

CPT_S 540 Homework 6
Chenrui Xu

Question 1

$$(\neg \text{Stench}(h1) \vee \text{Adjacent}(x, f(x))) \wedge (\neg \text{Stench}(h1) \vee \text{At}(\text{Wumpus}, f(x)))$$

Question 2

- (a) $\exists x[\text{Likes}(x, \text{Apples})] \rightarrow \text{Plays}(\text{John}, \text{Chess}) \wedge \text{Plays}(\text{Mary}, \text{Chess})$
- (b) $\exists x[\text{Likes}(x, \text{Oranges})] \rightarrow \text{Plays}(\text{John}, \text{Go}) \wedge \text{Plays}(\text{Mary}, \text{Go})$
- (c) $\forall x[(\text{Likes}(x, \text{Apples}) \wedge \neg \text{Likes}(x, \text{Oranges})) \vee (\neg \text{Likes}(x, \text{Apples}) \wedge \text{Likes}(x, \text{Oranges}))]$
- (d) $\text{Likes}(\text{John}, \text{Apples})$
- (e) $\forall y [\text{Likes}(\text{John}, y) \rightarrow \neg \text{Likes}(\text{Mary}, y)]$

Question 3

- (a) $(\neg \text{Likes}(x, \text{Apples}) \vee \text{Plays}(\text{John}, \text{Chess})) \wedge (\neg \text{Likes}(x, \text{Apples}) \vee \text{Plays}(\text{Mary}, \text{Chess}))$
- (b) $(\neg \text{Likes}(x, \text{Oranges}) \vee \text{Plays}(\text{John}, \text{Go})) \wedge (\neg \text{Likes}(x, \text{Oranges}) \vee \text{Plays}(\text{Mary}, \text{Go}))$
- (c) $(\text{Likes}(x, \text{Apples}) \vee \text{Likes}(x, \text{Oranges})) \wedge (\neg \text{Likes}(x, \text{Oranges}) \vee \neg \text{Likes}(x, \text{Apples}))$
- (d) $\text{Likes}(\text{John}, \text{Apples})$
- (e) $\neg \text{Likes}(\text{John}, y) \vee \neg \text{Likes}(\text{Mary}, y)$

- C1: $(\neg \text{Likes}(x, \text{Apples}) \vee \text{Plays}(\text{John}, \text{Chess}))$
- C2: $(\neg \text{Likes}(x, \text{Apples}) \vee \text{Plays}(\text{Mary}, \text{Chess}))$
- C3: $(\neg \text{Likes}(x, \text{Oranges}) \vee \text{Plays}(\text{John}, \text{Go}))$
- C4: $(\neg \text{Likes}(x, \text{Oranges}) \vee \text{Plays}(\text{Mary}, \text{Go}))$
- C5: $(\text{Likes}(x, \text{Apples}) \vee \text{Likes}(x, \text{Oranges}))$
- C6: $(\neg \text{Likes}(x, \text{Oranges}) \vee \neg \text{Likes}(x, \text{Apples}))$
- C7: $\text{Likes}(\text{John}, \text{Apples})$
- C8: $\neg \text{Likes}(\text{John}, y) \vee \neg \text{Likes}(\text{Mary}, y)$

Question 4

Add clause: $\text{Plays}(\text{Mary}, \text{Go})$

Negative as C9: $\neg \text{Plays}(\text{Mary}, \text{Go})$

Resolve: C4 $(\neg \text{Likes}(x, \text{Oranges}) \vee \text{Plays}(\text{Mary}, \text{Go}))$ and C9 $\neg \text{Plays}(\text{Mary}, \text{Go})$ left $\neg \text{Likes}(x1, \text{Oranges})$ as C10

$\{x1/x2\}$: $\neg \text{Likes}(x2, \text{Oranges})$

Resolve: C10 $\neg \text{Likes}(x2, \text{Oranges})$ and C5 $(\text{Likes}(x2, \text{Apples}) \vee \text{Likes}(x2, \text{Oranges}))$ left $\text{Likes}(x2, \text{Apples})$ as C11.

{x2/Mary} C11 *Likes(Mary, Apples)*

{y/Apple}: C8 $\neg \text{Likes}(\text{John}, \text{Apples}) \vee \neg \text{Likes}(\text{Mary}, \text{apples})$

Resolve: C11 *Likes(Mary, Apples)* and C8 $\neg \text{Likes}(\text{John}, \text{Apples}) \vee \neg \text{Likes}(\text{Mary}, \text{apples})$

left $\neg \text{Likes}(\text{John}, \text{Apples})$ as C12

Resolve: C12 $\neg \text{Likes}(\text{John}, \text{Apples})$ and C7: *Likes(John, Apples)* left empty clause.

Proved.

Question 5

fof(a1, axiom,

? [X] : (*Likes(X, Apples)*) => *Plays(John, Chess)* & *Plays(Mary, Chess)*).

fof(a2, axiom,

? [X] : (*Likes(X, Oranges)*) => *Plays(John, Go)* & *Plays(Mary, Go)*).

fof(a3, axiom,

! [X] : ($\neg(\text{Likes}(\text{X}, \text{Oranges}) \ \& \ \text{Likes}(\text{X}, \text{Apples}))$)).

fof(a3, axiom,

! [X] : ((*Likes(X, Apples)* & $\neg \text{Likes}(\text{X}, \text{Oranges})$))($\neg \text{Likes}(\text{X}, \text{Apples})$ & *Likes(X, Oranges)*)).

fof(a4, axiom, *Likes(John, Apples)*).

fof(a5, axiom,

! [y] : (*Likes(John, y)* => $\sim \text{Likes}(\text{Mary}, \text{y})$)).

fof(c1, conjecture, *Plays(Mary, Go)*).