Sample Questions

1. Bayesian Network

Consider a Bayesian network A → B ← C with 3 Boolean random variables with CPTs given below:
P(A)=0.2, P(C)=0.55, P(B|A,C)=0.25, P(B|A,¬C)=0.5, P(B|¬A,C)=0.3, P(B|¬A,¬C)=0.8. Compute: P(¬A,B,C), P(¬A |¬C), P(A|B,¬C)

2. Concept Learning

Num	Restaurant	Meal	Day	Cost	Reaction
1	The Nines	bkfst	Fri	$	sick (+)
2	Banfis	lunch	Fri	$$	ok (-)
3	The Nines	lunch	Sat	$	sick (+)
4	Moosewood	bkfst	Sun	$	ok (-)
5	The Nines	bkfst	Sun	$$	ok (-)

- [10 points] Apply the version space algorithm to the example above to learn the concept of *Reaction*. Show each step.
- [2 points] List two inadequacies of the algorithm

3. Decision Tree Learning

The following dataset will be used to learn a decision tree for predicting whether a mushroom is edible or not based on its shape, color and odor.

Shape	Color	Odor	Edible
C	B	1	Yes
D	B	1	Yes
D	W	1	Yes
D	W	2	Yes
C	B	2	Yes
D	B	2	No
D	G	2	No
C	U	2	No
C	B	3	No
C	W	3	No
D	W	3	No

a. What is entropy H(Edible | Order = 1 or Odor = 3)?
b. Which attribute would the decision tree algorithm (described in class) choose to use for root of the tree?
c. Draw the full decision tree that will be learned from this training set.

4. Naive Bayes Learning

Suppose we are given the following dataset, where A,B,C are input binary random variables, and y is a binary output whose value we want to predict.

A	B	C	y
0	0	1	0
0	1	0	0
1	1	0	0
0	0	1	1
1	1	1	1
1	0	0	1
1	1	0	1

How would a naive Bayes classifier predict y given this input: A=0, B=0, C=1.
Assume that in case of a tie the classifier always prefers to predict 0 for y.

5. For MLE, EM, Clustering and Planning – understand the examples in the lecture slides. Become familiar with the pdf expression for univariate gaussain.