

Specific Fulfillment Activity:

Generate delivery routes for a set of drivers (N) delivering customer orders (M) from several restaurants (R) in a specific market.

Performance Metric:

Minimize the tardiness of the customer order delivery time, while at the same time minimizing the total travel distance of all the drivers.

TABLE B1 - Process Variables

No.	INPUT PROCESS VARIABLE	DATA MEASURE	DATA SOURCE	UNCERTAINTY RANGE
V1	Customer order delivery location described by address entered at time of order entry	Address on a Cartesian plane	<input checked="" type="checkbox"/> Flow Entity <input type="checkbox"/> System State	7 square mile area
V2	Target order delivery time prescribed by system at the of order entry	Time Calendar	<input checked="" type="checkbox"/> Flow Entity <input type="checkbox"/> System State	15 to 45 minutes
V3	Driver Location at the start of the route generation process	Address on a Cartesian plane	<input checked="" type="checkbox"/> Flow Entity <input type="checkbox"/> System State	Within 3 miles of a restaurant
V4	Restaurant Location from where the customer order will be picked up for delivery	Address on a Cartesian plane	<input type="checkbox"/> Flow Entity <input checked="" type="checkbox"/> System State	4 square mile range
V5	Association array linking customer orders with a specific restaurant	Binary matrix	<input type="checkbox"/> Flow Entity <input checked="" type="checkbox"/> System State	Association variance ±10% across restaurants

TABLE B2 - Decision Variables

No.	DECISION VARIABLES	MADE BY	FREQUENCY
D1	Driver assignment to restaurants. One to many relationship, that is a driver is assigned to several restaurants, but only one driver to a restaurant.	<input type="checkbox"/> Manual <input checked="" type="checkbox"/> Computer Rule <input type="checkbox"/> Analytical Program	<input checked="" type="checkbox"/> Time - Cycle Time: Every 30 minutes during peak times and every 1 hour off-peak <input type="checkbox"/> Batch - Size:
D2	Order pickup from restaurants and customer drop sequence for the delivery route.	<input type="checkbox"/> Manual <input type="checkbox"/> Computer Rule <input checked="" type="checkbox"/> Analytical Program	<input type="checkbox"/> Time - Cycle Time: Every time a delivery route is assigned to a driver <input type="checkbox"/> Batch - Size:

TABLE B3 - Performance Transfer Relationships

No.	WHY - EFFECT INTELLIGENCE	DATA CURATION	FEATURE ENGINEERING
<i>Single Variable Effect</i>		<i>Threshold % = 35%</i>	
V1	Performance will progressively drop as the number of orders increases, and as the location density decreases.	Track data by time of day and day of the week	1. Traffic delays 2. Order basket value
V2	Performance will drop as the interval between the start time and the mean target delivery time decreases.	Track delivery-start time all orders by restaurant	1. Order queue length 2. Intra order times
V3	The shorter the average closest driver distance to each restaurant the better the performance will be.	Track data by time of day for all drivers	1. Sum of distance between drivers

V4	Performance will drop as the average distance of all orders served by each restaurant increases	Track data by time of day for all restaurants	1. Traffic delays 2. Delivery delays
V5	The array distribution effect on performance relationship is combinatorial and difficult to predict.	Track number of orders by restaurant by time of day	1. Restaurant sum of order basket value
<i>Paired Variable Effect</i>		<i>Threshold % = 30%</i>	
V1+V4	Increasing travel distance will increase both the delivery costs and the fulfillment time.	Track the cumulative intra-order distance	1. Delivery delays
V1+V2	Longer distances with shorter delivery times will negatively effect the performance. Ideally closer locations will have earlier fulfillment.	Track the time-distance product variable	
V4+V5	A balanced assignment of orders to restaurants and additionally balanced delivery distance is optimal for performance.	Track the mean variance of orders per restaurant	

Supervised Learning Questions:

1. Do one or more restaurants consistently have longer delivery distances?
2. Are any areas/locations a consistent source of traffic or delivery delays?
3. Is there a performance difference between drivers across restaurants?