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## Artificial Intelligence II

### Exercise 2

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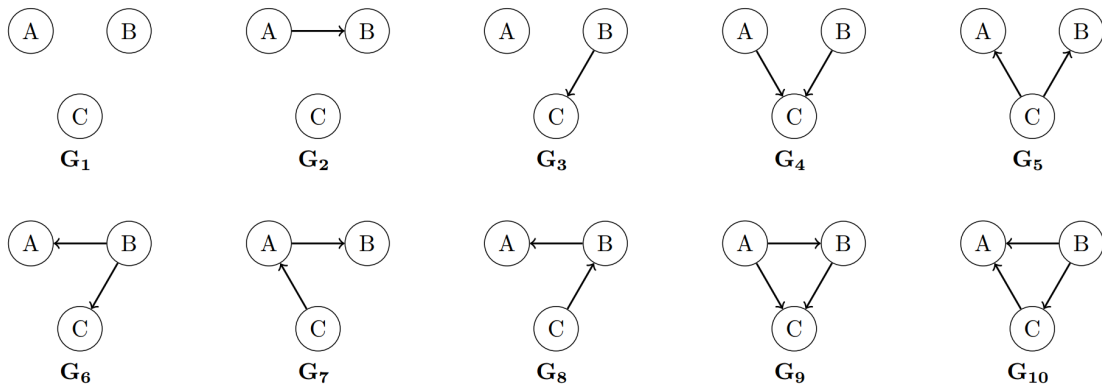
#### Q1. Bayes' Nets Modeling

Consider the following domain:

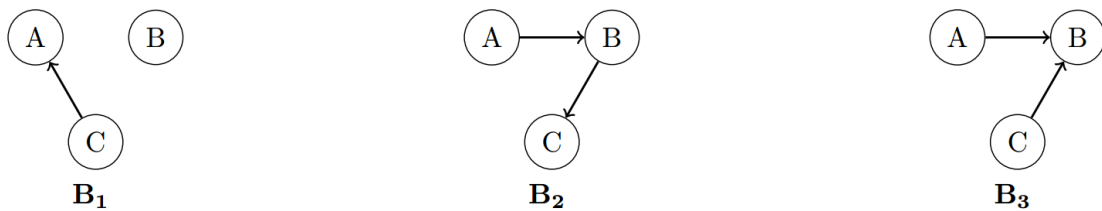
- Urbanization (U)
  - Deforestation (D)
  - Soil erosion (S)
  - Global warming (G)
  - Traffic (T)
  - Cavity (C)
  - Baseball game (B)
- (a) Construct the Bayes net from the above domain. **U**, **D**, **S**, **G**, **T**, **C** and **B** represent random variables of this domain. There can be more than one ways to model the Bayes net from the domain above, but you should have an explanation for your answer.
- (b) Define the CPT (Conditional Probability Table) for each node (random variable) in your Bayes network topology (*Hint: CPT for U can be defined as  $P(U)$* )

#### Q2. Bayes' Nets Representation and Conditional Independence

Assume we are given the following ten Bayes' nets, labeled  $G_1$  to  $G_{10}$ :



Assume we are also given the following three Bayes' nets, labeled  $B_1$  to  $B_3$ :



(a) Assume we know that a joint distribution  $d_1$  (over  $A; B; C$ ) can be represented by Bayes' net  $B_1$ . Mark all of the following Bayes' nets that are guaranteed to be able to represent  $d_1$ .

- $G_1$         $G_2$         $G_3$         $G_4$         $G_5$   
  $G_6$         $G_7$         $G_8$         $G_9$         $G_{10}$   
 None of the above.

(b) Assume we know that a joint distribution  $d_2$  (over  $A; B; C$ ) can be represented by Bayes' net  $B_2$ . Mark all of the following Bayes' nets that are guaranteed to be able to represent  $d_2$ .

- $G_1$         $G_2$         $G_3$         $G_4$         $G_5$   
  $G_6$         $G_7$         $G_8$         $G_9$         $G_{10}$   
 None of the above.

(c) Assume we know that a joint distribution  $d_3$  (over  $A; B; C$ ) **cannot** be represented by Bayes' net  $B_3$ . Mark all of the following Bayes' nets that are guaranteed to be able to represent  $d_3$ .

- $G_1$         $G_2$         $G_3$         $G_4$         $G_5$   
  $G_6$         $G_7$         $G_8$         $G_9$         $G_{10}$   
 None of the above.

(d) Assume we know that a joint distribution  $d_4$  (over  $A; B; C$ ) can be represented by Bayes' nets  $B_1, B_2$ , and  $B_3$ . Mark all of the following Bayes' nets that are guaranteed to be able to represent  $d_4$ .

- $G_1$
- $G_2$
- $G_3$
- $G_4$
- $G_5$
- $G_6$
- $G_7$
- $G_8$
- $G_9$
- $G_{10}$
- None of the above.