CSE 415: Assignment 6 Part I

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1 Bay of Bayes

Let F be the event that at least one fish is caught. Let R be the event that it has just stopped raining.

1.1 Determine the prior probability of catching a fish during a 10-minute attempt.

$P(F) = \frac{20}{100} = \frac{1}{5}$.

1.2 Determine the conditional probability that it has just stopped raining given that one or more fish were caught during a single attempt.

$P(R|F) = \frac{P(F|R)P(R)}{P(F)} = \frac{\frac{5}{7}\frac{7}{100}}{\frac{1}{5}} = \frac{1}{4}$.

1.3 Determine the conditional probability that it has just stopped raining given that no fish were caught.

$P(R|\neg F) = \frac{P(\neg F|R)P(R)}{P(\neg F)} = \frac{\frac{2}{7}\frac{7}{100}}{\frac{4}{5}} = \frac{1}{40}$.

1.4 Determine the probability of one fisherman catching one or more fish during a single 10-minute period given that it has just stopped raining using Bayes' rule.

$P(F|R) = \frac{P(R|F)P(F)}{P(R)} = \frac{\frac{1}{4}\frac{1}{5}}{\frac{7}{100}} = \frac{5}{7}$.

1.5 Determine the joint probability distribution for these two random variables.

	R	$\neg R$
F	$\frac{5}{100}$	$\frac{15}{100}$
$\neg F$	$\frac{2}{100}$	$\frac{78}{100}$

1.6 Write down the marginal distributions for each of the random variables. Then compute the product distribution for the two marginals.

R	$\neg R$	F	$\neg F$
$\frac{7}{100}$	$\frac{93}{100}$	$\frac{20}{100}$	$\frac{80}{100}$

RF	$\neg R \neg F$
$\frac{7}{500}$	$\frac{372}{500}$

We can conclude that these are not independent as the product distribution values contradict both what we observe and the conditional probabilities that we calculated. Given that this is a small sample size, we may be somewhat hesitant to reject independence, though the results we see above force our hand.

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

2.1 Give the number of different policies that are possible for Mecha-mouse in the hostel.

$3^4 = 81$ posible policies. This is derived from 3 possible actions per each 4 decision states.

2.2 Manually apply the values iteration method to this problem for six iterations. Show the value at each state in each iteration. Assume that the discount factor is 0.5.

D	M	L	P	A	K	
0	0	0	0	0	0	iter. 0
$\frac{16}{5}$	6	6	$\frac{16}{5}$	0	0	iter. 1
$\frac{24}{5}$	9	9	$\frac{24}{5}$	0	0	iter. 2
$\frac{36}{5}$	13.5	13.5	$\frac{36}{5}$	0	0	iter. 3
$\frac{54}{5}$	20.25	20.25	$\frac{54}{5}$	0	0	iter. 4
$\frac{81}{5}$	30.375	30.375	$\frac{81}{5}$	0	0	iter. 5
24.3	45.56	45.56	24.3	0	0	iter. 6

2.3 Based on your analysis, give the optimal policy as an action for each state.

Let $\pi^* : S \to A$ with S the set of states and A the set of possible actions be the optimal policy. Then we have:

$\pi^*(\cdot)$	$\pi^*(D)$	$\pi^*(M)$	$\pi^*(L)$	$\pi^*(P)$	$\pi^*(A)$	$\pi^*(K)$
$a \in A$	y	x	x	x	$*$	$*$