Monty Hall Problem

About

In a game show, the contestent is presented with three doors. Behind one door is a sports car, which they will win if they select the right door.

```
initial_doors = ["A" "B" "C"]
```

```
initial_doors = 1×3 string
"A"          "B"          "C"
```

```
correct_answer = "B"
```

```
correct_answer =
"B"
```

The contestent picks a random door:

```
initial_selection = "A"
```

```
initial_selection =
"A"
```

The game show host then selects one of the two remaining doors that **does not** contain the sports car, and opens it for the contestent.

```
reduced_doors = ["A" "B"]
```

```
reduced_doors = 1×2 string
"A"          "B"
```

The contestent is then presented a choice. Do they stick with their original decision, or flip to the other door.

```
second_selection = "A"
```

```
second_selection =
"A"
```

```
win = second_selection == correct_answer
```

```
win = logical
   0
```

The contestent sticks with their original answer, and fails to win a sports car.

Simulation Solution

```
results = table( [],[],[],[],[],[] );
results.Properties.VariableNames = ["correct_answer" "initial_selection" "removed_door" "second

methods = ["switch" "stick"];

iterations = 1000;
for i = 1:iterations
    initial_doors = ["A" "B" "C"];
```

```
    % Randomly assign a winning door
    correct_answer = initial_doors(randi(3));

    % Select a door
    initial_selection = initial_doors(randi(3));

    % Remove a incorrect door
    idx = find((initial_doors ~= initial_selection) & ...
        (initial_doors ~= correct_answer));
    idx=idx(randperm(length(idx),1));
    removed_door = initial_doors(idx);

    reduced_doors = initial_doors( initial_doors ~= removed_door );

    % Decide whether to switch or stick
    method = methods(randi(2));

    switch method
        case "switch"
            second_selection = reduced_doors(reduced_doors ~= initial_selection);
        case "stick"
            second_selection =  initial_selection;
    end

    win = any(second_selection == correct_answer);

    results = [results; {correct_answer initial_selection removed_door second_selection method
end
```

View results

```
results(randperm(height(results),8),:)
```

ans = 8×6 table

...

	correct_answer	initial_selection	removed_door	second_selection	method
1	"A"	"B"	"C"	"A"	"switch"
2	"A"	"C"	"B"	"C"	"stick"
3	"A"	"C"	"B"	"A"	"switch"
4	"A"	"A"	"B"	"A"	"stick"
5	"B"	"A"	"C"	"A"	"stick"
6	"A"	"C"	"B"	"A"	"switch"
7	"C"	"A"	"B"	"A"	"stick"
8	"B"	"B"	"A"	"C"	"switch"

Calculate win rates by method

```
win_rate = groupsummary(results(:,["method" "win"]), "method", 'mean')
```

win_rate = 2×3 table

	method	GroupCount	mean_win
1	"stick"	512	0.3398
2	"switch"	488	0.6393

```
for ii = 1:height(win_rate)
    disp( "Win rate for " + win_rate.method{ii} + " = " + num2str(win_rate.mean_win(ii)*100,"%1
end
```

```
Win rate for stick = 34%
Win rate for switch = 64%
```