

作業2 參考解答

(e) Find those manufacturers that sell Laptops, but not PC's.

(1) Algebraic expression

```
<latex> \pi_{\text{maker}}(\sigma_{\text{type=laptop}}(\text{Product}) - \sigma_{\text{type=pc}}(\text{Product})) </latex>
```

(2) Linear notation

```
<latex> R1:= \sigma_{\text{type=laptop}}(\text{Product}) </latex>
```

```
<latex> R2:= \sigma_{\text{type=pc}}(\text{Product}) </latex>
```

```
<latex> R3:= R1-R2 </latex>
```

```
<latex> \text{Answer}:=\pi_{\text{maker}}(R3) </latex>
```

(g) Find those pairs of PC models that have both the same speed and RAM. A pair should be listed only once; e.g., list (i,j) but not (j,i).

(1) Algebraic expression

```
<latex> \pi_{\{R.\text{model}, S.\text{model}\}}(\sigma_{\{R.\text{speed} = S.\text{speed} \wedge R.\text{ram}=S.\text{ram} \wedge R.\text{model} < S.\text{model}\}}(\rho_R(\text{PC}) \times \rho_S(\text{PC}))) </latex>
```

(2) Linear notation

```
<latex> R:=PC </latex>
```

```
<latex> S:=PC </latex>
```

```
<latex> T:=\sigma_{\{R.\text{speed} = S.\text{speed} \wedge R.\text{ram}=S.\text{ram} \wedge R.\text{model} < S.\text{model}\}}(R \times S) </latex> \text{ or } <latex> T:= R \bowtie_{\{R.\text{speed} = S.\text{speed} \wedge R.\text{ram}=S.\text{ram} \wedge R.\text{model} < S.\text{model}\}} S </latex>
```

```
<latex> \text{Answer}:=\pi_{\{R.\text{model}, S.\text{model}\}}(T) </latex>
```

(i) Find the manufacturer(s) of the computer (PC or laptop) with the highest available speed.

(1) Algebraic expression

```
<latex> \pi_{\text{maker}}^{1)}(\bowtie_{\{R3.\text{speed} < R4.\text{speed}\}} \rho_{R4}(\pi_{\{\text{model}, \text{speed}\}}(\text{PC}) \cup \pi_{\{\text{model}, \text{speed}\}}(\text{Laptop}))) \bowtie \text{Product} </latex>
```

(2) Linear notation

```
<latex> R1:= \pi_{\{\text{model}, \text{speed}\}}(\text{PC}) </latex>
```

```
<latex> R2:= \pi_{\{\text{model}, \text{speed}\}}(\text{Laptop}) </latex>
```

```
<latex> R3:= R1 \cup R2 </latex>
```

```

<latex> R4(model,speed2):= R3</latex>
<latex> R5(model, speed):= \pi_{R3.model, speed} (R3
\bowtie\limits_{speed<speed2}R4)</latex>
<latex> R6:= R3 - R5 </latex>
<latex> Answer:= \pi_{maker}(R6 \bowtie Product) </latex>

```

(k) Find the manufacturers who sell exactly three different models of PC.

(1) Algebraic expression

```

<latex> \pi_{maker}(\sigma_{m1\neq m2 \wedge m1\neq m3 \wedge m2\neq
m3}(\rho_{R1(maker, m1)}(\pi_{maker, model}(\sigma_{type=pc}(Product))) \bowtie
\rho_{R2(maker, m2)}(\pi_{maker, model}(\sigma_{type=pc}(Product))) \bowtie \rho_{R3(maker,
m3)}(\pi_{maker, model}(\sigma_{type=pc}(Product)))) - \pi_{maker}(\sigma_{m1\neq m2
\wedge m1\neq m3 \wedge m1\neq m4 \wedge m2\neq m3 \wedge m2\neq m4 \wedge m3\neq
m4}(\rho_{R1(maker, m1)}(\pi_{maker, model}(\sigma_{type=pc}(Product))) \bowtie
\rho_{R2(maker, m2)}(\pi_{maker, model}(\sigma_{type=pc}(Product))) \bowtie \rho_{R3(maker,
m3)}(\pi_{maker, model}(\sigma_{type=pc}(Product))) \bowtie \rho_{R4(maker, m4)}(\pi_{maker,
model}(\sigma_{type=pc}(Product)))) </latex>

```

(2) Linear notation

```

<latex> R1(maker, model1): \pi_{maker, model}(\sigma_{type=pc}(Product)) </latex>
<latex> R2(maker, model2):= R1 </latex>
<latex> R3(maker, model3):= R1 </latex>
<latex> R4(maker, model4):= R1 </latex>
<latex> R5(maker, model1,model2,model3):= R1 \bowtie R2 \bowtie R3 </latex>
<latex> R6(maker, model1, model2, model3, model4):= R4 \bowtie R5 </latex>
<latex> MThan3:=\pi_{maker}(\sigma_{model1\neq model2 \wedge model1\neq model3 \wedge
model2 \neq model3} (R5)) </latex>
<latex> MThan4:=\pi_{maker}(\sigma_{model1\neq model2 \wedge model1\neq model3 \wedge
model1 \neq model4 \wedge model2 \neq model3 \wedge model2 \neq model4 \wedge model3\neq
model4} (R6)) </latex>
<latex> Answer(maker):=MThan3 - MThan4 </latex>

```

1)

$R3 - \rho_{R5(model,speed)}(\pi_{R3.model,speed} (\rho_{R3})(\pi_{model,speed}(PC) \cup \pi_{model,speed}(Laptop$

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