MiniProject 3

ECE/CS 4720-7720 Machine Learning and Pattern Recognition

Write a program to evaluate the Bayesian belief network for the ***modified*** fish example in the textbook using the following information regarding $P(a_i)$, $P(b_j)$, $P(x_l|a_i, b_j)$, $P(c_k|x_l)$, and $P(d_m|x_l)$ – i.e. refer to the dependencies/graph in Example 4, in Chapter 2, but use the tables provided here instead.

P(a)			
$\mathrm{P}(a_1 = Winter)$	$\mathrm{P}(a_2 = Spring)$	$\mathrm{P}(a_3 = Summer)$	$\mathrm{P}(a_4 = Autumn)$
0.25	0.25	0.25	0.25

P(b)		
$\mathrm{P}(b_1 = NorthAtlantic)$	$\mathrm{P}(b_2 = MidAtlantic)$	$\mathrm{P}(b_3 = SouthAtlantic)$
0.4	0.2	0.4

P(X|a,b)			
	$\mathrm{P}(X_1 = Salmon\|a_i, b_j)$	$\mathrm{P}(X_2 = Tuna\|a_i, b_j)$	$\mathrm{P}(X_3 = SeaBass\|a_i, b_j)$
a_1, b_1	0.6	0.2	0.2
a_1, b_2	0.5	0.3	0.2
a_1, b_3	0.8	0.1	0.1
a_2, b_1	0.7	0.1	0.2
a_2, b_2	0.4	0.3	0.3
a_2, b_3	0.3	0.5	0.2
a_3, b_1	0.2	0.3	0.5
a_3, b_2	0.6	0.1	0.3
a_3, b_3	0.2	0.1	0.7
a_4, b_1	0.1	0.1	0.8
a_4, b_2	0.1	0.3	0.6
a_4, b_3	0.2	0.7	0.1

P(c|X)			
	$\mathrm{P}(c_1 = light\|X_l)$	$\mathrm{P}(c_2 = medium\|X_l)$	$\mathrm{P}(c_3 = dark\|X_l)$
X_1	0.3	0.3	0.4
X_2	0.5	0.3	0.2
X_3	0.4	0.2	0.4

P(d|X)			
	$\mathrm{P}(d_1 = wide\|X_l)$	$\mathrm{P}(d_2 = average\|X_l)$	$\mathrm{P}(d_3 = thin\|X_l)$
X_1	0.3	0.4	0.3
X_2	0.4	0.2	0.4
X_3	0.2	0.3	0.5

Test your program on the cases given below – **present the results in your report**, and state any assumptions you made. You should also try/report at least 3 other 'queries' of your own.

(a) A light, thin fish is caught in the North Atlantic in the Summer. What is the probability it is a SeaBass? How about Tuna?

(b) An average, light fish is caught in the North Atlantic. What is the probability it is winter? spring? summer? autumn?

(c) A median, thin fish is caught in the Summer. What is the probability it came from the Mid Atlantic?

Hint: to solve this problem, you must remember what is P(A, B | C) in terms of P(A, B) and P(C) – then, you must also remember how to find, say, for the same example, P(A,B) from P(A,B,C) and P(C) also from P(A,B,C).

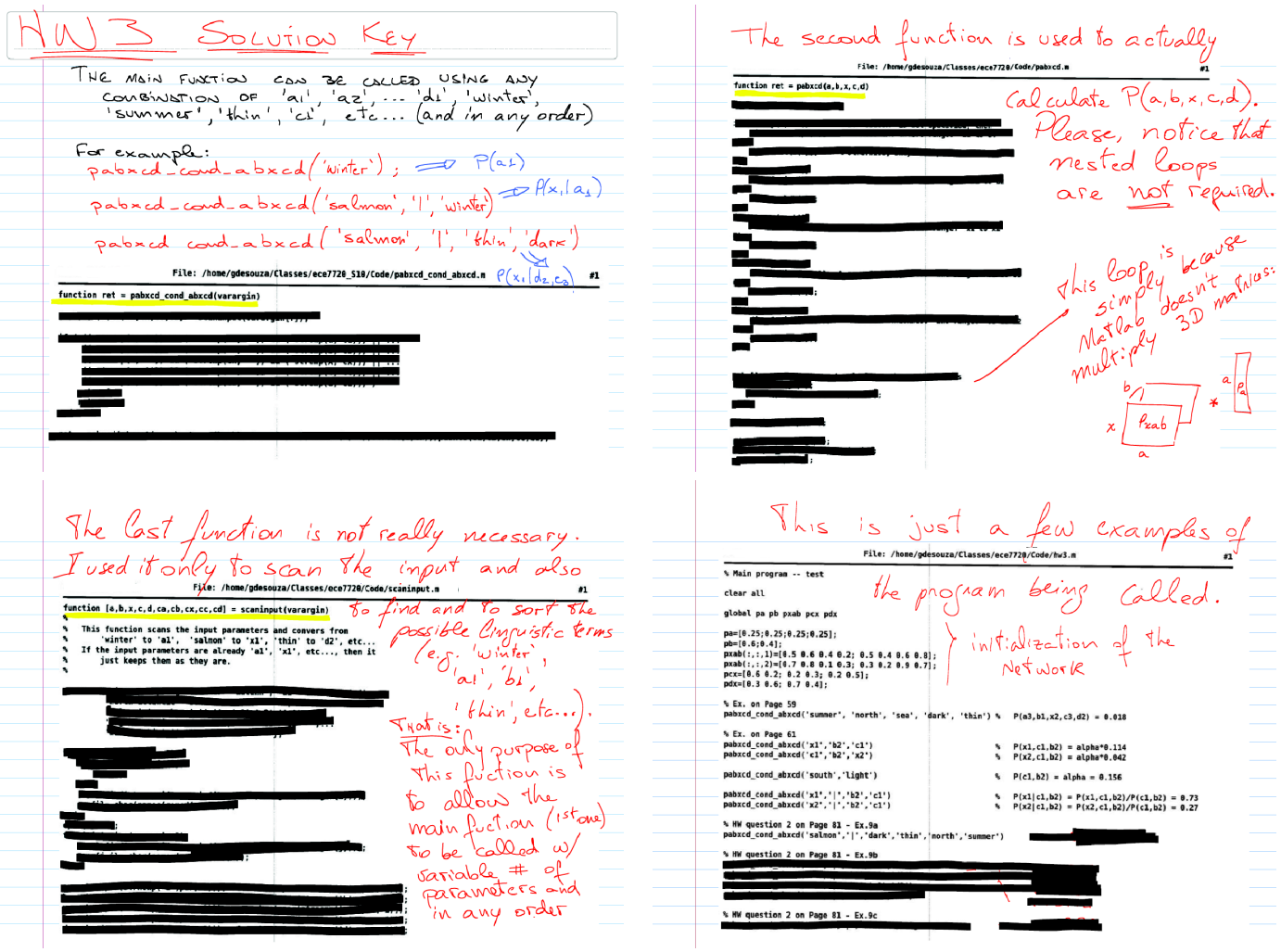

Figure 1: Solution for Question 2

Above is my **entire** solution for the original problem in the textbook. It is shown 'redacted' here just to give you an idea of how short and compact (number of lines) you should expect a solution for this problem to be. In other words, this problem is 90% inspiration and 10% perspiration.

I used Matlab, but as always, **you do NOT have to solve it in Matlab** and a solution in any other language+vector-library should be as compact.