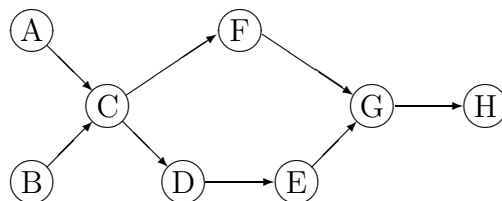


### 3. Exercise Sheet

#### Exercise 9 Separation Criteria: d-Separation

Consider the following directed graph:



Which of the following propositions hold true in the graph??

(„ $X \perp\!\!\!\perp Y \mid Z$ “ denotes „ $X$  and  $Y$  are d-separated (in  $G$ ) by  $Z$ .“)

- |   |   |
|---|---|
| i) $F \perp\!\!\!\perp H \mid G$          | v) $A \perp\!\!\!\perp B \mid D$              |
| ii) $C \perp\!\!\!\perp G \mid F$         | vi) $D \perp\!\!\!\perp F \mid \{C, G\}$      |
| iii) $F \perp\!\!\!\perp E \mid C$        | vii) $E \perp\!\!\!\perp F \mid \{A, B\}$     |
| iv) $A \perp\!\!\!\perp B \mid \emptyset$ | viii) $C \perp\!\!\!\perp E \mid \{D, F, H\}$ |

#### Exercise 10 Separation Criteria: u-Separation

Consider the undirected graph that is obtained if all arrow heads from the directed graph in exercise 9 are dropped. Check again the propositions i)–viii) of exercise 9, now with the u-separation criterion! Which differences can be observed?

#### Exercise 11 Separation Criteria: d/u-Separation

Remember the alternative way of checking for d-separation that was presented in the lecture (slides 51–53):  $X$  and  $Y$  are d-separated by  $Z$  if  $X$  and  $Y$  are u-separated by  $Z$  in the moralised minimal ancestral subgraph induced by  $X \cup Y \cup Z$ . With this approach, verify again the results from exercise 9!