**20 Relational Algebra Queries on HR Schema**

**Employees**

**employee\_id,first\_name,last\_name,job\_id,salary,hire\_date,manager\_id,department\_id**

**Departments**

**department\_id,department\_name,manager\_id,location\_id**

**Jobs**

**job\_id,job\_title,min\_salary,max\_salary**

**Locations**

**Location\_id,street,city,country\_id**

**1. List all employees with their department names**

Πfirst\_name, last\_name, department\_name (EMPLOYEES ⨝ DEPARTMENTS)

**2. List employees who earn more than 10,000 and work in 'IT' department**

Π first\_name, salary (**σ** salary > 10000 (EMPLOYEES) ⨝ department\_name = 'IT' (DEPARTMENTS))

**3. Find job titles of employees who were hired after 2005**

Πjob\_title (**σ** hire\_date > '2005-01-01' (EMPLOYEES) ⨝JOBS)

**4. Departments with no employees**

Πdepartment\_id (DEPARTMENTS) – Π department\_id (EMPLOYEES)

**5. All job titles, whether assigned or not**

JOBS **⟖** EMPLOYEES

**6. Average salary by department**

department\_id g AVG(salary) (EMPLOYEES)

**7. Employees who are also managers**

Πemployee\_id (EMPLOYEES) **Ո** Πmanager\_id (EMPLOYEES)

**8. Departments and locations (with all departments listed)**

DEPARTMENTS **⟕** LOCATIONS

**9. List employees and their managers**

RENAME E1(EMPLOYEES), E2(EMPLOYEES)

ΠE1.first\_name, E2.first\_name (E1 **⨝** E1.manager\_id = E2.employee\_id)

**10. Highest paid employee in each department**

department\_id g MAX(salary) (EMPLOYEES)

**11. Departments and their total salary expense**

department\_id g SUM(salary) (EMPLOYEES **⨝** DEPARTMENTS)

**12. Cities with departments**

Πdepartment\_name,city (DEPARTMENTS **⨝** LOCATIONS)

**13. Job IDs used in EMPLOYEES but missing in JOBS (data error)**

Πjob\_id (EMPLOYEES) DIFFERENCE Π job\_id (JOBS)

**14. All employee-job combinations (for testing)**

Πemployee\_id, job\_id (EMPLOYEES X JOBS)

**15. Employees with the same job title**

**ρ**E1(EMPLOYEES), **ρ**E2(EMPLOYEES)

**σ** E1.job\_id = E2.job\_id **Λ** E1.employee\_id != E2.employee\_id (E1 X E2)

**16. Count of employees per job**

job\_id g COUNT(employee\_id) (EMPLOYEES)

**17. Employees in departments located in 'Toronto'**

Πfirst\_name, department\_name (EMPLOYEES **⨝** DEPARTMENTS **⨝** city = 'Toronto' (LOCATIONS))

**18. Rename result of high earners to HighEarners**

**ρ** HighEarners (**σ** salary > 15000 (EMPLOYEES))

**19. Employees with same manager and department**

**ρ** E1(EMPLOYEES), **ρ** E2(EMPLOYEES)

**σ** E1.manager\_id = E2.manager\_id **Λ** E1.department\_id = E2.department\_id **Λ**

E1.employee\_id != E2.employee\_id (E1 X E2)

**20. Job titles with minimum salary more than 5000**

**σ** MIN(salary) > 5000 (job\_id g MIN(salary) (EMPLOYEES))