

Soluzioni gruppo 50 Esercitazione A.3.2:

1.

$$\begin{aligned}
 & \forall p(Persona(p) \implies \exists t \text{ haTelefono}(p, t)) \\
 & \quad \wedge \\
 & \quad \forall z(Persona(z) \implies \neg Telefono(z)) \\
 & \quad \wedge \\
 & \forall x, y(\text{ haTelefono}(x, y) \implies Persona(x) \wedge Telefono(y))
 \end{aligned} \tag{1}$$

2.

$$\begin{aligned}
 & \forall p(Persona(p) \implies \exists n \text{ siChiama}(p, n)) \\
 & \quad \wedge \\
 & \forall a \exists b(\text{ siChiama}(a, b) \implies \neg \exists \hat{b} \text{ siChiama}(a, \hat{b}) \wedge \hat{b} \neq b) \\
 & \quad \wedge \\
 & \quad \forall x(Persona(x) \implies \neg Stringa(x)) \\
 & \quad \wedge \\
 & \forall z, y(\text{ siChiama}(z, y) \implies Persona(z) \wedge Stringa(y))
 \end{aligned} \tag{2}$$

3.

$$\begin{aligned}
 & \forall d \exists a, b((lavora(d, a) \wedge lavora(d, b) \wedge a \neq b) \implies \\
 & \quad \neg \exists c(lavora(d, c) \wedge c \neq a \wedge c \neq b))
 \end{aligned} \tag{3}$$

4.

$$\begin{aligned}
 & \forall d(dipartimento(d) \implies \exists dir \text{ dirige}(d, dir)) \\
 & \quad \wedge \\
 & \forall x, y(\text{ dirige}(x, y) \implies dipartimento(x) \wedge direttore(y)) \\
 & \quad \wedge \\
 & \quad \forall z(direttore(z) \implies persona(z)) \\
 & \quad \wedge \\
 & \quad \forall \alpha(persona(\alpha) \implies \neg dipartimento(\alpha)) \\
 & \quad \wedge \\
 & \forall \beta \exists \gamma(\text{ dirige}(\beta, \gamma) \implies \neg \exists \pi \text{ dirige}(\beta, \pi) \wedge \pi \neq \gamma)
 \end{aligned} \tag{4}$$