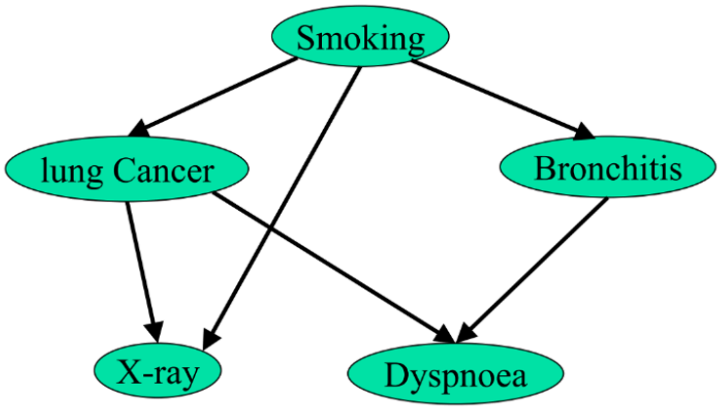
Advanced Artificial Intelligence, 2425

Workshop Task 1: Quiz on Discrete Bayes nets

Question 1

25 points

Given the following Bayesian Network with binary random variables,



(a) How is the joint distribution expressed in terms of the product of local conditional distributions -- in capitals and no spaces between characters? P(S,C,B,X,D) = [Blank 1]
(b) What is the number of probabilities using concise representations (i.e., inferring 1-p)? Answer = [Blank 2]
(c) What is the number of probabilities using full enumeration of domain values? Answer = [Blank 3]
(d) What is the number of parameters assuming that random variable S=Smoking has three values instead of two (and the other random variables remain binary) -- using concise representations? Answer = [Blank 4]
(e) What is the number of parameters assuming that random variable S=Smoking has three values instead of two (and the other random variables remain binary) -- using full enumerations? Answer = [Blank 5]

Blank 1

Blank 2

Blank 3

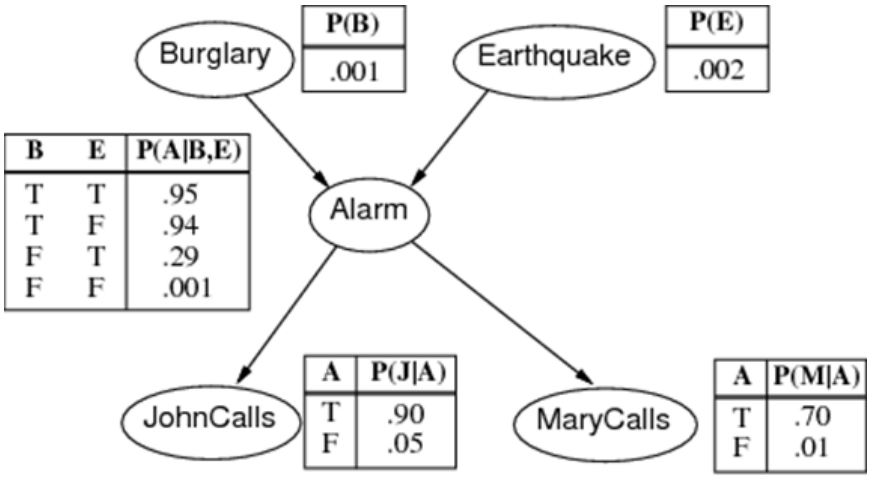
Blank 4

Blank 5

Question 2

25 points

Using the Burglary Bayes net discussed during this week's lecture



and the program `BayesNetInference.py` available in the workshop materials of task 2, calculate the following probabilities -- using up to 4 decimals and no rounding:
P(b|j,m)=[Blank 1]
P(-b|j,m)=[Blank 2]
P(e|j,m)=[Blank 3]
P(-e|j,m)=[Blank 4]

Blank 1

Blank 2

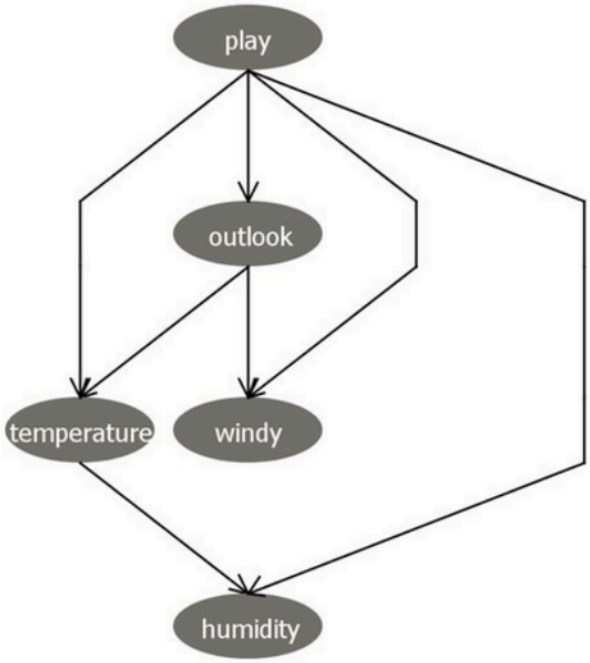
Blank 3

Blank 4

Question 3

25 points

Given the following Bayesian Network (where PT=play, O=outlook, T=temperature, W=windy, H=humidity) and the data discussed last week,



estimate its conditional probability tables using the program `CPT_Generator.py` (available in the workshop materials of this week) and calculate the following probabilities -- using up to 4 decimals and no rounding:
P(PT=yes|W=strong,O=rain)=[Blank 1] using Laplace smoothing
P(PT=no|W=strong,O=rain)=[Blank 2] using Laplace smoothing
P(PT=yes|W=strong,O=rain)=[Blank 3] using Additive smoothing with constant *l*=0.5
P(PT=no|W=strong,O=rain)=[Blank 4] using Additive smoothing with constant *l*=0.5
P(PT=yes|W=strong,O=rain)=[Blank 5] using bnlean as done last week
P(PT=no|W=strong,O=rain)=[Blank 6] using bnlean as done last week

Blank 1

Blank 2

Blank 3

Blank 4

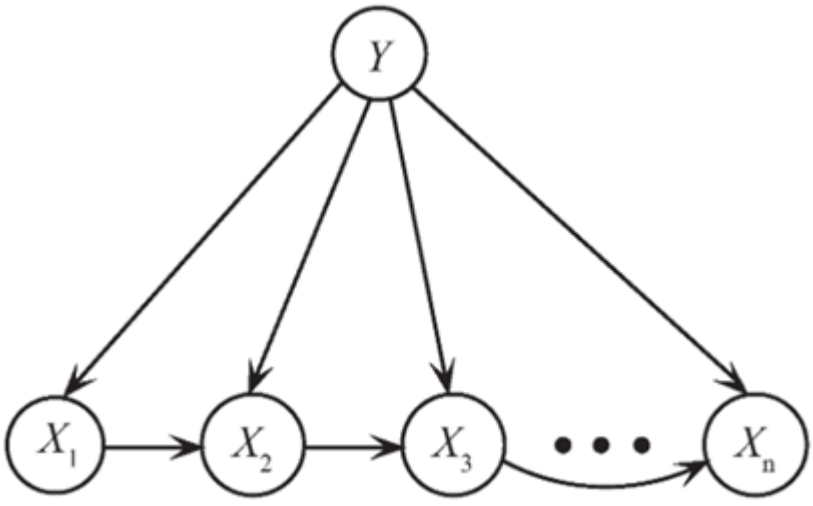
Blank 5

Blank 6

Question 4

25 points

Consider the following Bayesian network



and apply it to the task of language detection. Use the data in file `lang_detect_train.csv` to estimate the parameters using Laplace smoothing. Calculate the following probabilities with `BayesNetInference.py` using the provided test data (`lang_detect_test.csv`) -- your answers should use up to 4 decimals and no rounding:
P(Y=Dutch|hoe_gaat_het_met_je_vandaag)=[Blank 1]
P(Y=English|how_are_you_doing_today?)=[Blank 2]
P(Y=Spanish|como_estas_el_dia_de_hoy?)=[Blank 3]

If time permits (if not in your own time), repeat the calculations above but using a bnlearn-based program. Were the probabilities of bnlearn against those of `BayesNetInference.py` similar or very different?

Blank 1

Blank 2

Blank 3