

10.1.1.1

$$\pi_{d.name, d.floor}(\sigma_{d.head = e.eid \wedge e.classification = 4}(\rho_d(Department) \times \rho_e(Employee)))$$

10.1.1.2

$$\pi_{b1.did, b1.byear, b2.byear}(\sigma_{(b2.budget - 2 = b1.budget) \wedge (b2.byear - b1.byear = 1) \wedge b1.did = b2.did}(\rho_{b1}(Budget) \times \rho_{b2}(Budget)))$$

10.1.1.3

$$\pi_{pid, pname}(\rho_{Project} \times ((\pi_{eid, pid}(\rho_{Employee} \times \rho_{Project})) \div (\pi_{eid}(\sigma_{classification = 2}(Employee)))))$$

10.1.1.4

$$U \leftarrow \pi_{Project.budget}(\sigma_{Project.budget > 2019}(Project))$$

$$U = (\pi_{p1.budget}(\sigma_{p1.budget > p2.budget}(\rho_{p1}(U) \times \rho_{p2}(U))))$$

10.1.1.5

$$\pi_{pid}(\sigma_{byear = 2019}(Budget \times (\pi_{did}(Department) - \pi_{did}(\sigma_{classification \neq 2}(Employee)))))$$

10.1.1.6

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$$\{ \langle did \rangle / \exists dname, dhead (\langle did, dname, 4, dhead \rangle \in Department) \}$$



$\{ \langle did, mname \rangle \mid \exists n, f, head \}$

.2  $\neg Re$

.2  $\neg Pro$

$\langle did, n, f, head \rangle \in Department \wedge$

$\exists e, ename, esalary, msalary, classification ($

$\langle head, mname, msalary, did, classification \rangle \in Employee \wedge$

$\langle e, ename, esalary, did, classification \rangle \in Employee \wedge$

$head \neq e$

$\}) \}$

$\{ t[eid] \mid \exists e \in Employee, p \in Project, on \in Project ($

.2  $\neg Re$

.2  $\neg Pro$

$e[eid] = t[eid] \wedge e[eid] = on[eid] \wedge$

$on[pid] = p[pid] \wedge p[pid] = 4 \wedge$

$p[budget] < 1000000)$

$\}) \}$

$\{ t[dname, budget] \mid \exists d \in Department ($

.2  $\neg Re$

.3  $\neg Pro$

$\exists b \in Budget ($

$b[byear] = 2019 \wedge$

$b[budget] = t[budget]$

$) \wedge$

$\neg \exists e \in Employee ($

$e[did] = b[did] \wedge$

$e[classification] > 3$

$) \wedge$

$d[dname] = t[dname]$

$\}) \}$

$\exists pid / \exists e_1, n_1, s_1, d_1, e_2, n_2, s_2, d_2, f_1, f_2$

.2  $\neg Re$

$\neg \text{Pro}$

$\langle e_1, n_1, s_1, d_1, 3 \rangle \in \text{Employee}$

$\langle e_2, n_2, s_2, d_2, 3 \rangle \in \text{Employee}$

$e_1 \neq e_2$

$\langle pid, e_1, f_1 \rangle \in \text{Onproject}$

$\langle pid, e_2, f_2 \rangle \in \text{Onproject}$

$\neg \exists e_3, n_3, s_3, d_3, f_3$  (

$\langle e_3, n_3, s_3, d_3, 3 \rangle \in \text{Employee}$

$e_3 \neq e_1 \wedge e_3 \neq e_2$

$\langle pid, e_3, f_3 \rangle \in \text{Onproject}$

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