Foundations of Artificial Intelligence Exercise Sheet 7

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Exercise 7.1

a)

Applicable operators:	Resulting state:
A	$\{X,Y,Z\}$
В	$\{\neg X, Y, Z\}$
b)*	
$\pi = \langle A(\varnothing, \{X\}, \{Y, Z\}), F(\varnothing, \{Z\}, \{\neg Z, G\}) \rangle \bigvee$	

Exercise 7.2

a)

List conditional and non conditional probabilities:

P(is red) = 0.8

 $P(\neg is \ red) = 0.2$

 $P(seen \ as \ red|is \ red) = 0.7$

 $P(\neg seen \ as \ red | is \ red) = 0.3$

 $P(\neg seen \ as \ red | \neg is \ red) = 0.9$

 $P(seen \ as \ red | \neg is \ red) = 0.1$

b)

$$P(seen\ as\ red) = P(seen\ as\ red|is\ red) \cdot P(is\ red) + P(seen\ as\ red|\neg\ is\ red) \cdot P(\neg\ is\ red)$$

$$= 0.7 \cdot 0.8 + 0.1 \cdot 0.2$$

$$= 0.58 \ \checkmark$$

$$\begin{split} P(\textit{is red}|\textit{seen as red}) &= \frac{P(\textit{seen as red}|\textit{is red}) \cdot P(\textit{is red})}{P(\textit{seen as red})} \\ &= \frac{0.7 \cdot 0.8}{0.58} \\ &= 0.97 \quad \checkmark \end{split}$$

Exercise 7.3

a)

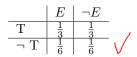
$$P(E) = 1/6 + 1/6 + 1/6$$

= 3/6
= 0.5 \/

$$P(O) = 1/6 + 1/6 + 1/6$$

= 3/6
= 0.5

$$P(E|T)=\frac{1}{4}+\frac{1}{4}=0.5=P(E)\Rightarrow {\rm E} \ {\rm and} \ {\rm T} \ {\rm are \ independent}.$$
 $P(O|T)=\frac{1}{4}+\frac{1}{4}=0.5=P(O)\Rightarrow {\rm O} \ {\rm and} \ {\rm T} \ {\rm are \ independent}.$ $P(E|O)=0\neq 0.5=P(E)\Rightarrow {\rm E} \ {\rm and} \ {\rm O} \ {\rm are \ dependent}.$



b)

Joint probability distribution table for the events E and T:

$$\begin{array}{l} P(T \wedge E) \stackrel{T,E \ independent}{=} P(T) \cdot P(E) = \frac{2}{3} \cdot 0.5 = \frac{1}{3} \\ P(T \wedge \neg E) = P(T) \cdot P(\neg E) = \frac{2}{3} \cdot 0.5 = \frac{1}{3} \\ P(\neg T \wedge E) = P(\neg T) \cdot P(E) = \frac{1}{3} \cdot 0.5 = \frac{1}{6} \\ P(\neg T \wedge \neg E) = P(\neg T) \cdot P(\neg E) = \frac{1}{3} \cdot 0.5 = \frac{1}{6} \end{array}$$

 $\mathbf{c})$

$$P(\neg e|t) \stackrel{T,E \ independent}{=} P(\neg e) = 0.5 \quad \bigvee$$