

Q1.

a)

$$\pi_{dname}(\sigma_{budget \geq 20,000} Department)$$

b)

$$\pi_{age}(\sigma_{salary \geq 50,000} Employee)$$

c)

$$\pi_{age}((\sigma_{dname="Catering"} Department) \bowtie Works \bowtie Employee))$$

d)

$$\pi_{salary}(Employee \bowtie (\sigma_{percentage \geq 30} Works) \bowtie (\sigma_{budget \geq 500,000} Department))$$

e)

$$\begin{aligned} &\pi_{ename}(Employee \bowtie Works \bowtie (\sigma_{dname="Marketing"} Department)) \\ &\cup \pi_{ename}(Employee \bowtie (\sigma_{percentage > 50} Works)) \end{aligned}$$

f)

$$\begin{aligned} &\pi_{ename} \left(\left(\pi_{eid}(Works \bowtie \sigma_{dname="Catering"} Department) \right. \right. \\ &\left. \left. - \pi_{eid}(Works \bowtie \sigma_{budget > 500,000} Department) \right) \right) \bowtie Employee \end{aligned}$$

g)

$$\pi_{dname}((\pi_{did}(Works) - \pi_{did}(\sigma_{age > 40} Employee \bowtie Works)) \bowtie Department)$$

h)

$$\rho(TMP1, Works)$$

$$\rho(TMP2, Works)$$

$$\rho(TMP3, \pi_{eid} Works - \pi_{eid}(TMP1 \bowtie_{(TMP1.eid=TMP2.eid) \wedge (TMP1.did <> TMP2.did)} TMP2))$$

$$\pi_{age}(TMP3 \bowtie Employee)$$

i)

$$\pi_{salary}(Employee \bowtie_{eid=managerid} Department))$$

j)

$$\rho(TMP1, Department)$$
$$\rho(TMP2, Department)$$
$$\rho(TMP3, \pi_{managerid} Department)$$
$$- \pi_{managerid}(TMP1 \bowtie_{(TMP1.managerid=TMP2.managerid) \wedge (TMP1.did <> TMP2.did)} TMP2))$$
$$\pi_{age}(TMP3 \bowtie_{managerid=eid} Employee)$$

Q2.

a)

$$\pi_{title}(\sigma_{studio="Universal"} Movies)$$

b)

$$\pi_{name}((\pi_{actor_id}(\sigma_{character="Forrest Gump"} StarsIn)) \bowtie Actors)$$

c)

$$\pi_{name}(\sigma_{nationality="German"} Actors)$$

d)

$$\pi_{nationality}((\pi_{actor_id}(\sigma_{character="Forrest Gump"} StarsIn)) \bowtie Actors)$$

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$$\pi_{nationality}((\pi_{movie_id}(\sigma_{year=1980} Movies)) \bowtie StarsIn \bowtie Actors)$$

e)

$$\rho(TMP1, StarsIn)$$
$$\rho(TMP2, StarsIn)$$
$$\rho(TMP3, \pi_{actor_id} StarsIn)$$
$$- \pi_{actor_id}(TMP1 \bowtie_{(TMP1.actor_id=TMP2.actor_id) \wedge (TMP1.movie_id <> TMP2.movie_id)} TMP2))$$
$$\pi_{name}(TMP3 \bowtie Actors)$$

f)

$$\rho(TMP1, \pi_{actor_id}(StarsIn \bowtie \sigma_{year \geq 1980} Movies))$$

$$\rho(TMP2, \pi_{actor_id}(StarsIn \bowtie \sigma_{studio='Universal'} Movies))$$
$$\pi_{name}((TMP1 - TMP2) \bowtie Actors)$$