Note Title 2/4/2009

HW2 — all exercises from [J07], ch. 2

2.1 (i) $\frac{2}{3}$, $\frac{1}{3}$, $\frac{1}{2}$

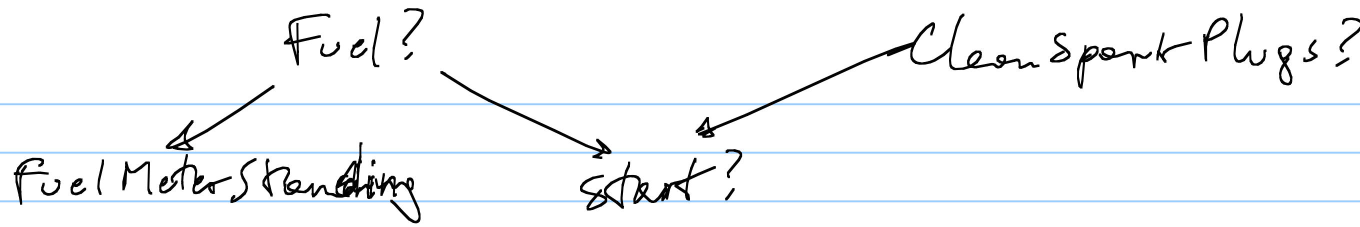
(ii) nearly ϕ, well below the minimum of the prob resulting from either individual action

2.4 Fig. 2.18. All variables are d-connected to A.

Note that for variables adjacent to A, e.g., C, there is no path (chain) with an intermediate variable V as required in defn. 2.1 on p. 30 [J07], so adjacent variables are <u>not</u> d-separated, so they are d-connected.

Fig. 2.19 All except C and F. C and F are d-separated from A because all paths between A and {C, F} go through $E \to I \leftarrow F$, and there is no evidence on I or one of its descendants.

2.5



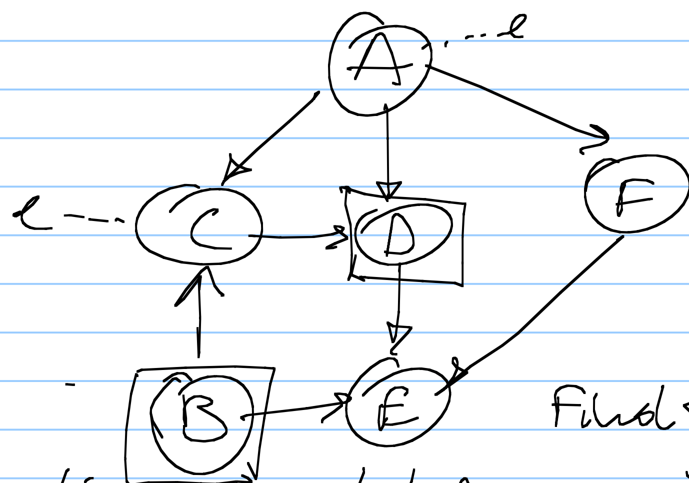
Each of the three pairs of adjacent vars cannot be d-seperated.

FuelMeterStanding can be d-seperated from Start? by {Fuel?}, {Fuel?, CleanSpark Plugs?}

" " " CleanSpark Plugs? by {}, {Fuel?}, {Fuel?, Start?}

Fuel? can be d-separated from CleanSparkPlugs by {} and {FuelMeterStanding}.

Fig. 2.20



$C \leftarrow A \rightarrow F \rightarrow E$

$C \leftarrow A \rightarrow D \rightarrow E$

$C \rightarrow D \rightarrow E$

$C \leftarrow B \rightarrow E$

min. hitting sets of the sets of nodes in the chains

Find the hitting set of

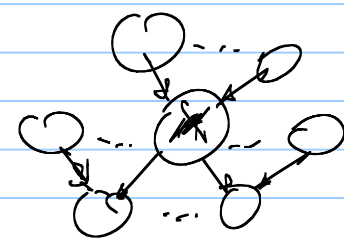
(no conv. connections) { {A, F}, {A, D}, {D}, {B} }

2.6. C and E: $\{A, B, D\}$ and $\{B, D, F\}$

A and B: $\{\}$

C and E: $\{A, B, D, F\}$

A and B: $\{F\}$



2.7 A: $\underbrace{\{C, D, F\}}_{\text{children}} \cup \underbrace{\{\ \}}_{\text{parents}} \cup \underbrace{\{B\}}_{\text{parents of children, spouses}} = \{B, C, D, F\}$

B: $\{C, E\} \cup \{\} \cup \{A, D, F\} = \{A, C, D, E, F\}$

C: $\{D\} \cup \{A, B\} \cup \{A\} = \{A, B, D\}$

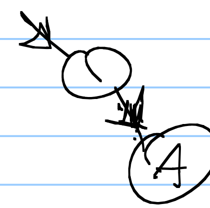
D: $\{E\} \cup \{A, C\} \cup \{B, F\} = \{A, B, C, E, F\}$

E: $\{\ \} \cup \{B, D, E\} \cup \{\ \} = \{B, D, E\}$

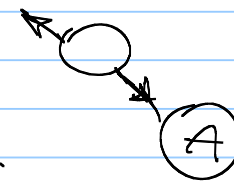
F: $\{E\} \cup \{A\} \cup \{B, D\} = \{A, B, D, E\}$

2.8 (Sketch) Consider all possible cases for chains ending at A:

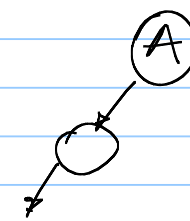
(1) chain into a parent of A (and into A)
blocked at the parent — serial connection



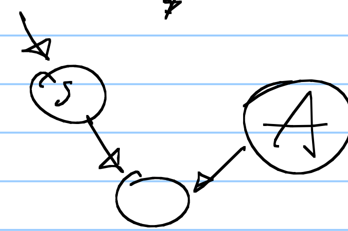
(2) chain out of a parent of A (and into A)
blocked at the parent — diverging connection

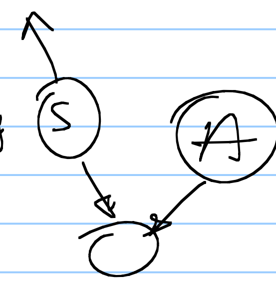


(3) chain out of a child of A (and out of A)
blocked at the child — serial connection



(4) chain into a child of A (and out of A)
blocked at the spouse$_S$: serial or diverging

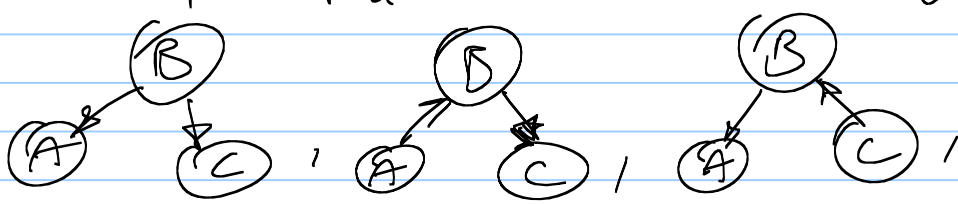




2.9 The ancestral graph of A, C, B for the graph of Figure 2.19 is A B C.

There is no path from A to C in this graph, so there is all paths from A to C are intersected by $\{B\}$, so A and C are d-separated by B.

2.10. For the three networks ($\perp$ means: d-separated; $\not\perp$ means: d-connected)



$A \perp C \mid B$

$A \not\perp C \mid \{\}$

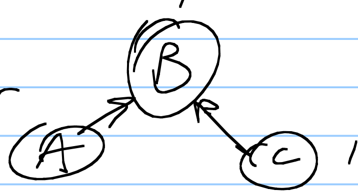
$A \not\perp B \mid C$

$B \not\perp C \mid A$

$A \not\perp B \mid \{\}$

$B \not\perp C \mid \{\}$

so they are I-equivalent

For  , $A \perp C \mid \{\}$

$A \not\perp C \mid \{B\}$

+ , so this network is not I-equivalent to the other three.