Effective Programming Practices for Economists

Background

A Primer on Graphs

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Graph definition

A graph G is a pair (N, E) of sets, where N are nodes and E are edges:

$$G = (N, E)$$

Edges are

- sets of two nodes (undirected graphs)
- pairs of nodes (directed graphs)

Chain (undirected)

$$
\begin{aligned}
N =& \{x_0, x_1, x_2, x_3\} \\
E =& \{ \\
& \quad \{x_0, x_1\}, \\
& \quad \{x_1, x_2\}, \\
& \quad \{x_2, x_3\} \\
& \}
\end{aligned}
$$

Chain (undirected)

$$N = \{x_0, x_1, x_2, x_3\}$$

$$E = \{ \{x_1, x_0\}, \{x_1, x_2\}, \{x_2, x_3\} \}$$

Chain (directed)

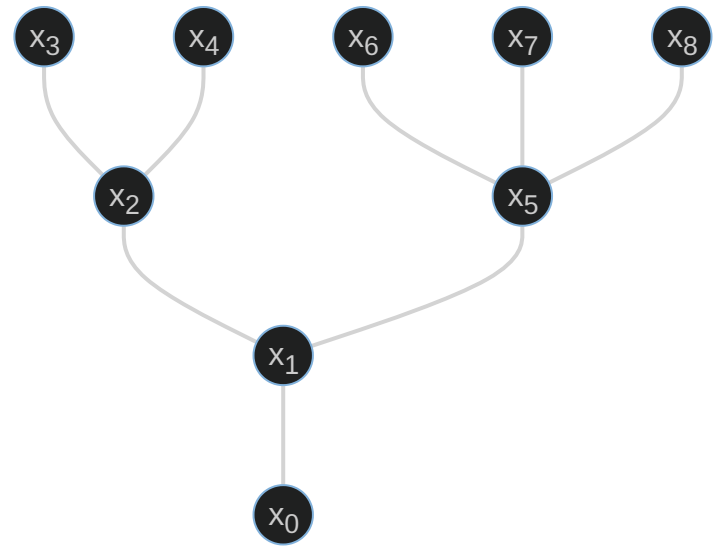
$$N = \{x_0, x_1, x_2, x_3\}$$

$$E = \{ (x_0, x_1), (x_1, x_2), (x_2, x_3) \}$$

Tree (undirected)

$$N = \{x_0, x_1, \ldots, x_8\}$$

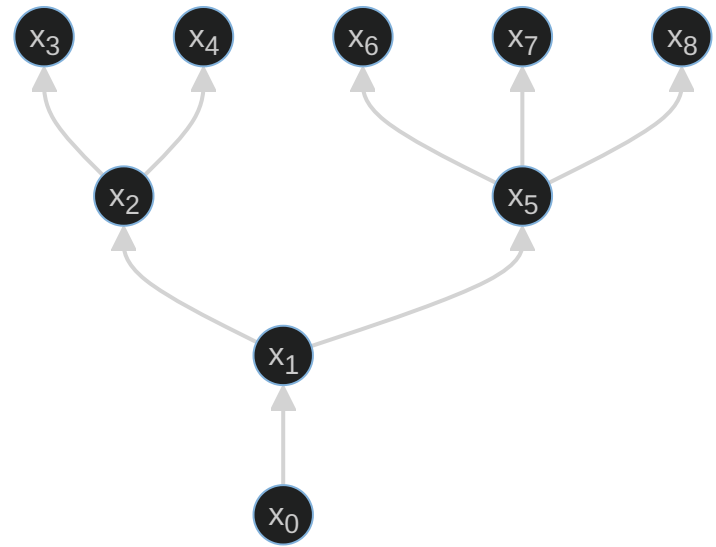
$$E = \{ \{x_0, x_1\}, \{x_1, x_2\}, \{x_2, x_3\}, \{x_2, x_4\}, \{x_1, x_5\}, \{x_5, x_6\}, \{x_5, x_7\}, \{x_5, x_8\} \}$$



Tree (directed, "arborescence")

$$N = \{x_0, x_1, \ldots, x_8\}$$

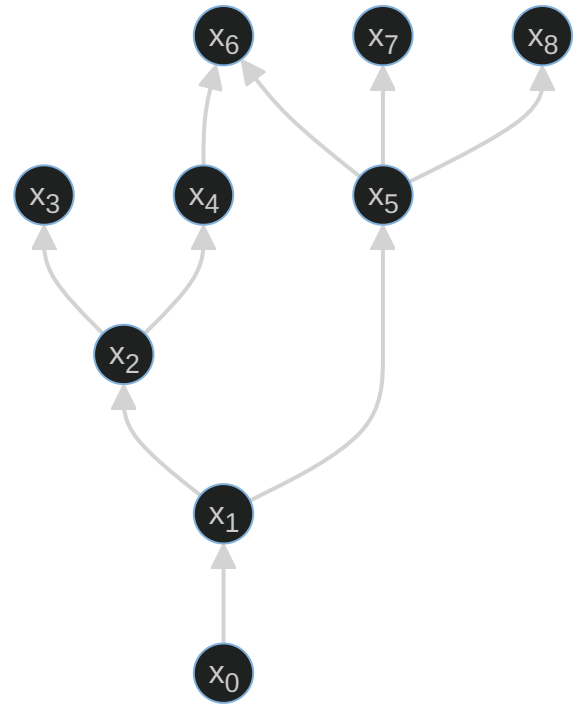
$$E = \{ (x_0, x_1), (x_1, x_2), (x_2, x_3), (x_2, x_4), (x_1, x_5), (x_5, x_6), (x_5, x_7), (x_5, x_8) \}$$



Directed Acyclic Graph (DAG)

$$N = \{x_0, x_1, \ldots, x_8\}$$

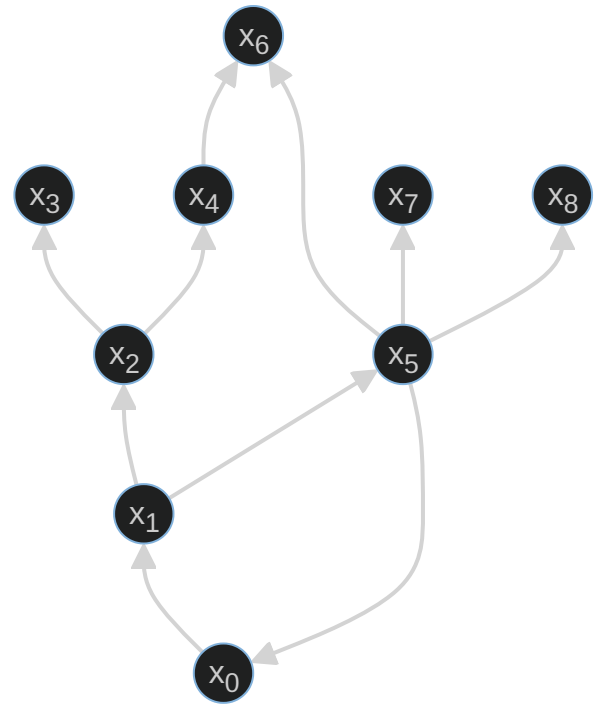
$$E = \{ (x_0, x_1), (x_1, x_2), (x_2, x_3), (x_2, x_4), (x_1, x_5), (x_5, x_6), (x_5, x_7), (x_5, x_8), (x_4, x_6) \}$$



Directed ~~Acyclic~~ Graph

$$N = \{x_0, x_1, \ldots, x_8\}$$

$$E = \{ (x_0, x_1), (x_1, x_2), (x_2, x_3), (x_2, x_4), (x_1, x_5), (x_5, x_6), (x_5, x_7), (x_5, x_8), (x_4, x_6), (x_5, x_0) \}$$



Graph Use Cases

- The file system
- Git
- Reproducible research
- Causal theory
- Behavioural economics
- ...