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1 Problem 1

a) The fundamental Naive Bayes assumption is that each feature makes an independent and equal contribution to the outcome. In this example, we have the X=Temperature and Y=Season. As such we check for independence between the features (X and Y). To do so, we can see that P(X—Y) = P(X) and similarly for P(Y—X) = P(Y) since P(X) = P(Y) =.5 by marginalizing the table, we can say that the Naive Bayes assumption holds true. Temperature and Season are independent for high or low electricity use.

b) Compute using NB: $p(Z=1|A=0,B=1,C=0) = \frac{(A=0,B=1,C=0|Z=1)}{p(A,B,C}$

$$p(A=0) = .75$$
$$p(B=1) = .50$$
$$p(C=0) = .75$$
$$p(Z=1) = .75$$

$$p(A=0|Z=1) = .66$$
$$p(B=1|Z=1) = .33$$
$$p(C=0|Z=1) = .66$$

plug in the values derived from the data in the given table results in:

$$p(Z=1|A=0,B=1,C=0) = \frac{.66 * .33 * .66 * .75}{.75 * .5 * .75} = .3833$$

2 Problem 2

Consider a multiclass perceptron with initial weights w_A = [1 0 0], w_B = [0 1 0] and w_C = [0 0 1]. For prediction, if there is a tie, A is chosen over B over C. The following table gives a sequence of three training examples to be incorporated. When incorporating the second training example, start from the weights obtained from having incorporated the first training example. Similarly, when incorporating the third training example, start from the weights obtained from having incorporated the first training example and the second training example. Fill in the resulting weights in each row.

Feature Vector	Label	w_A	w_B	w_C
		[1 0 0]	[0 1 0]	[0 0 1]
[1 -2 3]	A	[2 -2 3]	[0 1 0]	[-1 2 -2]
[1 1 -2]	B	[2 -2 3]	[1 2 -2]	[-2 1 0]
[1 -1 4]	B	[2 -2 3]	[1 2 -2]	[-2 1 0]