

## Mathematics Governor's Institute 2003

**Title of Project:** Willy Dropitt

**Team Members:** Russ Bishop, Melissa Cooper, Niki Scyoc, and Sue Shoemaker

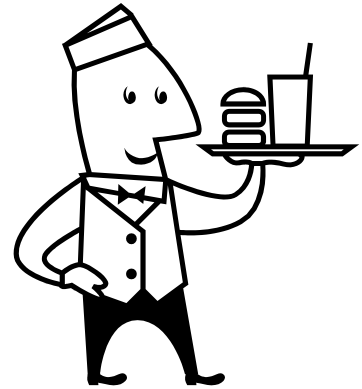
**Grade Level:** Grades 9 – 12

**Concepts used:** Simple Probability, Permutations, Sample Space, Outcomes, Experimental Probability, Theoretical Probability, Compound Probability, and Event

**PA Standards Addressed:** 2.2.11A, 2.5.11C, 2.7.11C, 2.7.11D, and 2.7.11E

**NCTM Standards Addressed:** Numbers and Operations, Data Analysis and Probability, Connections, Representations, Problem Solving, and Communications

**Introduction / Applications:** Willy Dropitt, a waiter at the Greasy Spoon, is having a rough day. So far he has dropped a milkshake on his boss's wife's lap and bumped into a waitress carrying a tray of spaghetti. With his job on the line and under the watchful eye of his boss, Willy rushes over to table four (4) forgetting his order pad. Willing to risk it, he successfully memorizes the orders. However, when Willy goes to deliver the meals, he can't recall who ordered what?



**Question:** What is the chance that all four guests receive the correct meal? Only one guest receives the correct meal? Exactly 2 guests receive the correct meal? Exactly 3 guests receive the correct meal?

**Model:** Students will use simulations to arrive at experimental probability leading to the calculation of theoretical probability.

**Resources and Materials (estimated cost):** 4 placemats (\$4), paper plates (\$2.50), magazine(s) containing food items (that will be glued onto the plates) (\$5), brown grocery bags (free at a local grocery store), glue (\$1), student worksheet (below), and a marker (\$1.29).

### Procedures and Activities:

- 1.) In groups of 5 (4 guests and Willy the waiter) students will simulate the event 50 times. The simulation will involve Willy randomly pulling one plate at a time out of the paper bag and placing it on the placemat of the first guest to his left and continuing clockwise until all four plates are distributed.
- 2.) After all four guests have a meal; students should record the number of guests receiving the correct meal. A tally chart is an option for recording the 50 outcomes.
- 3.) Using the data, calculate the experimental probabilities that 0, 1, 2, 3, and all 4 guests received the correct meal.
- 4.) List all possible permutations of the four meals.
- 5.) For each permutation determine the number of guests receiving the correct meal. Then use that information to determine the theoretical probabilities.
- 6.) Compare the theoretical and experimental probabilities in order to discuss the connection.

7.) **Extension:** Take into consideration that all four guests have ordered beverages. What are the probabilities that Willy gives each guest the correct meal and beverage?

**Solutions:**

	# correct		# correct		# correct		# correct
1 2 3 4	4	2 1 3 4	2	3 1 2 4	1	4 1 2 3	0
1 2 4 3	2	2 1 4 3	0	3 1 4 2	0	4 1 3 2	1
1 3 2 4	2	2 3 1 4	1	3 2 1 4	2	4 2 1 3	1
1 3 4 2	1	2 3 4 1	0	3 2 4 1	1	4 2 3 1	2
1 4 2 3	1	2 4 1 3	0	3 4 1 2	0	4 3 1 2	0
1 4 3 2	2	2 4 3 1	1	3 4 2 1	0	4 3 2 1	0

$$P(0 \text{ correct}) = \frac{9}{24}$$

$$P(2 \text{ correct}) = \frac{6}{24}$$

$$P(4 \text{ correct}) = \frac{1}{24}$$

$$P(1 \text{ correct}) = \frac{8}{24}$$

$$P(3 \text{ correct}) = 0$$

**Accommodations/Adaptations:**

**ESL:** provide reading assistance as needed

**Special Education:** Allow students to complete the activity with only three guests (reducing the number of permutations)

**Enrichment:** Find the theoretical probabilities associated with more than four guests.

## Willy Dropitt Workspace

Willy Dropitt, a waiter at the Greasy Spoon, is having a rough day. So far he has dropped a milkshake on his boss's wife's lap and bumped into a waitress carrying a tray of spaghetti. With his job on the line and under the watchful eye of his boss, Willy rushes over to table four (4) forgetting his order pad. Willing to risk it he successfully memorizes the orders. However, when Willy goes to deliver the meals he can't recall who ordered what?

What is the chance that all four guests receive the correct meal? Only one guest receives the correct meal? Exactly 2 guests receive the correct meal? Exactly 3 guests receive the correct meal?

### Tally Space:

# Correct	Tally
0	
1	
2	
3	
4	

### Experimental Probabilities:

$P(0 \text{ correct}) =$

$P(2 \text{ correct}) =$

$P(4 \text{ correct}) =$

$P(1 \text{ correct}) =$

$P(3 \text{ correct}) =$

### Theoretical Probabilities:

$P(0 \text{ correct}) =$

$P(2 \text{ correct}) =$

$P(4 \text{ correct}) =$

$P(1 \text{ correct}) =$

$P(3 \text{ correct}) =$