HW 2 exercise

2.4 (Fig. 2.18)

every (non-instr.)

terminal is e-

A-connected to A.
All variables except C, F are d-connected to A.
Ex. 2.5

Fig. 2.1

F

Fuel?

CSP

Clean Spark Plugs

FMS

Fuel Metering System

Start

S

FMS and F, F and S, S and CSP cannot be A-separated.

FMS and S can be A-separated by: \{F\}, \{F, CSP\}

FMS and CSP cannot:
\{F\}, \{F, S\}

F and CSP cannot:
\{F\}, \{FNS\}
Exercise 2.6

\[ \{A, F\} \] hitting set in \( \Pi \) of \( \{A, D, B\} \) minimal

\[ \{D\} \] minimal \( \Delta \)-separating set: \( \{A, D, B\} \)

\[ \{B\} \] \{F, D, B\}

\( A \Delta B \) (minimal)

\( A \rightarrow C \leftarrow B \), \( A \rightarrow C \rightarrow D \rightarrow E \leftarrow B \), \( A \rightarrow D \rightarrow E \leftarrow B \), \( A \rightarrow D \rightarrow C \rightarrow E \)

\( A \rightarrow F \leftarrow E \leftarrow B \), \( A \rightarrow F \rightarrow E \leftarrow D \leftarrow C \leftarrow B \). All paths
between A & B have (at least) one converging connection, so \( \exists \} A, B \) separate A & B

\( C \& E \) (maximal) : \{A, B, D, F\}

\( A \& B \) (maximal) : \{F\}

Exercise 2.9

The graph induced by the ancestral graph on A, B, C from the graph of Fig. 2.19 is:

\[
\begin{array}{ccc}
A & B & C \\
\end{array}
\]

The moralized version of this graph is unchanged
In this graph, A is separated from C given B. So, B d-separates A from C or the event $\mathbb{P}(A \mid B, C)$ is greater than 0.

Other question: is A d-separated from C given B and J ($18, 18$).
Moralize and get

In this graph, A is separated from C.

So, it is still the case that A and C are d-separated given B and J.

Exercise 2.10
\[ \frac{2}{3} \text{ I-equivalent classes} \]
\[ A \perp C | \{B\} \]
\[ A \perp C \{1,3\} \]

(Important for learning)

Exercise 1.18
\[ P(A, B, C) \]
\[ P(B, C) = \begin{bmatrix}
0.02 & 0.08 \\
0.19 & 0.72
\end{bmatrix} \]
\[ P(B) = \begin{bmatrix}
0.2 \\
0.8
\end{bmatrix} \]
A and C are independent given B

\[ P(A = a_1, B = b_1, C = c_1) \]

(Shorthand):

\[ P(a_1, b_1, c_1) = \frac{P(a_1, b_1, c_1)}{P(b_1, c_1)} = \frac{0.006}{0.02} = 0.3 \]

In general, \[ P(a_i, b_i, c_k) = \frac{P(a_i, b_i, c_k)}{P(b_i, c_k)} \]
Homework: Ex. 1.7 [JOT7], Ex. 1.12 [JOT7]

\[ P(A) = (0.2, 0.8) \]

\[
\begin{array}{c|cc}
A = \text{Yes} & A = \text{No} \\
\hline
T = \text{Yes} & 0.99 & 0.01 \\
T = \text{No} & 0.01 & 0.99 \\
\end{array}
\]