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Principles of AI Planning
Exercise Sheet 2

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Exercise 2.1 - Effect Normal Form

a) Transform the operator into ENF

$$\langle \neg e \vee f, (a \rhd (b \rhd c)) \wedge (\neg d \rhd c) \wedge (\neg(\neg c \wedge \neg a) \rhd (d \wedge \neg e)) \wedge (d \rhd \neg e) \rangle$$

De Morgan's Law

$$\langle \neg e \vee f, (a \rhd (b \rhd c)) \wedge (\neg d \rhd c) \wedge ((c \vee a) \rhd (d \wedge \neg e)) \wedge (d \rhd \neg e) \rangle$$

(7)

$$\langle \neg e \vee f, ((a \wedge b) \rhd c)) \wedge (\neg d \rhd c) \wedge ((c \vee a) \rhd (d \wedge \neg e)) \wedge (d \rhd \neg e) \rangle$$

(9)

$$\langle \neg e \vee f, ((a \wedge b \vee \neg d) \rhd c) \wedge ((c \vee a) \rhd (d \wedge \neg e)) \wedge (d \rhd \neg e) \rangle$$

(8)

$$\langle \neg e \vee f, ((a \wedge b \vee \neg d) \rhd c) \wedge ((c \vee a) \rhd d) \wedge ((c \vee a) \rhd \neg e) \wedge (d \rhd \neg e) \rangle$$

(9)

$$\langle \neg e \vee f, ((a \wedge b \vee \neg d) \rhd c) \wedge ((c \vee a) \rhd d) \wedge ((c \vee a \vee d) \rhd \neg e) \rangle$$

b) Transform the operator into positive normal form

$$\langle \neg e \vee f, ((a \wedge b \vee \neg d) \rhd c) \wedge ((c \vee a) \rhd d) \wedge ((c \vee a \vee d) \rhd \neg e) \rangle$$

We identify the negative atom $\neg e$ and we change it for $\hat{e}$

$$\langle \hat{e} \vee f, ((a \wedge b \vee \neg d) \rhd c) \wedge ((c \vee a) \rhd d) \wedge ((c \vee a \vee d) \rhd \neg e) \rangle$$

We change effect $\neg e$ for $\neg e \wedge \hat{e}$

$$\langle \hat{e} \vee f, ((a \wedge b \vee \neg d) \rhd c) \wedge ((c \vee a) \rhd d) \wedge ((c \vee a \vee d) \rhd (\neg e \wedge \hat{e})) \rangle$$

We identify the negative atom $\neg d$ and we change it for $\hat{d}$.

$$\langle \hat{e} \vee f, ((a \wedge b \vee \hat{d}) \rhd c) \wedge ((c \vee a) \rhd d) \wedge ((c \vee a \vee d) \rhd (\neg e \wedge \hat{e})) \rangle$$

We change effect d for $d \wedge \neg \hat{d}$

$$\langle \hat{e} \vee f, ((a \wedge b \vee \hat{d}) \rhd c) \wedge ((c \vee a) \rhd (d \wedge \neg \hat{d})) \wedge ((c \vee a \vee d) \rhd (\neg e \wedge \hat{e})) \rangle$$

(8)

$$\langle \hat{e} \vee f, ((a \wedge b \vee \hat{d}) \rhd c) \wedge ((c \vee a) \rhd d) \wedge ((c \vee a) \rhd \neg \hat{d}) \wedge ((c \vee a \vee d) \rhd (\neg e \wedge \hat{e})) \rangle$$

(8)

$$\langle \hat{e} \vee f, ((a \wedge b \vee \hat{d}) \rhd c) \wedge ((c \vee a) \rhd d) \wedge ((c \vee a) \rhd \neg \hat{d}) \wedge ((c \vee a \vee d) \rhd \neg e) \wedge ((c \vee a \vee d) \rhd \hat{e}) \rangle$$