

## Part 1

- a)  $\{c.name \mid CITY(c) \wedge \neg \exists(p) (PLAYGROUND(p) \wedge p.city\_name = c.name)\}$
- b)  $\{c.name, c.population \mid CITY(c) \wedge \neg \exists(c2) (CITY(c2) \wedge (c2.population < c.population))\}$
- c)  $\{e.SIN, e.name \mid EMPLOYEE(e) \wedge \forall (k) (KID(k) \wedge (k.p1\_sin = e.SIN \vee k.p2\_SIN = e.SIN)) \Rightarrow \exists(p) (PLAYGROUD(p) \wedge p.name = k.playground\_name)\}$
- d)  $\{p.name \mid PLAYGROUND(p) \wedge \forall (k) (KID(k) \wedge k.playgroud\_name = p.name) \Rightarrow \exists(e) (EMPLOYEE(e) \wedge (e.SIN = k.p1\_sin \vee e.SIN = k.p2\_SIN) \wedge (e.city\_name = p.city\_name))\}$
- e)  $\{e.name \mid EMPLOYEE(e) \wedge \exists (k) (KID(k) \wedge (k.p1\_sin = e.SIN \vee k.p2\_SIN = e.SIN)) \Rightarrow \forall (p) (PLAYGROUND(p) \wedge p.name = k.playgroud\_name)\}$

## Part 2

- a)  $\{c \mid (\exists c \exists d \exists e \exists f) (CITY(c, d, e, f) \wedge \neg (\exists p \exists q \exists r \exists s) (PLAYGROUND(p, q, r, s) \wedge r = c))\}$
- b)  $\{ac \mid (\exists a \exists b \exists c \exists d) (CITY(a, b, c, d) \wedge \neg (\exists c \exists d \exists e \exists f) (CITY(c, d, e, f) \wedge e < c))\}$
- c)  $\{ab \mid (\exists a \exists b \exists c \exists d \exists e \exists f) EMPLOYEE(a, b, c, d, e, f) \wedge (\forall u \forall v \forall w \forall x \forall y \forall z) (KID(u, v, w, x, y, z) \wedge (x = a \vee y = a)) \Rightarrow (\exists p \exists q \exists r \exists s) (PLAYGROUD(p, q, r, s) \wedge p = z)\}$
- d)  $\{p \mid (\exists p \exists q \exists r \exists s) (PLAYGROUD(p, q, r, s) \wedge (\forall u \forall v \forall w \forall x \forall y \forall z) (KID(u, v, w, x, y, z) \wedge z = p) \Rightarrow (\exists a \exists b \exists c \exists d \exists e \exists f) (EMPLOYEE(a, b, c, d, e, f) \wedge (a = x \vee a = y) \wedge f = r))\}$
- e)  $\{a \mid (\exists a \exists b \exists c \exists d \exists e \exists f) EMPLOYEE(a, b, c, d, e, f) \wedge (\exists u \exists v \exists w \exists x \exists y \exists z) (KID(u, v, w, x, y, z) \wedge (x = a \vee y = a)) \Rightarrow (\forall p \forall q \forall r \forall s) (PLAYGROUD(p, q, r, s) \wedge p = z)\}$