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CSCI1820 hw3

Problem 0
Code for this program can be found in 'alignment_with_inversions.py'. Instructions can be found in README.txt

The U and V matrices store information for the linear gap function. Using these matrices allows reduction to quadratic computing time.
The W matrix stores the score for an alignment ending at the given position.
The Z matrix stores the score for global alignment of sequence 1 from position *g* to *i* with the reverse complement of sequence 2 from position *h* to *j.*

Problem 1
Code for this problem can be found in 'contamination.py'. Instructions can be found in README.txt.

The following sequence/vector combinations are contaminated:

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
V1			X			X				X
V2					X					
V3		X								
V4					X					
V5										
V6	X					X		X		X
V7					X					
V8	X	X	X	X		X	X	X	X	X
V9			X			X				
V10	X	X	X			X	X			X
V11	X	X							X	
V12								X		
V13			X					X	X	

Problem 2

1) 5 doors, 3 goats, 2 cars.
   I found it easier to justify this problem without conditional probability. Initially, each door has a uniform probability of a car (2/5 in this case). The sum of the probabilities for all doors is equivalent to the number of cars available (2 in this case). The sum of probabilities must remain constant through the entire game.
   The door you choose is fixed with a probability of 2/5. After Monty opens a door, the remaining probability "density" must be redistributed among the remaining doors, not including the one you chose. This means 8/5 must be distributed among the three remaining doors, giving each probability 8/15 of having a car. 8/15 > 2/5, therefore you should switch after Monty reveals a goat.

2) (m+n) doors, m goats, n cars.

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The probability of choosing a car on your initial pick is $\frac{(n+m)}{n}$, referred to hereafter as p_1.
The sum of probabilities across all doors is the number of cars, *n.*
After Monty reveals a door, there are *(m+n-2)* doors left to distribute probability $(n-p_1)$.
If we call the probability of picking a car after switching p_2:

$$n = p_1 + (m + n - 2)p_2$$

$$p_2 = \frac{n - p_1}{(m + n - 2)}$$

It is advantageous to switch if $p_2 > p_1$. As it turns out, it is always advantageous to switch!

Problem 3

The FDA rep is incorrect in her reasoning. The situation presented is equivalent to the Monty Hall problem with pharma A being the door you pick, and Monty revealing one of the other pharmas as a "goat." As we've seen, this says nothing about the probability of pharma A being successful. Their probability remains at 1/3.