

A. i) select employee_id, first_name, salary, department_name

from employees e, departments d

where e.department_id = d.department_id and d.department_name = 'Marketing'

and e.salary >= 10000

ii)

$\Pi_{\text{employee_id}, \text{first_name}, \text{salary}, \text{department_name}} (\sigma_{\text{department_name} = \text{'Marketing'}} \wedge \text{salary} \geq 10000)$

employees \bowtie employees.department_id = departments.department_id departments

B. i) select job_title, start_date

from employees e, jobs j, job_history h

where e.last_name = 'Taylor' and e.employee_id = h.employee_id and j.job_id = h.job_id

order by start_date

ii) $\Pi_{\text{job_title}, \text{start_date}} (\sigma_{\text{last_name} = \text{'Taylor'}} ((e \bowtie \{e.\text{employee_id} = h.\text{employee_id}\}) \bowtie \{h.\text{job_id} = j.\text{job_id}\}))$

C. i) select department_name, first_name

from departments d, employees e

where d.manager_id = e.employee_id

ii) $\Pi_{\text{department_name}, \text{first_name}} (\text{departments} \bowtie \{\text{departments.manager_id} = \text{employees.employee_id}\} \text{employees})$

D. i) select last_name, department_name, city, country_name, region_name

from locations l, employees e, departments d, countries c, regions r

where l.location_id = d.location_id and d.department_id = e.department_id and c.country_id = l.country_id and r.region_id = c.region_id and r.region_name = 'Europe' and e.salary >= 10000

ii) $\Pi_{\text{first_name, department_name, city, country_name, region_name}} (\sigma_{r.\text{region_name} = \text{'Europe}} \wedge e.\text{salary} \geq 10000)$

$\left(\left(\left(\left(e \bowtie_{e.\text{department_id} = d.\text{department_id}} d \right) \bowtie_{d.\text{location_id} = l.\text{location_id}} l \right) \bowtie_{l.\text{country_id} = c.\text{country_id}} c \right) \right)$

$\bowtie_{c.\text{region_id} = r.\text{region_id}} r \right) \downarrow \text{regions}$

departments locations countries

E.

1 (1) join query 4 & 8

select e.first_name, e.salary, m.first_name, m.salary

from employees e, employees m

where e.manager_id = m.employee_id and e.salary >= m.salary

(2) subquery 4 & 8

select e.first_name, e.salary, m.first_name, m.salary

from employees e, (select employee_id, salary, first_name

from employees

where employee_id in (select manager_id
from employees)) m

where e.manager_id = m.employee_id and e.salary >= m.salary

i) $\Pi_{\text{e.first_name, e.salary, m.first_name, m.salary}} (e \bowtie_{e.\text{manager_id} = m.\text{employee_id}} \wedge e.\text{salary} \geq m.\text{salary})$

\downarrow
employees employees

) $\Pi_{\text{e.first_name, e.salary, m.first_name, m.salary}} (e \bowtie_{e.\text{manager_id} = m.\text{employee_id}} \wedge e.\text{salary} \geq m.\text{salary})$

$\left(\Pi_{\text{employee_id, salary, first_name}} (\sigma_{\text{employee_id} \in (\Pi_{\text{manager_id}} (\text{employees}))} (\text{employees})) \right) \right)$

$\hookrightarrow m$

F.

i) Select e.first_name, e.employee_id, m.first_name, m.employee_id
from employees e, employees m

where e.manager_id = m.employee_id and e.department_id != m.department_id

ii)

$\Pi_{e.first_name, e.employee_id, m.first_name, m.employee_id}$ (e M₁
employees +
m.department_id M₂)
employees
e.manager_id = m.employee_id \wedge e.department_id !=
m.department_id