THM Content Design Document

Title:	Monty Hall Problem
Course:	(the course code which this design is for)
Due date:	(when the demo is due, set by content manager)

Instructions Text:

Here you'll learn about the Monty Hall problem. Use Explore Mode to simulate the game, then go to the quiz for a probabilistic analysis.

Description Text:

Simulate & analyze the Monty Hall problem.

Subject Filter:

Statistics

Subject Tags:

Statistics

Special considerations / Additional resources:

(This section is for miscellaneous instructions specific to this demo and resources the developer could use to better understand this concept.)

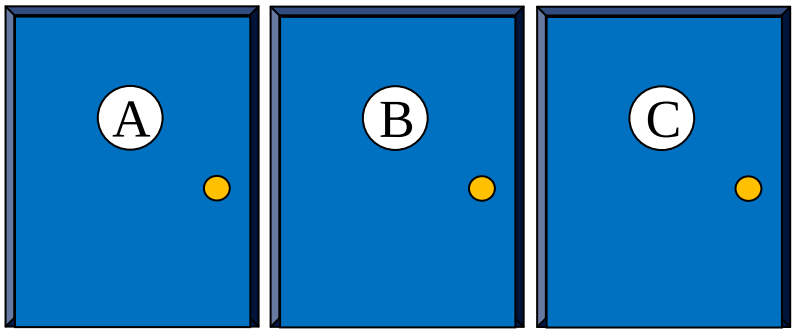
Content manager approval:	(Sign off for THM content manager)
Professor approval:	(Sign off for the commissioning professor)

Explore mode storyboard

Progress Bar

Title text block

Welcome to the Monty Hall game! Behind one of the doors is a large cash prize, but the rest contain nothing. Click a door to make your guess.



Switched	Didn't Switch
Total: Wins: Wins/Total =	Total: Wins: Wins/Total =

Control Panel

Go to Quiz

Simulate…

5 runs

Switch

Don't switch

Go

Description:

When Explore Mode starts, everything is displayed as above, except the two boxes at the bottom labelled "Switched" and "Didn't Switch". These are invisible initially.

Here the user can repeatedly play the Monty Hall guessing game (described below), or use the Control Panel to quickly simulate many repetitions of the game.

In the Monty Hall game, there are 3 doors, with a prize behind one of them (drawn as a bag with a "$" on it). Each time the user repeats the game, the prize should randomly be placed behind a different door. The other two doors are empty, and just contain black space when opened.

The steps for playing the game are as follows.

1. Initially the displayed text is "Welcome to the Monty Hall game! Behind one of the doors is a large cash prize, but the rest contain nothing. Click a door to make your guess."

   The user can now click any one of the doors. Doing so outlines the door in yellow to indicate the selection.
2. Once a door is selected, one of the empty doors opens (but *never* the door the user chose), to reveal the empty black space. The displayed text changes to "Now one of the empty doors is revealed! You can now switch doors or stay with your current choice. Which door do you choose?"

   The selection from step 1 remains, but the user is free to click either of the two remaining

unopened doors, to switch the selection or stay with the current selection. Clicking either one brings the game to step 3.

3. The selected door opens, to reveal whatever was behind it (either the $ bag, or black space). The displayed text changes to either, “Congratulations, you won the prize!”, or “Sorry, better luck next time.”, followed by “Click below to play again, or use the Control Panel to quickly simulate many runs. When ready, click “Go to Quiz” for a probabilistic analysis of the game.”

   Whether or not the user won the prize, a button also appears behind the selected door when it opens. This button says “Play Again”, and clicking it resets the game to Step 1.

The first time the game is played, once Step 3 is reached, the two boxes beneath the doors appear. These are labelled “Switched” and “Didn’t Switch”. In each box, “Total” keeps track of the number of times the user made that choice, and “Wins” keeps track of the number of times the user won with that choice. So, when the user switches doors, only the “Switched” box gets updated, and when they don’t, only “Didn’t Switch” gets updated.

The user can use the Control Panel to quickly simulate the game many times. The user enters the number of repetitions in the text box, which also has up/down arrows to change the value. The user then chooses a strategy, “Switch” or “Don’t Switch”, from the two radio buttons. This choice will get applied to every repetition of the game.

When the user clicks “Go”, the game gets played automatically by the demo, as many times as the user specified. During this, the “Go” button changes to “Cancel”, which stops the process. The steps of the game occur mostly as if the user were clicking through the game, as described in steps 1 – 3, but with a few differences:

-The displayed text simply says “Simulating gameplay. Use the Control Panel to cancel.” This does not change until all the repetitions are done, at which point it changes back to the initial text.
-The steps of the game should play out quickly, such that each repetition of the game takes only 1 second.
-There is no “Play Again” button behind the last door chosen. When the repetition is over, all the doors close, and the location of the prize is again randomized.

For each repetition, the boxes below the doors should be updated appropriately.

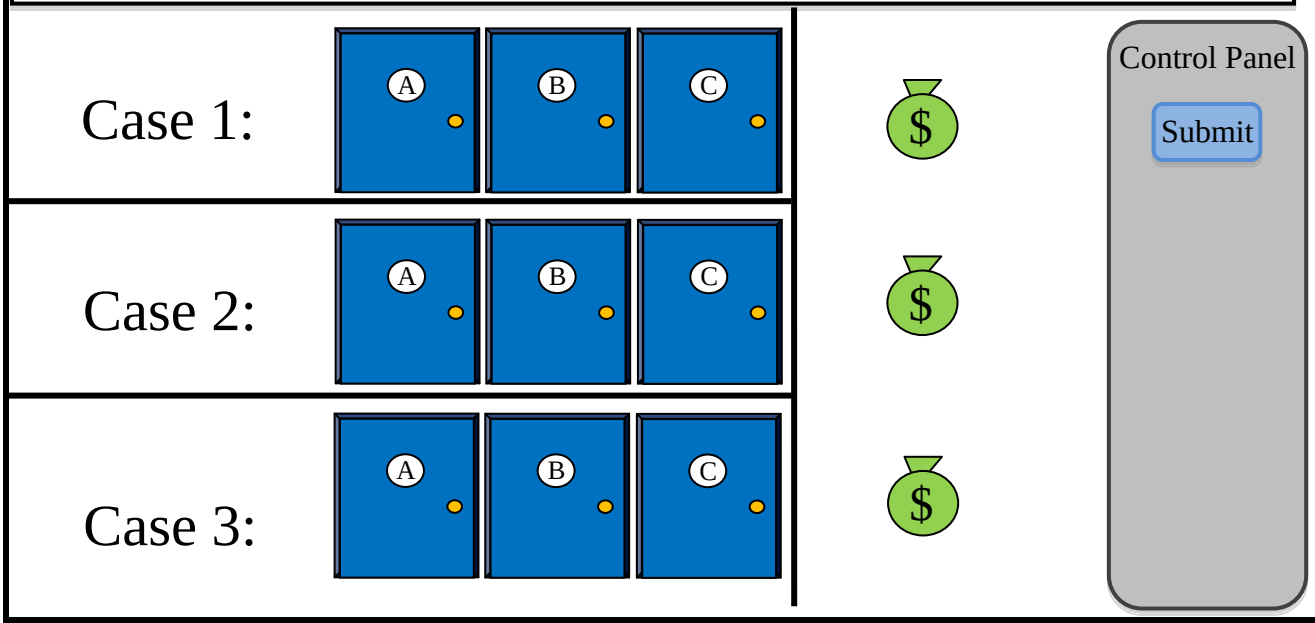
Question storyboard

Question number: 1

Progress Bar

Title text block

Now we'll calculate the probability of winning under each strategy. To begin, set up each possible initial configuration by dragging the prizes to different doors. Then click "Submit" and next.



Description:

The screen is now split into 3 rows, by horizontal lines. The rows are labelled "Case 1", "Case 2", "Case 3". Each row has a copy of the 3 doors from Explore Mode, but smaller.

There is a vertical line to the right of these doors, cutting off the horizontal lines. In the blank space past this, there are 3 small $ bags, arranged as shown. The user can drag any of these bags to any of the doors, and the bag should sit in front of that door. Dragging a bag to any location other than a door causes it to snap back to its previous position. Only one bag can fit on a door at a time.

Correct answer:

There should be one bag on door A, one on door B, and one on door C. All the bags should be on separate rows. Otherwise, the answer is incorrect.

Incorrect answer animation:

If not all the bags have been placed, the remaining bag(s) turn red briefly, then back to green.

If all the bags have been placed, but some are not in the correct configuration, a popup appears that says "Please try again. In each case, there should be only 1 door with a prize."

"Show Answer" animation:

The bags move to different doors. If none have been placed yet:
-the bag on the top row moves to door A
-the bag on the middle row moves to door B
-the bag on the bottom row moves to door C

If the user has already placed some bags, the rest should move such that the answer is correct. The bags placed by the user should not be moved, except for any that are incorrect.

Question storyboard

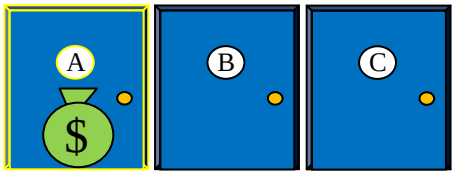
Question number: 2

Progress Bar

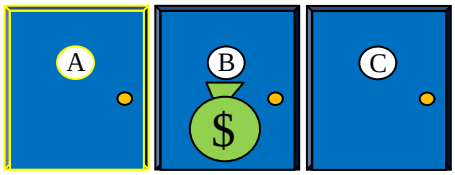
Title text block

The player chooses door A. What is the probability that they win the prize? What is the probability that the door is empty? Click to choose your answers, then click "Submit" and next.

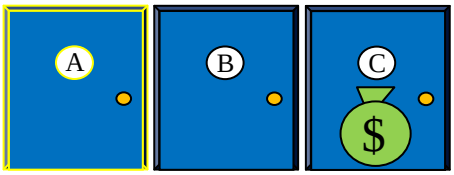
Case 1:



Case 2:



Case 3:



P(prize)=

1/3 0

1 2/3

P(empty)=

1/3 0

1 2/3

Control Panel

Submit

Description:

The bags remain in the positions assigned by the user in the last question.

Now, Door A has a yellow outline in each row (as if selected, in Explore Mode).

In the blank space to the right, there are now 2 labels, with 4 clickable options beneath each, as shown above. Only 1 option from each group can be selected at a time. The selected circle turns a lighter colour, and gets a thick outline, to indicate it's selected.

The user answers by selecting an option from each group.

Correct answer:

In the group labelled “P(Prize)=”, the option 1/3 should be selected. In the group labelled “P(No Prize)=”, the option 2/3 should be selected.
Incorrect answer animation:
The incorrect selection turns red briefly, then turns back to its original colour.
“Show Answer” animation:
The correct options become selected.

Question storyboard

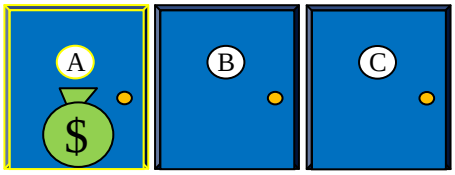
Question number: 3

Progress Bar

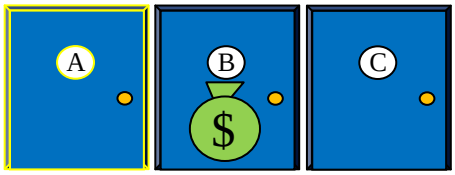
Title text block

Now, reveal one empty door for the player, by clicking on the door. Do this for each case, then click “Submit” and next.

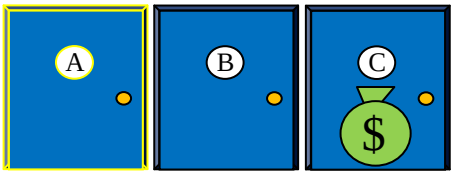
Case 1:



Case 2:



Case 3:



Control Panel

Submit

Description:

The display is the same as last question, except the white space to the right is empty.

The user can now click on any door to open/close it. If it’s an empty door, it should just display black space. If the door has a money bag, the bag should still be visible whether the door is open or closed.

Correct answer:

Exactly 1 **empty** door from each row should be opened, otherwise the answer is incorrect. It does not matter *which* empty doors are opened.

Incorrect answer animation:

The label on any row that has an error turns red, until the user clicks a door on that row.

“Show Answer” animation:

1 empty door from each row becomes open.

Question storyboard

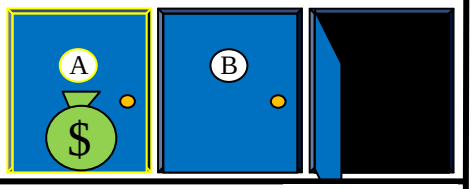
Question number:	4

Progress Bar

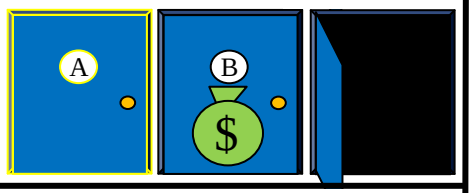
Title text block

Now, reveal one empty door for the player, by clicking on the door. Do this for each case, then click “Submit” and next.

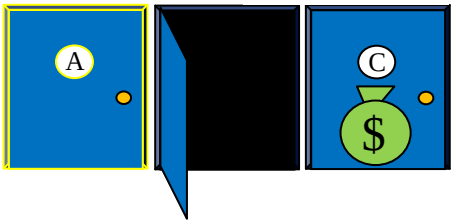
Case 1:



Case 2:



Case 3:



P(prize|switch)=

1/3 0

1 2/3

P(prize|no switch)=

1/3 0

1 2/3

Control Panel

Submit

Switch

Don’t Switch

Description:

The doors that were opened in the last question are still open now.

In the empty space to the right, there are 2 labels, each with a group of 4 options that can be selected (as in Question 2). Here the labels are different, as shown above.

In the Control Panel are two buttons, “Switch” and “Don’t Switch”. Only one can be selected at a time; this one turns a lighter colour, and gets a thick outline. These control which doors are “selected” (yellow outline).

If “Don’t Switch” is selected, the doors that are “selected” are just Door A (as in previous questions). If “Switch” is selected, the selected door on each row changes to whichever door isn’t opened. For example, on the row “Case 1”, door B would become selected, but on “Case 3”, door C would become selected.

The user can click both these buttons to switch back and forth between the cases.

Correct answer:

The correct answer only depends on which green circles are selected. In the top group, “2/3” should be selected; in the bottom group, “1/3” should be selected.

Incorrect answer animation:

Any incorrectly selected items turn red briefly, then return to their previous colour.
“Show Answer” animation:
The correct options become selected.

Appendix storyboard

Appendix Number	(The appendix number)

Description:

(A basic description of any graphics above. If additional room is needed use additional appendixes)