CSE 415 Assignment 6: Bayes' Rule and Markov Deicision

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Problems

1. Should Anyone Panic?

(a) ***Solution.*** Let D be the event that the Lucy has *HPAI* and E the event that test result is positive. Then the probability will be

$$\begin{aligned} P(D|E) &= \frac{P(D \cap E)}{P(E)} \\ &= \frac{P(E|D)P(D)}{P(E|D)P(D) + P(E|D^c)P(D^c)} \end{aligned}$$

We have the probability table

	True(Effected)	False(Not Effected)
Positive	0.95	0.05
Negative	0	1

$$\begin{aligned} P(D|E) &= \frac{P(E|D)P(D)}{P(E|D)P(D) + P(E|D^c)P(D^c)} \\ &= \frac{(0.95)(\frac{1}{1000})}{(0.95)(\frac{1}{1000}) + (0.05)(\frac{999}{1000})} \\ &\approx 0.01866 \\ &= 1.866\% \end{aligned}$$

So the updated probability that Lucy has *HPAI* is 1.866%

(b) ***Solution.*** Similiarly, let D be the event that the Lucy has *HPAI* and E the event that test result is positive. Then the probability will be

$$
\begin{aligned}
P(D|E) &= \frac{P(D \cap E)}{P(E)} \\
&= \frac{P(E|D)P(D)}{P(E|D)P(D) + P(E|D^c)P(D^c)} \\
&= \frac{(0.95)(\frac{1}{80})}{(0.95)(\frac{1}{80}) + (0.05)(\frac{79}{80})} \\
&\approx 0.1939 \\
&= 19.39\%
\end{aligned}
$$

So the updated probability that James has *HPAI* is 19.39%

As the result, James should seek for assistance since he has a probability of ~19% that he has *HPAI* meanwhile Lucy could be not panic for having the decease.

2. The Mecha-Mouse at the Hostel for Travelling Droids

i. ***Answer.*** The number of different policies that are possible for Mecha-mouse is

$$3^4 = 81$$

where 4 is the number of rooms (s), and 3 is the number of possible actions (a) in each room (state).

ii. ***Answer.*** Using the Bellman Equation

$$V^*_{k+1}(s) = max_a \sum_{s'} T(s,a,s')[R(s,a,s') + \gamma V^*_k(s')]$$

Value iterations for six times which means iterating til $k = 6$ from $k = 0$

Iteration	Dormitory	Mess Hall	Lavatory	Pantry	Ambushed	Kaput
#1	3.2	6	6	3.2	0	0
#2	6.2	7.6	7.6	6.2	0	0
#3	7	9.1	9.1	7	0	0
#4	7.75	9.5	9.5	7.75	0	0
#5	7.95	9.875	9.875	7.95	0	0
#6	8.1375	9.975	9.975	8.1375	0	0

iii. *Answer:* The optimal policy I got is

D	L	P	M	A	K
Y	X	X	X	$*$	$*$