CS267A: Homework #3

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Acknowledgements: If you have discussed with other students in the class regarding this homework, please acknowledge their names. See the syllabus for detailed policies about collaboration and academic honesty.

Problem 1

1.
> **Solution:**
> Value Probability
> true 0.561600
> false 0.438400

2. Please find the following my code that generates the solution.

```
let a = flip 0.3 in
let b = flip 0.6 in
let c = flip 0.1 in
let d = flip 0.8 in
let e = flip 0.4 in
(a || b || !c )&& (b||c||d||!e)&&(!b||!d||e)&&(!a||!b)
```

3.
> **Solution:**
> Value Probability
> true 0.665000
> false 0.335000

4. Please find the following my code that generates the solution.

```
let a = flip 0.2 in
let b = flip 0.1 in
let c = flip 0.8 in
let d = flip 0.3 in
let e = flip 0.5 in
(!a || c || d )&& (b||c||!d||e)&&(!c||d||!e)
```

Problem 2

> **Solution:**
>
> Value Probability
>
> true 0.459664
>
> false 0.540336

1.

2. Please find the following my code that generates the solution.

```
let burglary = flip 0.001 in
let earthquake = flip 0.002 in
let alarm = if burglary then if earthquake then flip 0.95 else flip
    0.94 else if earthquake then flip 0.29 else flip 0.001 in
let john =        if alarm then flip 0.9 else flip 0.05 in
let mary =        if alarm then flip 0.7 else flip 0.01 in
let temp = observe john in
let temp = observe mary in
burglary || earthquake
```

> **Solution:**
>
> Value Probability
>
> true 0.037894
>
> false 0.962106

3.

4. Please find the following my code that generates the solution.

```
let burglary = flip 0.001 in
let earthquake = flip 0.002 in
let alarm = if burglary then if earthquake then flip 0.95 else flip
    0.94 else if earthquake then flip 0.29 else flip 0.001 in
let john =        if alarm then flip 0.9 else flip 0.05 in
let mary =        if alarm then flip 0.7 else flip 0.01 in
let temp = observe !burglary in
let temp = observe mary in
earthquake
```

Problem 3

> **Solution:** The probability of picking the car at the first time is 0.3333... as we know, from the program we can tell that when we observe a goat door, the probability of picking a car after switch become
>
> Value Probability
>
> true 0.666667
>
> false 0.333333

1. In that case, the probability of switching increase and the contestant should always switch.

2. Please find the following my code that generates the solution.

2

```
let a = flip 0.33333 in
let b = flip 0.33333 in
let c = flip 0.33333 in
let _ = observe ((a&&!b&&!c)||(!a&&b&&!c) ||(!a&&!b&&c)) in
let z = if a then b || c
else (if b then b else c) in
z
```

> **Solution:** According to the question, the probability of picking a car at the beginning is 0.6 at this time. Then we can calculate the probability of picking the correct car after switch:
>
> Value Probability
>
> true 0.264591
>
> false 0.735409
>
> From the output we can tell that the probability after switching is lower than the beginning. So the contestant should not switch.

3.

4. Please find the following my code that generates the solution.

```
let a = flip 0.6 in
let b = flip 0.3 in
let c = flip 0.1 in
let _ = observe ((a&&!b&&!c)||(!a&&b&&!c) ||(!a&&!b&&c)) in
let z = if a then b || c
else (if b then b else c) in
z
```

Problem 4

Solution: The diagram is as follows: