social Gathering	112	25	200
Meat	Social Gathering	116	27	200
Fruits	Social Gathering	128	30	600
Baked Goods	Social Gathering	112	20	400
Baked Goods	Social Gathering	152	25	400
Baked Goods	Social Gathering	140	40	600
Dairy Products	Social Gathering	152	25	400
Dairy Products	Social Gathering	136.8	29	400
Vegetables	Social Gathering	88	15	200
Meat	Social Gathering	140	35	600

Type of Food	Event Type	Optimal Quant	Wastage Per U	Cost Per U
Meat	Wedding	114	20	200
Meat	Wedding	142.5	25	400
Fruits	Wedding	152	35	600
Meat	Wedding	190	25	200
Meat	Wedding	166.25	40	600
Fruits	Wedding	180.5	35	600
Fruits	Wedding	190	40	600
Meat	Wedding	152	25	400
Fruits	Wedding	190	40	600
Meat	Wedding	98.8	22	400
Fruits	Wedding	233.22	32	600
Fruits	Wedding	166.25	40	600
Meat	Wedding	190	50	600
Vegetables	Wedding	133	15	200
Meat	Wedding	118.75	40	600
Fruits	Wedding	109.25	30	400
Baked Goods	Wedding	209.95	32	200
Vegetables	Wedding	166.25	35	600
Fruits	Wedding	118.75	20	400
Baked Goods	Wedding	188.58	31	400
Dairy Products	Wedding	166.25	25	400
Fruits	Wedding	126.82	30	200
Fruits	Wedding	142.5	35	600
Meat	Wedding	190	50	600
Baked Goods	Wedding	104.5	10	200
Meat	Wedding	123.98	23	400
Meat	Wedding	190	30	600
Vegetables	Wedding	166.25	40	600
Fruits	Wedding	142.5	15	400
Meat	Wedding	104.5	23	400
Meat	Wedding	118.75	25	400
Fruits	Wedding	190	40	600
Vegetables	Wedding	130.62	16	200
Baked Goods	Wedding	133	25	400
Baked Goods	Wedding	104.5	15	400
Baked Goods	Wedding	190	40	600

Sensitivity_Analysis_Results.csv

Budg	Guest Factor	Wastage Factor	Event Type	Optimal Wasta	Status
300	0.2	0.5	Corporate	208341	Optimal
300	0.2	0.7	Corporate	290340.5	Optimal
300	0.2	0.8999999999999999	Corporate	371482.5	Optimal
300	0.2	1.0999999999999999	Corporate	454847.5	Optimal
300	0.2	1.2999999999999998	Corporate	538214.5	Optimal
300	0.2	1.4999999999999998	Corporate	620861	Optimal
300	0.4	0.5	Corporate	416812	Optimal
300	0.4	0.7	Corporate	580839.5	Optimal
300	0.4	0.8999999999999999	Corporate	743170.5	Optimal
300	0.4	1.0999999999999999	Corporate	909948	Optimal
300	0.4	1.2999999999999998	Corporate	1076730	Optimal
300	0.4	1.4999999999999998	Corporate	1242068	Optimal
300	0.6000000000000001	0.5	Corporate	625449	Optimal
300	0.6000000000000001	0.7	Corporate	871598	Optimal
300	0.6000000000000001	0.8999999999999999	Corporate	1115187	Optimal
300	0.6000000000000001	1.0999999999999999	Corporate	1365446	Optimal
300	0.6000000000000001	1.2999999999999998	Corporate	1615714.5	Optimal
300	0.6000000000000001	1.4999999999999998	Corporate	1863818.5	Optimal
300	0.8	0.5	Corporate	833741.5	Optimal
300	0.8	0.7	Corporate	1161846.5	Optimal
300	0.8	0.8999999999999999	Corporate	1486555	Optimal
300	0.8	1.0999999999999999	Corporate	1820155.5	Optimal
300	0.8	1.2999999999999998	Corporate	2153769	Optimal
300	0.8	1.4999999999999998	Corporate	2484494	Optimal
300	1	0.5	Corporate	1042159.5	Optimal
300	1	0.7	Corporate	1452292.5	Optimal
300	1	0.8999999999999999	Corporate	1858174.5	Optimal
300	1	1.0999999999999999	Corporate	2275170	Optimal
300	1	1.2999999999999998	Corporate	2692182	Optimal
300	1	1.4999999999999998	Corporate	3105581	Optimal
400	0.2	0.5	Corporate	208341	Optimal

Budg	Guest Factor	Wastage Factor	Event Type	Optimal Wasta	Status
300	0.2	0.5	Birthday	156652.5	Optimal
300	0.2	0.7	Birthday	218471	Optimal
300	0.2	0.8999999999999999	Birthday	279947.5	Optimal
300	0.2	1.0999999999999999	Birthday	342513	Optimal
300	0.2	1.2999999999999998	Birthday	405512.5	Optimal
300	0.2	1.4999999999999998	Birthday	467577	Optimal
300	0.4	0.5	Birthday	313229	Optimal
300	0.4	0.7	Birthday	436839.5	Optimal
300	0.4	0.8999999999999999	Birthday	559768.5	Optimal
300	0.4	1.0999999999999999	Birthday	684870.5	Optimal
300	0.4	1.2999999999999998	Birthday	810843	Optimal
300	0.4	1.4999999999999998	Birthday	934938	Optimal
300	0.6000000000000001	0.5	Birthday	469904.5	Optimal
300	0.6000000000000001	0.7	Birthday	655342.5	Optimal
300	0.6000000000000001	0.8999999999999999	Birthday	839757	Optimal
300	0.6000000000000001	1.0999999999999999	Birthday	1027434.5	Optimal
300	0.6000000000000001	1.2999999999999998	Birthday	1216415	Optimal
300	0.6000000000000001	1.4999999999999998	Birthday	1402582.5	Optimal
300	0.8	0.5	Birthday	626421.5	Optimal
300	0.8	0.7	Birthday	873630	Optimal
300	0.8	0.8999999999999999	Birthday	1119474.5	Optimal
300	0.8	1.0999999999999999	Birthday	1369664	Optimal
300	0.8	1.2999999999999998	Birthday	1621595	Optimal
300	0.8	1.4999999999999998	Birthday	1869771.5	Optimal
300	1	0.5	Birthday	783176	Optimal
300	1	0.7	Birthday	1092241	Optimal
300	1	0.8999999999999999	Birthday	1399601.5	Optimal
300	1	1.0999999999999999	Birthday	1712399.5	Optimal
300	1	1.2999999999999998	Birthday	2027369.5	Optimal
300	1	1.4999999999999998	Birthday	2337648.5	Optimal
400	0.2	0.5	Birthday	156652.5	Optimal

Budg	Guest Factor	Wastage Factor	Event Type	Optimal Wasta	Status
300	0.2	0.5	Social Gathering	172003.5	Optimal
300	0.2	0.7	Social Gathering	239361.5	Optimal
300	0.2	0.8999999999999999	Social Gathering	306914	Optimal
300	0.2	1.0999999999999999	Social Gathering	375588	Optimal
300	0.2	1.2999999999999998	Social Gathering	444436	Optimal
300	0.2	1.4999999999999998	Social Gathering	512420	Optimal
300	0.4	0.5	Social Gathering	343855	Optimal
300	0.4	0.7	Social Gathering	478512	Optimal
300	0.4	0.8999999999999999	Social Gathering	613553.5	Optimal
300	0.4	1.0999999999999999	Social Gathering	750841	Optimal
300	0.4	1.2999999999999998	Social Gathering	888473	Optimal
300	0.4	1.4999999999999998	Social Gathering	1024381.5	Optimal
300	0.6000000000000001	0.5	Social Gathering	516079	Optimal
300	0.6000000000000001	0.7	Social Gathering	718171.5	Optimal
300	0.6000000000000001	0.8999999999999999	Social Gathering	920848	Optimal
300	0.6000000000000001	1.0999999999999999	Social Gathering	1126897.5	Optimal
300	0.6000000000000001	1.2999999999999998	Social Gathering	1333463.5	Optimal
300	0.6000000000000001	1.4999999999999998	Social Gathering	1537442.5	Optimal
300	0.8	0.5	Social Gathering	688038	Optimal
300	0.8	0.7	Social Gathering	957476	Optimal
300	0.8	0.8999999999999999	Social Gathering	1227686.5	Optimal
300	0.8	1.0999999999999999	Social Gathering	1502393.5	Optimal
300	0.8	1.2999999999999998	Social Gathering	1777788.5	Optimal
300	0.8	1.4999999999999998	Social Gathering	2049734.5	Optimal
300	1	0.5	Social Gathering	860048.5	Optimal
300	1	0.7	Social Gathering	1196846.5	Optimal
300	1	0.8999999999999999	Social Gathering	1534610.5	Optimal
300	1	1.0999999999999999	Social Gathering	1877995.5	Optimal
300	1	1.2999999999999998	Social Gathering	2222239.5	Optimal
300	1	1.4999999999999998	Social Gathering	2562171.5	Optimal
400	0.2	0.5	Social Gathering	172003.5	Optimal

Budg	Guest Factor	Wastage Factor	Event Type	Optimal Wasta	Status
300	0.2	0.5	Wedding	205689	Optimal
300	0.2	0.7	Wedding	285814.5	Optimal
300	0.2	0.8999999999999999	Wedding	366054	Optimal
300	0.2	1.0999999999999999	Wedding	447981.5	Optimal
300	0.2	1.2999999999999998	Wedding	530299	Optimal
300	0.2	1.4999999999999998	Wedding	611740.5	Optimal
300	0.4	0.5	Wedding	411558	Optimal
300	0.4	0.7	Wedding	571881.5	Optimal
300	0.4	0.8999999999999999	Wedding	732420	Optimal
300	0.4	1.0999999999999999	Wedding	896357	Optimal
300	0.4	1.2999999999999998	Wedding	1061058	Optimal
300	0.4	1.4999999999999998	Wedding	1224014.5	Optimal
300	0.6000000000000001	0.5	Wedding	617616	Optimal
300	0.6000000000000001	0.7	Wedding	858228	Optimal
300	0.6000000000000001	0.8999999999999999	Wedding	1099149	Optimal
300	0.6000000000000001	1.0999999999999999	Wedding	1345166.5	Optimal
300	0.6000000000000001	1.2999999999999998	Wedding	1592335	Optimal
300	0.6000000000000001	1.4999999999999998	Wedding	1836883	Optimal
300	0.8	0.5	Wedding	823067	Optimal
300	0.8	0.7	Wedding	1143707	Optimal
300	0.8	0.8999999999999999	Wedding	1464769.5	Optimal
300	0.8	1.0999999999999999	Wedding	1792627	Optimal
300	0.8	1.2999999999999998	Wedding	2122011	Optimal
300	0.8	1.4999999999999998	Wedding	2447905.5	Optimal
300	1	0.5	Wedding	1028700.5	Optimal
300	1	0.7	Wedding	1429443	Optimal
300	1	0.8999999999999999	Wedding	1830722.5	Optimal
300	1	1.0999999999999999	Wedding	2240485.5	Optimal
300	1	1.2999999999999998	Wedding	2652164	Optimal
300	1	1.4999999999999998	Wedding	3059477.5	Optimal
400	0.2	0.5	Wedding	205689	Optimal