

NAME:

**COLLABORATOR(S):** Please write down the names of your collaborators. If none, please write so. Otherwise, you'll be deducted 10 points. You need to write your own solutions.

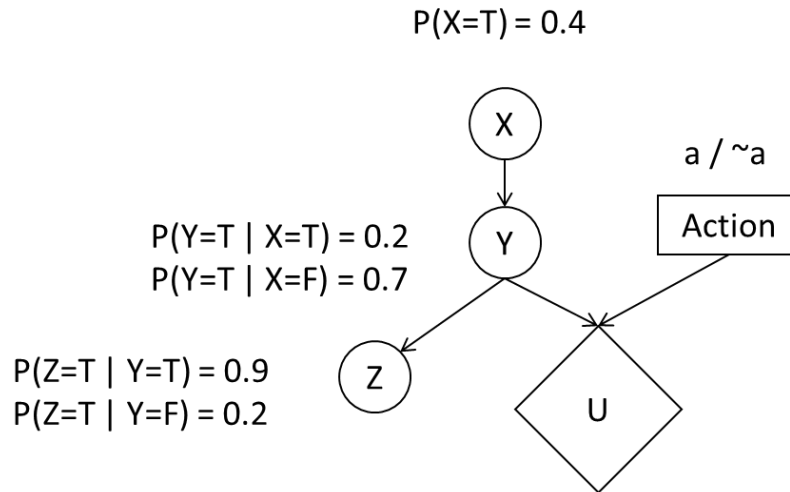
**CS480 – HOMEWORK 5**

**Assigned on: Wednesday, 11/19/2014**

**Due: Sunday, 11/30/2014, 11:59pm**

Please submit your solutions through blackboard assignment page.

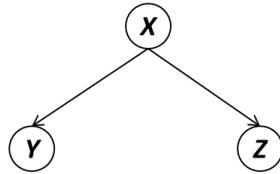
1. We are given the following decision network.



Y	Action	U(Y, Action)
T	a	800
T	$\sim a$	400
F	a	200
F	$\sim a$	1000

- What action should you take?
- What is the value of information of Z?
- What is the value of information of X?

2. We are given the following Bayesian network structure and the dataset. X and Y are binary with values T and F, Z has three possible values: R, G, B. In the data table, if a count is zero, it is not listed. For example, the count for <T, T, B> is zero, the count for <T, F, B> is zero, etc.



X	Y	Z	Counts
T	T	R	56
T	T	G	24
T	F	R	84
T	F	G	36
F	T	R	400
F	T	G	240
F	T	B	160

- Please estimate the necessary parameters for the network using maximum likelihood estimation.
  - Please estimate the necessary parameters for the network using Laplace smoothing.
3. We are given the following dataset. The class variable is C. Please answer the following questions.

F1	F2	C	Counts
T	T	T	9
T	T	F	3
T	F	T	27
T	F	F	9
F	T	T	3
F	T	F	21
F	F	T	1
F	F	F	7

- Estimate the necessary parameters for a naïve Bayes model using maximum likelihood estimation. (Do not prove maximum likelihood estimation.)
- Using the naïve Bayes model from part a, compute  $P(C|F1=F, F2=T)$ . That is, compute  $P(C=T|F1=F, F2=T)$  and  $P(C=F|F1=F, F2=T)$ . Simplify the terms as much as you can. Important: use the naïve Bayes model for this question, not the data.
- Estimate the necessary parameters for a naïve Bayes model using Laplace smoothing.

4. We have the following data.

F1	F2	C
-3	32	FALSE
-2	16	FALSE
-1	8	FALSE
1	4	TRUE
2	2	TRUE
3	1	TRUE

- Assuming  $w_b=0$ ,  $w_1=0$ ,  $w_2=0$ , what is the conditional log likelihood (CLL). Write down the equation and then calculate it using a calculator.
- Assuming  $w_b=0$ ,  $w_1=0$ ,  $w_2=0$ , what is the value of the gradient of the CLL with respect to  $w_b$ ? You should be able to calculate it without using a calculator.
- Assuming  $w_b=0$ ,  $w_1=0$ ,  $w_2=0$ , what is the value of the gradient of the CLL with respect to  $w_1$ ? You should be able to calculate it without using a calculator.
- Assuming  $w_b=0$ ,  $w_1=0$ ,  $w_2=0$ , what is the value of the gradient of the CLL with respect to  $w_2$ ? You should be able to calculate it without using a calculator.