

Let's Make a Deal!

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- Grade Level:** Grades 9 – 12
- Concepts Used:** Modeling, Probability, Predicting, Relative Frequency, Law of Large Numbers
- PA Standards:** 2.4.11.B, C, E
2.5.11.B, C, D
2.6.11.H
2.7.11.A, B, C, D
- NCTM Standards:** Data Analysis
Problem Solving
Reasoning and Proof
Communication
Connections
Representation
- Introduction:** Bill and Ted were watching “Let’s Make a Deal”. In the game contestants are shown three doors and asked to choose one. Behind one door may be a shiny car, money or some other wonderful prize. Behind the other two doors are less glamorous prizes. After the contestant chooses which mystery door he wants, Monty Hall shows him what was behind one of the losing doors. The contestant is then given the option to stay with his original choice or to switch to the other unknown door. Bill and Ted began comparing how they would each play the game if they were contestants. Bill said he would always choose to stay with his original choice when Monty Hall shows him the losing door. Ted disagreed saying he would always switch doors, abandoning his original choice. Help Bill and Ted settle their disagreement on which strategy is more successful in the long run.

Question: In the long run, who is more likely to win the wonderful prize, Bill or Ted?

Model: Students will use simulations, probability, graphing and drawing conclusions to examine game show strategies.

Resources: Let's Make a Deal game show

Materials:

- 1) Group Tally and Conclusion Worksheets
- 2) Three index cards - two labeled lose and one labeled win
- 3) Class Tally Sheet on overhead

Procedures:

- 1) Students would be told the rules of "Let's Make a Deal" and presented with the question above.
- 2) Teacher would lead them in a discussion of which strategy leads to success more often.
- 3) Teacher would ask for a volunteer to play ten trials of "Let's Make a Deal" using a particular strategy, either always **staying with original choice** or **always switching to the other unknown door**.
- 4) Teacher assigns students to groups of three. Student A would be Monty Hall and using the 3 index cards select which door is the winner. Student B is the contestant choosing the door. Student C is the recorder tallying the results from each trial (see student table below).

Group Tally Worksheet

Stay Strategy

Switch Strategy

	win	lose		win	lose
Trial 1					
Trial 2					
Trial 3					
Trial 4					
Trial 5					
Trial 6					
Trial 7					
Trial 8					
Trial 9					
Trial 10					
Total					

5) The groups of three students would each play 10 trials with student B (contestant) playing the **stay strategy**. For the next 10 trials student B would play the **switch strategy**.

6) As each group finishes, Student C (recorder) should take group tally sheet to the teacher to collect cumulative data. Cumulative data can be recorded by the teacher on the Class Tally Sheet (overhead) so students can record all other groups' data. Teacher leads students in filling out Conclusions Worksheet. (See **Conclusions Worksheet**)

7) After filling in the Conclusions Worksheet, use the ordered pairs written in Column 4 to make a line graph (stay strategy). Use the ordered pairs written in Column 7 to make a line graph (switch strategy). This will show that the empirical probability will limit to the theoretical probability as the number of trials increase.

Answers:

Results are student generated and empirical probability will be consistent with theoretical probability with a class size of about 20 students. The theoretical probability of winning using the stay strategy is $1/3$ and the switch strategy is $2/3$.

For more information about "Let's Make a Deal", watch the show or go to

<http://members.shaw.ca/ron.blond/TLE/MONTY.APPLET.FRONTEND/MONTY.APPLET/index.html>

Accommodations / Adaptations: We feel this experience would benefit the learning support and ESL students through the hands on learning, group cooperative and teacher modeling. Any accommodations or adaptations can be made as necessary.

For the gifted student, teacher could lead a lesson explaining the theoretical probability as explained by Bayes' Theorem.

Let's Make a Deal Class Tally Sheet

- Directions:
- 1) Record the total number of wins using the STAY strategy.
 - 2) Record the total number of wins using the SWITCH strategy.
 - 3) Teacher and students may then fill in the Conclusions Worksheet together.

	Number of STAY Strategy WINS		Number of SWITCH Strategy WINS
Group 1			
Group 2			
Group 3			
Group 4			
Group 5			
Group 6			
Group 7			
Group 8			
Group 9			
Group 10			
Group 11			
Group 12			

Let's Make a Deal Group Tally Sheet

- Directions:
- 1) Student C (recorder) will record results from 10 trials of each strategy
→ 10 trials using STAY strategy and 10 trials using SWITCH strategy.
 - 2) After completing all trials, total each column and record in the total row.
 - 3) Take Group Tally Sheet up to the teacher.

	Stay	Strategy		Switch	Strategy
	<u>Win</u>	<u>Lose</u>		<u>Win</u>	<u>Lose</u>
Trial 1					
Trial 2					
Trial 3					
Trial 4					
Trial 5					
Trial 6					
Trial 7					
Trial 8					
Trial 9					
Trial 10					
<u>Total</u>			<u>Total</u>		

All done? Take Group Tally Sheet up to the teacher.

Let's Make a Deal

Name _____

Let's Make a Deal Conclusions Worksheet

You can help Bill and Ted analyze their strategies by playing many games and examining the relative frequency of winning using both of these strategies. To keep track of the data, fill in the table below.

1	2	3	4	5	6	7
Class Results	Number of Wins Using STAY Strategy	Cumulative % of Wins Using STAY Strategy Column 2 / Column 1 x 100%	Ordered Pair use (Column 1, Column 3)	Number of Wins Using SWITCH Strategy	Cumulative % of Wins Using SWITCH Strategy Column 5 / Column 1 x 100%	Ordered Pair use (Column 1, Column 6)
After 10 Trials						
After 20 Trials						
After 30 Trials						
After 40 Trials						
After 50 Trials						
After 60 Trials						
After 70 Trials						
After 80 Trials						

After 90 Trials						
After 100 Trials						
After 110 Trials						
After 120 Trials						
After 130 Trials						
After 140 Trials						
After 150 Trials						
After 160 Trials						
After 170 Trials						
After 180 Trials						
After 190 Trials						
After 200 Trials						
		The above number is the Long Run Relative Frequency using STAY			The above number is the Long Run Relative Frequency using SWITCH	

The probability of an event equals the long run relative frequency of the times the event occurs. Here our long run relative frequency of wins using STAY strategy is _____, and our long run relative frequency of wins using SWITCH strategy is _____. Or in symbols $P(\text{winning using STAY strategy}) = \underline{\hspace{2cm}}$ and $P(\text{winning using SWITCH strategy}) = \underline{\hspace{2cm}}$.

Conclusion: On a separate sheet write what you would recommend Bill or Ted to convince them which strategy leads to success more often.