Artificial Intelligence: Homework #5

Assigned on 12/13/2022 (Tuesday); Due at 12:00 am on 1/3/2023 (Tuesday)

Description:

Assume that we consider a Bayesian network $\boldsymbol{N}$ as shown in Figure 1. Given a set of observed nodes $\boldsymbol{Z}$, we want to find the set of nodes $\boldsymbol{Y}$ that contains all nodes that are d-separated from the source nodes $\boldsymbol{X}$. Please implement the algorithm $\boldsymbol{Y} =$ d_separated $(\boldsymbol{N}, \boldsymbol{X}, \boldsymbol{Z})$ that finds all d-separated nodes.

NOTE *Your code should be well-commented and easy to read to get full credit.*

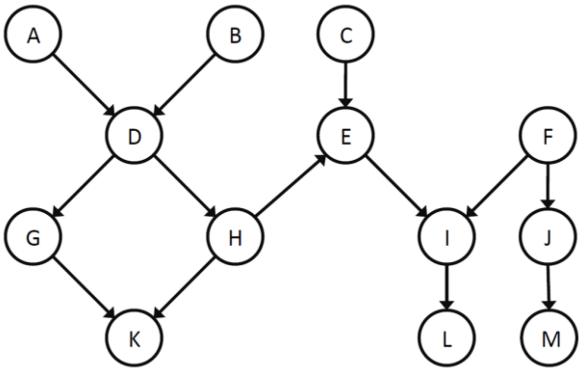

Figure 1：A directed acyclic graph

Verify your solutions for the following problems (a)-(e) using your algorithm：

- For problems (a)-(c), find all nodes that are d-separated from the source node using your algorithm, and find out whether the target node is included in the predicted set $\boldsymbol{Y}$.
- For problems (d)-(e), compare the nodes obtained from your algorithm with your original solution.

(a) Given $\boldsymbol{Z} = \{K, J\}$, can influence flow from node A to node J? Justify your answer.

(b) Given $\boldsymbol{Z} = \{D\}$, can influence flow from node G to node L? Justify your answer.

(c) Given $\boldsymbol{Z} = \{C, L\}$, can influence flow from node B to node F? Justify your answer.

(d) Find the set $\boldsymbol{Y}$ that contains all nodes that are d-separated from node A, given $\boldsymbol{Z} = \{K, E\}$.

(e) Find the set $\boldsymbol{Y}$ that contains all nodes that are d-separated from node B, given $\boldsymbol{Z} = \{L\}$.

Submission Requirements:

- You can use any programming language to implement this homework.
- Please zipped your source code along with a simple report (in pdf) to explain how you represents the given graph and how you derive your answer.
- Please named your zipped file in the format "{Student ID}_{Name}.zip", and named your report in the format "{Student ID}_{Name}.pdf".
- Honor code: This is an individual homework. DO NOT copy others' work. We will use the Turnitin system to check for plagiarism. Both the plagiarist and the victim will get a 0 in this homework.