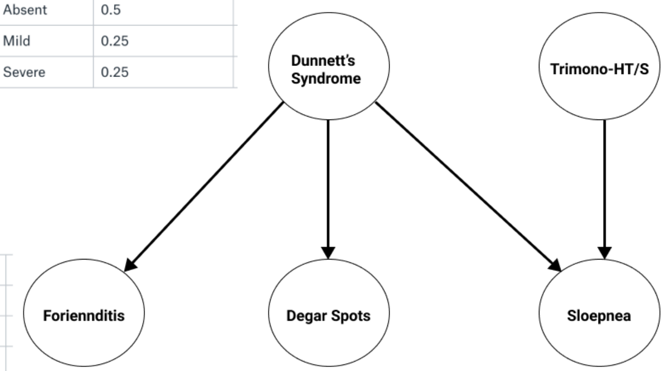
Assignment 4

A4Q1



Dunnett	Probability
Absent	0.5
Mild	0.25
Severe	0.25

Value	Probability
Has gene	0.1
Doesn't have	0.9

Dunnett	Probability
Absent	0.01
Mild	0.3
Severe	0.8

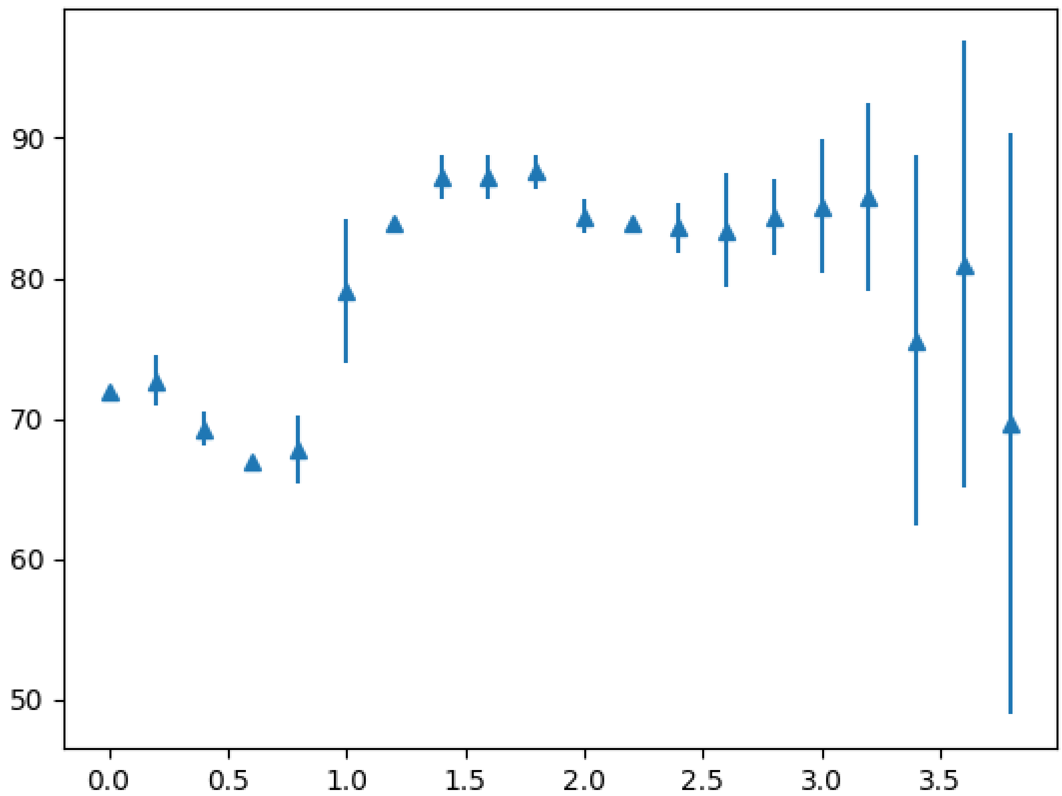
Dunnett	Probability
Absent	0.01
Mild	0.8
Severe	0.3

Dunnett	Has Trimono	Probability
Absent	No	0.01
Absent	Yes	0.001
Mild	No	0.5
Mild	Yes	0.05
Severe	No	0.5
Severe	Yes	0.05

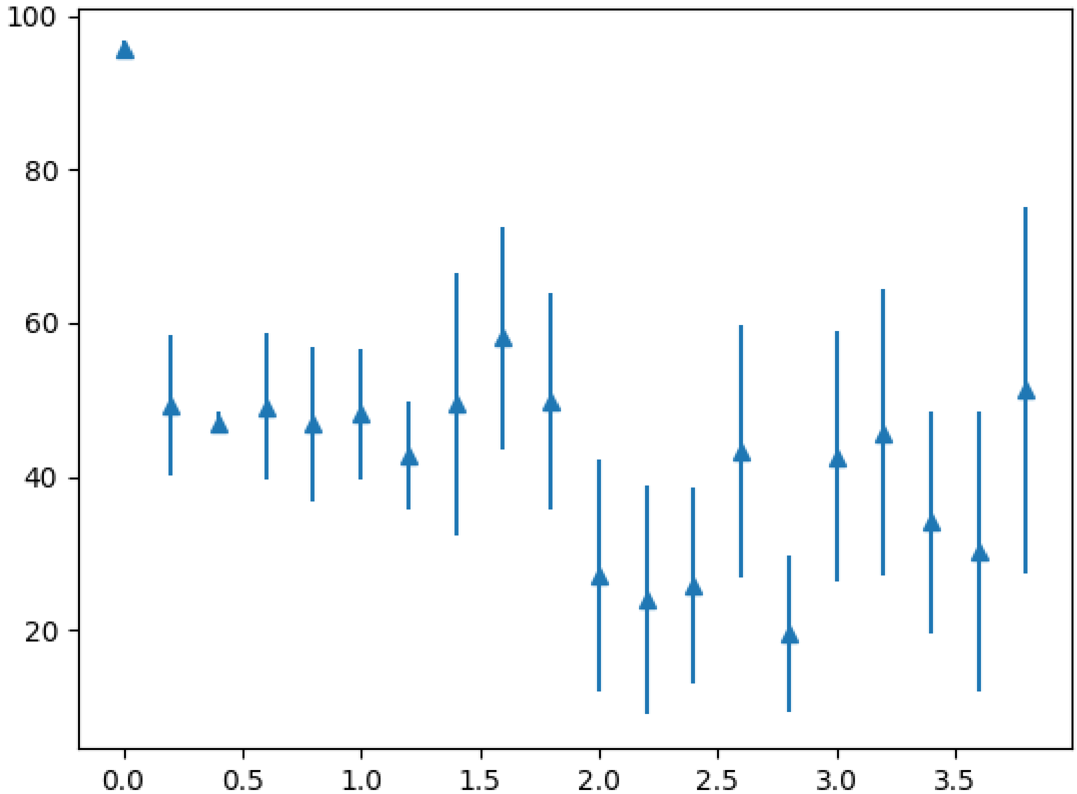
A4Q1b)

View `em.py` and `bn.py`

A4Q1c)



Before EM



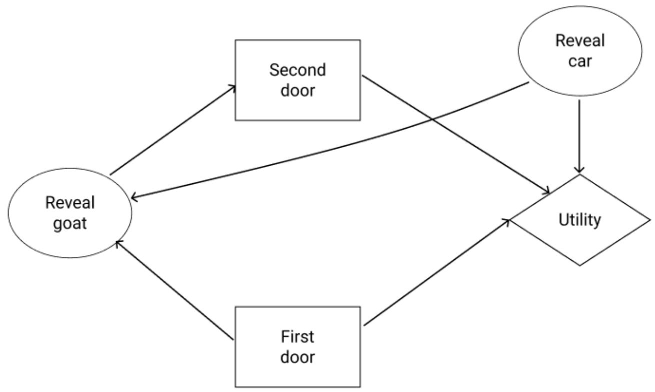
After EM

A4Q2

A4Q2a

First door	Reveal car	Reveal goat	Value
1	1	1	0
1	1	2	0.5
1	1	3	0.5
1	2	1	0
1	2	2	0
1	2	3	1
1	3	1	0
1	3	2	1
1	3	3	0
2	1	1	0
2	1	2	0
2	1	3	1
2	2	1	0.5
2	2	2	0
2	2	3	0.5
2	3	1	1
2	3	2	0
2	3	3	0
3	1	1	0
3	1	2	1
3	1	3	0
3	2	1	1
3	2	2	0
3	2	3	0
3	3	1	0.5
3	3	2	0.5
3	3	3	0

Reveal car	Value
1	p_1
2	p_2
3	$1 - p_1 - p_2$



First door	Second door	Reveal car	Value
1	1	1	1
1	1	2	0
1	1	3	0
1	2	1	0
1	2	2	1
1	2	3	0
1	3	1	0
1	3	2	0
1	3	3	1
2	1	1	1
2	1	2	0
2	1	3	0
2	2	1	0
2	2	2	1
2	2	3	0
2	3	1	0
2	3	2	0
2	3	3	1
3	1	1	1
3	1	2	0
3	1	3	0
3	2	1	0
3	2	2	1
3	2	3	0
3	3	1	0
3	3	2	0
3	3	3	1

Variables

- **First door**: Decision variable, which door we choose first
- **Reveal goat**: Random variable, which door we reveal to have a goat
- **Second door**: Decision variable, which door we choose next
- **Reveal car:** Random variable, where the car is located
- **Utility:** Utility function

Reveal car	Value	
1	p_1	
2	p_2	
3	$1 - p_1 - p_2$	

First door	Second door	Reveal car	Value	
1	Stay	1	1	
1	Stay	2	0	
1	Stay	3	0	
1	Switch	1	0	
1	Switch	2	1	
1	Switch	3	1	
2	Stay	1	0	

2	Stay	2	1	
2	Stay	3	0	
2	Switch	1	0	
2	Switch	2	1	
2	Switch	3	1	
3	Stay	1	0	
3	Stay	2	0	
3	Stay	3	1	
3	Switch	1	1	
3	Switch	2	1	
3	Switch	3	0	

First door	**Reveal car**	**Reveal goat**	**Value**	
1	1	1	0	
1	1	2	0.5	
1	1	3	0.5	
1	2	1	0	
1	2	2	0	
1	2	3	1	
1	3	1	0	
1	3	2	1	
1	3	3	0	
2	1	1	0	
2	1	2	0	
2	1	3	1	
2	2	1	0.5	
2	2	2	0	
2	2	3	0.5	

2	3	1	1	
2	3	2	0	
2	3	3	0	
3	1	1	0	
3	1	2	1	
3	1	3	0	
3	2	1	1	
3	2	2	0	
3	2	3	0	
3	3	1	0.5	
3	3	2	0.5	
3	3	3	0	

A4Q2b)

<u>(Answer is based on intuition for part marks)</u>
The optimal policy is to pick any door initially, and then always switch.

We set $p_1 = \frac{1}{3}$ and $p_2 = \frac{1}{3}$
We sumout on **Reveal Car**

First door	**Reveal goat**	**Value**	
1	1	0	
1	2	1/6	
1	3	1/6	
2	1	1/6	
2	2	0	
2	3	1/6	
3	1	1/6	
3	2	1/6	

3	3	0	

A4Q2c)

The optimal policy is to pick door 3. If door 1 is revealed to have a goat, then stay. Otherwise, if door 2 is revealed to have a goat, then swap to door 1.