

# MATH 4810/5210

## PROJECT. SIMULATING MONTY HALL

The purpose of the project is to acquire skills of simulating random experiments and to gain intuition for the Monty Hall paradox. The project is due December 1.

There are 6 scenarios to analyze. For each scenario run 100 simulations. Follow the steps below.

1. Write a computer code that simulates the steps involved in the Monty Hall game: first, one of three doors, indexed 1,2, and 3, is chosen at random to place the car behind, then the participant picks at random one of the doors, after which Monty Hall opens a door behind which is a goat. After that the participant chooses one of the two unopened doors and wins if the car is behind the chosen door. The output of the code is the winning probability over 100 rounds.
2. Investigate the following strategies by the participant:
  - (a) she sticks with the door she picked at first (“stay strategy”),
  - (b) she picks the other available door (“switch strategy”),
  - (c) she flips a fair coin to decide whether to stay or to switch.
3. Investigate different strategies by Monty Hall when, provided the participant picked the door with the car, the door with a goat is chosen
  - (a) at random,
  - (b) to have the smaller index out of the two doors with goats with probability  $1/3$  and to have the larger index, with probability  $2/3$ .
4. Give a probabilistic analysis of the scenario where the participant follows strategy 3 and Monty Hall follows strategy 2.
5. Write a report on your findings. It must contain: a description of the problem, a description of the algorithm used (pseudocode), the code with the results of simulations, theoretical analysis as stipulated in part 4, and your conclusions on which strategy maximizes the winning probability. The report must be written in such a way that a person who has no idea about the Monty Hall paradox can understand both the setting and the results.