

# SQL

# Qu'est ce que c'est ?

- C'est simplement un paraphrasage d'une expression de l'algèbre relationnelle en anglais.

## Format simplifié

```
SELECT A1, A2, ..., Ap
      FROM R1, R2, ..., Rk
      WHERE Q [{UNION | INTERSECT | EXCEPT} ... ]
```

## Algèbre relationnelle

```
PROJECT A1, A2, ..., Ap (
  RESTRICT Q [{UNION | INTERSECT | EXCEPT} ... ] (
    PRODUIT (R1, R2, ..., Rk ) ) )
```

# Expressions de bases

| Fonction            | SELECT   |             |   |        |        |      |     |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|---------------------|--|-------------|---|--------|--------|------|-----|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|--|--|
| But                 | Sélectionne les attributs provenant d'une table  |             |   |        |        |      |     |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Exemple             | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> | Identifiant | Prénom  | Nom    | Taille | Sexe | 1   | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |  |  |
|                     | Identifiant  | Prénom      | Nom   | Taille | Sexe   |      |     |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|                     | 1  | Pierre      | Or  | 1.80   | m      |      |     |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|                     | 2  | Paul        | Ni  | 1.70   | m      |      |     |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| 3                   | Jacqueline   | Car         | 1.49  | f      |        |      |     |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| SQL                 | SELECT Nom FROM Personne   |             | <table><tr><th>Nom</th></tr><tr><td>Or</td></tr><tr><td>Ni</td></tr><tr><td>Car</td></tr></table> | Nom    | Or     | Ni   | Car |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Nom                 |  |             |   |        |        |      |     |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Or                  |  |             |   |        |        |      |     |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Ni                  |  |             |   |        |        |      |     |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Car                 |  |             |   |        |        |      |     |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Algèbre relationnel | $\pi(Nom)(Personne)$   |             |   |        |        |      |     |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |

# Expressions de bases

| Fonction   | DISTINCT   |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |   |     |   |   |     |    |     |
|--|--|---|--------|--------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|---|-----|---|---|-----|----|-----|
| But  | Sélectionne les attributs uniques provenant d'une table  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |   |     |   |   |     |    |     |
| Exemple  | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Or</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> | Identifiant   | Prénom | Nom    | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Or | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f | <table><tr><td>SQL</td><td>SELECT    DISTINCT    Nom    FROM<br/>Personne</td></tr></table> | SQL | SELECT    DISTINCT    Nom    FROM<br>Personne | <table><tr><th>Nom</th></tr><tr><td>Or</td></tr><tr><td>Car</td></tr></table> | Nom | Or | Car |
|  | Identifiant  | Prénom  | Nom    | Taille | Sexe   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |   |     |   |   |     |    |     |
|  | 1  | Pierre  | Or     | 1.80   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |   |     |   |   |     |    |     |
| 2  | Paul   | Or  | 1.70   | m      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |   |     |   |   |     |    |     |
| 3  | Jacqueline   | Car   | 1.49   | f      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |   |     |   |   |     |    |     |
| SQL  | SELECT    DISTINCT    Nom    FROM<br>Personne  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |   |     |   |   |     |    |     |
| Nom  |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |   |     |   |   |     |    |     |
| Or   |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |   |     |   |   |     |    |     |
| Car  |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |   |     |   |   |     |    |     |
| <table><tr><td>Algèbre<br/>relationnel</td><td>Non applicable. L'algèbre relationnel applique le distinct par défaut</td></tr></table> | Algèbre<br>relationnel   | Non applicable. L'algèbre relationnel applique le distinct par défaut |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |   |     |   |   |     |    |     |
| Algèbre<br>relationnel   | Non applicable. L'algèbre relationnel applique le distinct par défaut  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |   |     |   |   |     |    |     |

| Nom |
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| Or  |
| Car |

# Expressions de bases

| Fonction            | WHERE  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|---------------------|--|--|--------|--------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|--|
| But                 | Sélectionne les attributs provenant d'une table respectant une condition   |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Exemple             | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> | Identifiant  | Prénom | Nom    | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |  |
|                     | Identifiant  | Prénom   | Nom    | Taille | Sexe   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|                     | 1  | Pierre   | Or     | 1.80   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|                     | 2  | Paul   | Ni     | 1.70   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| 3                   | Jacqueline   | Car  | 1.49   | f      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| SQL                 | SELECT Nom FROM Personne WHERE Taille > 1.50   | <table><tr><th>Nom</th></tr><tr><td>Or</td></tr><tr><td>Ni</td></tr></table> | Nom    | Or     | Ni     |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Nom                 |  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Or                  |  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Ni                  |  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Algèbre relationnel | $\pi(Nom)(\sigma(Taille>1.50)(Personne))$  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |

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# Expressions de bases

| Fonction            | AND  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|---------------------|--|--|--------|--------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|--|
| But                 | Sélectionne les attributs provenant d'une table respectant une condition 1 ET une condition 2  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Exemple             | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> | Identifiant  | Prénom | Nom    | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |  |
|                     | Identifiant  | Prénom   | Nom    | Taille | Sexe   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|                     | 1  | Pierre   | Or     | 1.80   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|                     | 2  | Paul   | Ni     | 1.70   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| 3                   | Jacqueline   | Car  | 1.49   | f      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| SQL                 | SELECT Nom FROM Personne WHERE Taille > 1.50 AND sexe='m'  | <table><tr><th>Nom</th></tr><tr><td>Or</td></tr><tr><td>Ni</td></tr></table> | Nom    | Or     | Ni     |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Nom                 |  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Or                  |  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Ni                  |  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Algèbre relationnel | $\pi(Nom)(\sigma(Taille > 1.50)(Personne)) \cap \pi(Nom)(\sigma(sexe = 'm')(Personne))$  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |

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# Expressions de bases

| Fonction | INTERSECT  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|----------|--|--|--------|--------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|--|
| But      | Sélectionne les attributs résultant de l'intersection de 2 requêtes.   |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Exemple  | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> | Identifiant  | Prénom | Nom    | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |  |
|          | Identifiant  | Prénom   | Nom    | Taille | Sexe   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|          | 1  | Pierre   | Or     | 1.80   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| 2        | Paul   | Ni   | 1.70   | m      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| 3        | Jacqueline   | Car  | 1.49   | f      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|          | SQL  | <div>SELECT Nom FROM Personne WHERE Taille &gt; 1.50<br/>INTERSECT<br/>SELECT Nom FROM Personne WHERE sexe = 'm'</div>                               |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|          | Algèbre relationnel  | <div><math>\pi(Nom)(\sigma(Taille &gt; 1.50) (Personne))</math><br/><math>\cap</math><br/><math>\pi(Nom)(\sigma(sexe = 'm') (Personne))</math></div> |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |

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# Expressions de bases

| Fonction            | OR   |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|---------------------|--|---|--------|--------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|--|
| But                 | Sélectionne les attributs provenant d'une table respectant une condition 1 OU une condition 2  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Exemple             | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> | Identifiant   | Prénom | Nom    | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |  |
|                     | Identifiant  | Prénom  | Nom    | Taille | Sexe   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|                     | 1  | Pierre  | Or     | 1.80   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|                     | 2  | Paul  | Ni     | 1.70   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| 3                   | Jacqueline   | Car   | 1.49   | f      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| SQL                 | SELECT Nom FROM Personne WHERE Taille > 1.50 OR sexe='f'   | <table><tr><th>Nom</th></tr><tr><td>Or</td></tr><tr><td>Ni</td></tr><tr><td>Car</td></tr></table> | Nom    | Or     | Ni     | Car  |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Nom                 |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Or                  |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Ni                  |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Car                 |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Algèbre relationnel | $\pi(Nom)(\sigma(Taille > 1.50) (Personne)) \cup \pi(Nom)(\sigma(sexe = 'f') (Personne))$  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |

| Nom |
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| Car |



# Expressions de bases

| Fonction            | UNION  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|---------------------|--|---|--------|--------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|--|
| But                 | Sélectionne les attributs résultant de l'intersection de 2 requêtes.   |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Exemple             | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> | Identifiant   | Prénom | Nom    | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |  |
|                     | Identifiant  | Prénom  | Nom    | Taille | Sexe   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|                     | 1  | Pierre  | Or     | 1.80   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|                     | 2  | Paul  | Ni     | 1.70   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| 3                   | Jacqueline   | Car   | 1.49   | f      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| SQL                 | SELECT Nom FROM Personne WHERE Taille > 1.50<br>UNION<br>SELECT Nom FROM Personne WHERE sexe = 'f'   | <table><tr><th>Nom</th></tr><tr><td>Or</td></tr><tr><td>Ni</td></tr><tr><td>Car</td></tr></table> | Nom    | Or     | Ni     | Car  |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Nom                 |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Or                  |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Ni                  |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Car                 |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Algèbre relationnel | $\pi(Nom)(\sigma(Taille > 1.50) (Personne)) \cup \pi(Nom)(\sigma(sexe = 'f') (Personne))$  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |

| Nom |
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| Or  |
| Ni  |
| Car |

# Expressions de bases

| Fonction            | EXCEPT   |             |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|---------------------|--|-------------|--------|--------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|--|
| But                 | Sélectionne les attributs résultant de la différence entre 2 requêtes.   |             |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Exemple             | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> | Identifiant | Prénom | Nom    | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |  |
|                     | Identifiant  | Prénom      | Nom    | Taille | Sexe   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|                     | 1  | Pierre      | Or     | 1.80   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|                     | 2  | Paul        | Ni     | 1.70   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| 3                   | Jacqueline   | Car         | 1.49   | f      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| SQL                 | <pre>SELECT Nom FROM Personne WHERE Taille &gt; 1.50<br/>EXCEPT<br/>SELECT Nom FROM Personne WHERE sexe = 'm'</pre>  | <b>Nom</b>  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Algèbre relationnel | $\pi(Nom)(\sigma(Taille > 1.50) (Personne))$<br>-<br>$\pi(Nom)(\sigma(sexe = 'm') (Personne))$   |             |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |

Nom

# Expressions de bases

| Fonction            | IN   |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|---------------------|--|---|--------|--------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|--|
| But                 | Permet de vérifier qu'un attribut est égal à une des valeurs comprise dans un set de valeurs déterminés.   |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Exemple             | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> | Identifiant   | Prénom | Nom    | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |  |
|                     | Identifiant  | Prénom  | Nom    | Taille | Sexe   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|                     | 1  | Pierre  | Or     | 1.80   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|                     | 2  | Paul  | Ni     | 1.70   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| 3                   | Jacqueline   | Car   | 1.49   | f      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| SQL                 | SELECT Nom FROM Personne WHERE<br>Sexe IN ('m','f')  | <table><tr><th>Nom</th></tr><tr><td>Or</td></tr><tr><td>Ni</td></tr><tr><td>Car</td></tr></table> | Nom    | Or     | Ni     | Car  |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Nom                 |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Or                  |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Ni                  |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Car                 |  |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Algèbre relationnel | $\pi(Nom)(\sigma(sexe='m') (Personne))$<br>$\cup$<br>$\pi(Nom)(\sigma(sexe='f') (Personne))$   |   |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |

| Nom |
|-----|
| Or  |
| Ni  |
| Car |

# Expressions de bases

| Fonction            | EXISTS / NOT EXISTS  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|---------------------|--|--|--------|--------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|--|
| But                 | Permet de savoir si la requête encapsulée retourne un résultat.  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Exemple             | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> | Identifiant  | Prénom | Nom    | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |  |
|                     | Identifiant  | Prénom   | Nom    | Taille | Sexe   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
|                     | 1  | Pierre   | Or     | 1.80   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| 2                   | Paul   | Ni   | 1.70   | m      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| 3                   | Jacqueline   | Car  | 1.49   | f      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| SQL                 | SELECT Nom FROM Personne<br>WHERE EXISTS (<br>SELECT * FROM Personne where Sexe = 'm'<br>)   | <table><tr><th>Nom</th></tr><tr><td>Or</td></tr><tr><td>Ni</td></tr></table> | Nom    | Or     | Ni     |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Nom                 |  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Or                  |  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Ni                  |  |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |
| Algèbre relationnel | Non applicable   |  |        |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |

| Nom |
|-----|
| Or  |
| Ni  |

# Expressions de bases

| Fonction            | BETWEEN  |             |  |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|---------------------|--|-------------|--|--------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|--|--|
| But                 | Permet de vérifier qu'un attribut est compris dans un intervalle de données  |             |  |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Exemple             | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> | Identifiant | Prénom   | Nom    | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |  |  |
|                     | Identifiant  | Prénom      | Nom  | Taille | Sexe   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|                     | 1  | Pierre      | Or   | 1.80   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|                     | 2  | Paul        | Ni   | 1.70   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| 3                   | Jacqueline   | Car         | 1.49   | f      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| SQL                 | SELECT Nom FROM Personne WHERE Taille BETWEEN 1.50 AND 1.99  |             | <table><tr><th>Nom</th></tr><tr><td>Or</td></tr><tr><td>Ni</td></tr></table> | Nom    | Or     | Ni   |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Nom                 |  |             |  |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Or                  |  |             |  |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Ni                  |  |             |  |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Algèbre relationnel | Pas d'équivalent   |             |  |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |

# Expressions de bases

| Fonction            | LIKE  |  |        |        |        |      |   |        |      |      |   |   |      |      |      |   |   |            |    |      |   |  |
|---------------------|---|--|--------|--------|--------|------|---|--------|------|------|---|---|------|------|------|---|---|------------|----|------|---|--|
| But                 | Permet de vérifier qu'un attribut ressemble à un terme recherché  |  |        |        |        |      |   |        |      |      |   |   |      |      |      |   |   |            |    |      |   |  |
| Exemple             | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>NiBo</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>BaNi</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Ni</td><td>1.49</td><td>f</td></tr></table> | Identifiant  | Prénom | Nom    | Taille | Sexe | 1 | Pierre | NiBo | 1.80 | m | 2 | Paul | BaNi | 1.70 | m | 3 | Jacqueline | Ni | 1.49 | f |  |
|                     | Identifiant   | Prénom   | Nom    | Taille | Sexe   |      |   |        |      |      |   |   |      |      |      |   |   |            |    |      |   |  |
|                     | 1   | Pierre   | NiBo   | 1.80   | m      |      |   |        |      |      |   |   |      |      |      |   |   |            |    |      |   |  |
|                     | 2   | Paul   | BaNi   | 1.70   | m      |      |   |        |      |      |   |   |      |      |      |   |   |            |    |      |   |  |
| 3                   | Jacqueline  | Ni   | 1.49   | f      |        |      |   |        |      |      |   |   |      |      |      |   |   |            |    |      |   |  |
| SQL                 | SELECT Nom FROM Personne WHERE<br>Nom LIKE 'Ni%'  | <table><tr><th>Nom</th></tr><tr><td>Nibo</td></tr><tr><td>Ni</td></tr></table> | Nom    | Nibo   | Ni     |      |   |        |      |      |   |   |      |      |      |   |   |            |    |      |   |  |
| Nom                 |   |  |        |        |        |      |   |        |      |      |   |   |      |      |      |   |   |            |    |      |   |  |
| Nibo                |   |  |        |        |        |      |   |        |      |      |   |   |      |      |      |   |   |            |    |      |   |  |
| Ni                  |   |  |        |        |        |      |   |        |      |      |   |   |      |      |      |   |   |            |    |      |   |  |
| Algèbre relationnel | Pas d'équivalent  |  |        |        |        |      |   |        |      |      |   |   |      |      |      |   |   |            |    |      |   |  |

| Nom  |
|------|
| Nibo |
| Ni   |

# Expressions de bases

| Fonction            | INNER JOIN  |   |     |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
|---------------------|---|---|-----|--------|--|----|--------|-----|-----|--------|----|--------|------------|-----|------|------|--------|-----------------|--|------|--------|------------|-----|------|------|---|------|---|---|------|---|---|------|---|--|
| But                 | Effectue une jointure dans laquelle la condition est la concordance de la clé primaire et secondaire. |   |     |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
| Exemple             | Patronyme   | <table><thead><tr><th>ID</th><th>Prénom</th><th>Nom</th></tr></thead><tbody><tr><td>1</td><td>Pierre</td><td>Or</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td></tr><tr><td>4</td><td>Jean</td><td>Michel</td></tr></tbody></table> | ID  | Prénom | Nom  | 1  | Pierre | Or  | 2   | Paul   | Ni | 3      | Jacqueline | Car | 4    | Jean | Michel | Caractéristique | <table><thead><tr><th>Id2</th><th>Taille</th><th>Sexe</th></tr></thead><tbody><tr><td>1</td><td>1.80</td><td>m</td></tr><tr><td>4</td><td>1.55</td><td>m</td></tr><tr><td>3</td><td>1.60</td><td>f</td></tr><tr><td>2</td><td>1.70</td><td>m</td></tr></tbody></table> | Id2  | Taille | Sexe       | 1   | 1.80 | m    | 4 | 1.55 | m | 3 | 1.60 | f | 2 | 1.70 | m |  |
|                     | ID  | Prénom  | Nom |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
|                     | 1   | Pierre  | Or  |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
|                     | 2   | Paul  | Ni  |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
| 3                   | Jacqueline  | Car   |     |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
| 4                   | Jean  | Michel  |     |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
| Id2                 | Taille  | Sexe  |     |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
| 1                   | 1.80  | m   |     |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
| 4                   | 1.55  | m   |     |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
| 3                   | 1.60  | f   |     |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
| 2                   | 1.70  | m   |     |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
| SQL                 | SELECT * FROM Patronyme INNER JOIN Caractéristique ON Patronyme.id = Caractéristique.id               |   |     |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
| Algèbre relationnel | $Patronyme_{id = id2} \bowtie Caractéristique$  |   |     |        | <table><thead><tr><th>ID</th><th>Prénom</th><th>Nom</th><th>Id2</th><th>Taille</th></tr></thead><tbody><tr><td>1</td><td>Pierre</td><td>Or</td><td>1</td><td>1.80</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>2</td><td>1.70</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>3</td><td>1.60</td></tr></tbody></table> | ID | Prénom | Nom | Id2 | Taille | 1  | Pierre | Or         | 1   | 1.80 | 2    | Paul   | Ni              | 2  | 1.70 | 3      | Jacqueline | Car | 3    | 1.60 |   |      |   |   |      |   |   |      |   |  |
| ID                  | Prénom  | Nom   | Id2 | Taille |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
| 1                   | Pierre  | Or  | 1   | 1.80   |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
| 2                   | Paul  | Ni  | 2   | 1.70   |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |
| 3                   | Jacqueline  | Car   | 3   | 1.60   |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |   |   |      |   |   |      |   |  |

# Expressions de bases


| Fonction | FULL JOIN   |   |      |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
|----------|---|---|------|--------|--|----|--------|-----|-----|--------|----|--------|------------|-----|------|------|--------|-----------------|--|------|--------|------------|-----|------|------|---|------|--------|------|------|---|---|------|---|------|--|
| But      | Effectue une INNER JOIN et remplis les valeurs avec NULL si la condition n'est pas respectée. |   |      |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
| Exemple  | Patronyme   | <table><tr><th>ID</th><th>Prénom</th><th>Nom</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td></tr><tr><td>4</td><td>Jean</td><td>Michel</td></tr></table> | ID   | Prénom | Nom  | 1  | Pierre | Or  | 2   | Paul   | Ni | 3      | Jacqueline | Car | 4    | Jean | Michel | Caractéristique | <table><tr><th>Id2</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>1.80</td><td>m</td></tr><tr><td>3</td><td>1.60</td><td>f</td></tr><tr><td>2</td><td>1.70</td><td>m</td></tr><tr><td>5</td><td>2.30</td><td>m</td></tr></table> | Id2  | Taille | Sexe       | 1   | 1.80 | m    | 3 | 1.60 | f      | 2    | 1.70 | m | 5 | 2.30 | m |      |  |
|          | ID  | Prénom  | Nom  |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
|          | 1   | Pierre  | Or   |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
|          | 2   | Paul  | Ni   |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
| 3        | Jacqueline  | Car   |      |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
| 4        | Jean  | Michel  |      |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
| Id2      | Taille  | Sexe  |      |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
| 1        | 1.80  | m   |      |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
| 3        | 1.60  | f   |      |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
| 2        | 1.70  | m   |      |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
| 5        | 2.30  | m   |      |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
|          | SQL   | SELECT * FROM Patronyme FULL JOIN<br>Caractéristique ON Patronyme.id =<br>Caractéristique.id2   |      |        |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
|          | Algèbre<br>relationnel  | Pas d'équivalent  |      |        | <table><tr><th>ID</th><th>Prénom</th><th>Nom</th><th>Id2</th><th>Taille</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1</td><td>1.80</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>2</td><td>1.70</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>3</td><td>1.60</td></tr><tr><td>4</td><td>Jean</td><td>Michel</td><td>null</td><td>null</td></tr><tr><td></td><td></td><td></td><td>5</td><td>2.30</td></tr></table> | ID | Prénom | Nom | Id2 | Taille | 1  | Pierre | Or         | 1   | 1.80 | 2    | Paul   | Ni              | 2  | 1.70 | 3      | Jacqueline | Car | 3    | 1.60 | 4 | Jean | Michel | null | null |   |   |      | 5 | 2.30 |  |
| ID       | Prénom  | Nom   | Id2  | Taille |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
| 1        | Pierre  | Or  | 1    | 1.80   |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
| 2        | Paul  | Ni  | 2    | 1.70   |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
| 3        | Jacqueline  | Car   | 3    | 1.60   |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
| 4        | Jean  | Michel  | null | null   |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |
|          |   |   | 5    | 2.30   |  |    |        |     |     |        |    |        |            |     |      |      |        |                 |  |      |        |            |     |      |      |   |      |        |      |      |   |   |      |   |      |  |




# Expressions de bases

| Fonction | NATURAL JOIN   |   |        |        |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
|----------|--|---|--------|--------|-----|--------|--------|----|--------|------|------|---|------------|------|----|------|--------|-----------------|--|-----|--------|------|---|------|--------|------|------|---|---|------|---|---|------|---|--|--|
| But      | Effectue une jointure dans laquelle la condition est la concordance de deux clés ayant le même nom et de même type |   |        |        |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
| Exemple  | Patronyme  | <table><tr><th>ID</th><th>Prénom</th><th>Nom</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td></tr><tr><td>4</td><td>Jean</td><td>Michel</td></tr></table>   | ID     | Prénom | Nom | 1      | Pierre | Or | 2      | Paul | Ni   | 3 | Jacqueline | Car  | 4  | Jean | Michel | Caractéristique | <table><tr><th>Id2</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>1.80</td><td>m</td></tr><tr><td>4</td><td>1.55</td><td>m</td></tr><tr><td>3</td><td>1.60</td><td>f</td></tr><tr><td>2</td><td>1.70</td><td>m</td></tr></table> | Id2 | Taille | Sexe | 1 | 1.80 | m      | 4    | 1.55 | m | 3 | 1.60 | f | 2 | 1.70 | m |  |  |
|          | ID   | Prénom  | Nom    |        |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
|          | 1  | Pierre  | Or     |        |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
|          | 2  | Paul  | Ni     |        |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
| 3        | Jacqueline   | Car   |        |        |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
| 4        | Jean   | Michel  |        |        |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
| Id2      | Taille   | Sexe  |        |        |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
| 1        | 1.80   | m   |        |        |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
| 4        | 1.55   | m   |        |        |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
| 3        | 1.60   | f   |        |        |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
| 2        | 1.70   | m   |        |        |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
|          | SQL  | SELECT * FROM Patronyme NATURAL JOIN Caractéristique ON Patronyme.id = Caractéristique.id   |        |        |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
|          | Algèbre relationnel  | $Patronyme_{id} \bowtie_{id = id} Caractéristique$  |        |        |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
|          |  | <table><tr><th>ID</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.60</td><td>f</td></tr><tr><td>4</td><td>Jean</td><td>Michel</td><td>1,55</td><td>m</td></tr></table> | ID     | Prénom | Nom | Taille | Sexe   | 1  | Pierre | Or   | 1.80 | m | 2          | Paul | Ni | 1.70 | m      | 3               | Jacqueline   | Car | 1.60   | f    | 4 | Jean | Michel | 1,55 | m    |   |   |      |   |   |      |   |  |  |
| ID       | Prénom   | Nom   | Taille | Sexe   |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
| 1        | Pierre   | Or  | 1.80   | m      |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
| 2        | Paul   | Ni  | 1.70   | m      |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
| 3        | Jacqueline   | Car   | 1.60   | f      |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |
| 4        | Jean   | Michel  | 1,55   | m      |     |        |        |    |        |      |      |   |            |      |    |      |        |                 |  |     |        |      |   |      |        |      |      |   |   |      |   |   |      |   |  |  |

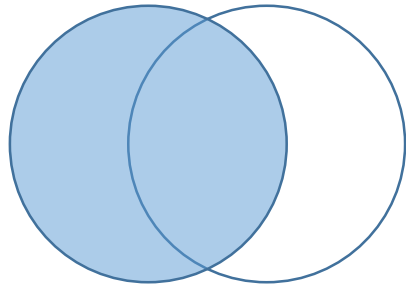
# Expressions de bases

| Fonction | LEFT JOIN   |   |        |        |      |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
|----------|---|---|--------|--------|------|-----|--------|------|---|--------|----|---|------------|-----|---|------|--------|-----------------|--|-----|--------|------------|-----|------|------|---|------|------|--------|------|------|------|------|---|--|--|
| But      | Effectue une jointure listant tous les éléments de la table de gauche même s'il n'y a pas de concordance dans la deuxième table |   |        |        |      |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
| Exemple  | Patronyme   | <table><tr><th>ID</th><th>Prénom</th><th>Nom</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td></tr><tr><td>4</td><td>Jean</td><td>Michel</td></tr></table>   | ID     | Prénom | Nom  | 1   | Pierre | Or   | 2 | Paul   | Ni | 3 | Jacqueline | Car | 4 | Jean | Michel | Caractéristique | <table><tr><th>Id2</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>1.80</td><td>m</td></tr><tr><td>3</td><td>1.60</td><td>f</td></tr><tr><td>2</td><td>1.70</td><td>m</td></tr><tr><td>5</td><td>2.30</td><td>m</td></tr></table> | Id2 | Taille | Sexe       | 1   | 1.80 | m    | 3 | 1.60 | f    | 2      | 1.70 | m    | 5    | 2.30 | m |  |  |
|          |   | ID  | Prénom | Nom    |      |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
|          |   | 1   | Pierre | Or     |      |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
|          |   | 2   | Paul   | Ni     |      |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
| 3        | Jacqueline  | Car   |        |        |      |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
| 4        | Jean  | Michel  |        |        |      |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
| Id2      | Taille  | Sexe  |        |        |      |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
| 1        | 1.80  | m   |        |        |      |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
| 3        | 1.60  | f   |        |        |      |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
| 2        | 1.70  | m   |        |        |      |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
| 5        | 2.30  | m   |        |        |      |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
|          | SQL   | SELECT * FROM Patronyme RIGHT JOIN Caractéristique ON Patronyme.id = Caractéristique.id2  |        |        |      |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
|          | Algèbre relationnel   | Pas d'équivalent dans l'algèbre « basique ».   |        |        |      |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
|          |   | <table><tr><th>ID</th><th>Prénom</th><th>Nom</th><th>Id2</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>2</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>3</td><td>1.60</td><td>f</td></tr><tr><td>4</td><td>Jean</td><td>Michel</td><td>null</td><td>null</td><td>null</td></tr></table> | ID     | Prénom | Nom  | Id2 | Taille | Sexe | 1 | Pierre | Or | 1 | 1.80       | m   | 2 | Paul | Ni     | 2               | 1.70   | m   | 3      | Jacqueline | Car | 3    | 1.60 | f | 4    | Jean | Michel | null | null | null |      |   |  |  |
| ID       | Prénom  | Nom   | Id2    | Taille | Sexe |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
| 1        | Pierre  | Or  | 1      | 1.80   | m    |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
| 2        | Paul  | Ni  | 2      | 1.70   | m    |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
| 3        | Jacqueline  | Car   | 3      | 1.60   | f    |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |
| 4        | Jean  | Michel  | null   | null   | null |     |        |      |   |        |    |   |            |     |   |      |        |                 |  |     |        |            |     |      |      |   |      |      |        |      |      |      |      |   |  |  |

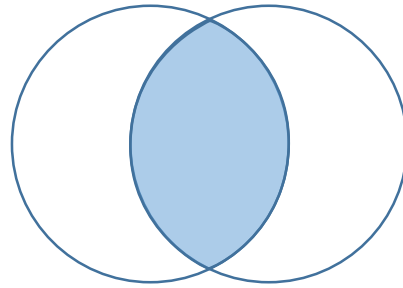
# Expressions de bases

| Fonction | RIGHT JOIN  |   |     |        |      |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
|----------|---|---|-----|--------|------|--|--------|--------|-----|------|--------|------|------------|--------|----|------|--------|-----------------|--|------|--------|------|------|------|---|------------|------|---|------|------|------|------|------|---|------|---|
| But      | Effectue une jointure listant tous les éléments de la table de droite même s'il n'y a pas de concordance dans la deuxième table |   |     |        |      |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
| Exemple  | Patronyme   | <table><tr><th>ID</th><th>Prénom</th><th>Nom</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td></tr><tr><td>4</td><td>Jean</td><td>Michel</td></tr></table> | ID  | Prénom | Nom  | 1  | Pierre | Or     | 2   | Paul | Ni     | 3    | Jacqueline | Car    | 4  | Jean | Michel | Caractéristique | <table><tr><th>Id2</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>1.80</td><td>m</td></tr><tr><td>3</td><td>1.60</td><td>f</td></tr><tr><td>2</td><td>1.70</td><td>m</td></tr><tr><td>5</td><td>2.30</td><td>m</td></tr></table> | Id2  | Taille | Sexe | 1    | 1.80 | m | 3          | 1.60 | f | 2    | 1.70 | m    | 5    | 2.30 | m |      |   |
|          | ID  | Prénom  | Nom |        |      |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
|          | 1   | Pierre  | Or  |        |      |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
|          | 2   | Paul  | Ni  |        |      |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
| 3        | Jacqueline  | Car   |     |        |      |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
| 4        | Jean  | Michel  |     |        |      |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
| Id2      | Taille  | Sexe  |     |        |      |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
| 1        | 1.80  | m   |     |        |      |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
| 3        | 1.60  | f   |     |        |      |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
| 2        | 1.70  | m   |     |        |      |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
| 5        | 2.30  | m   |     |        |      |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
|          | SQL   | SELECT * FROM Patronyme LEFT JOIN<br>Caractéristique ON Patronyme.id =<br>Caractéristique.id2   |     |        |      |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
|          | Algèbre<br>relationnel  | Pas d'équivalent dans l'algèbre<br>« basique ».    |     |        |      | <table><tr><th>ID</th><th>Prénom</th><th>Nom</th><th>Id2</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>2</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>3</td><td>1.60</td><td>f</td></tr><tr><td>null</td><td>null</td><td>null</td><td>5</td><td>2.30</td><td>m</td></tr></table> | ID     | Prénom | Nom | Id2  | Taille | Sexe | 1          | Pierre | Or | 1    | 1.80   | m               | 2  | Paul | Ni     | 2    | 1.70 | m    | 3 | Jacqueline | Car  | 3 | 1.60 | f    | null | null | null | 5 | 2.30 | m |
| ID       | Prénom  | Nom   | Id2 | Taille | Sexe |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
| 1        | Pierre  | Or  | 1   | 1.80   | m    |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
| 2        | Paul  | Ni  | 2   | 1.70   | m    |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
| 3        | Jacqueline  | Car   | 3   | 1.60   | f    |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |
| null     | null  | null  | 5   | 2.30   | m    |  |        |        |     |      |        |      |            |        |    |      |        |                 |  |      |        |      |      |      |   |            |      |   |      |      |      |      |      |   |      |   |

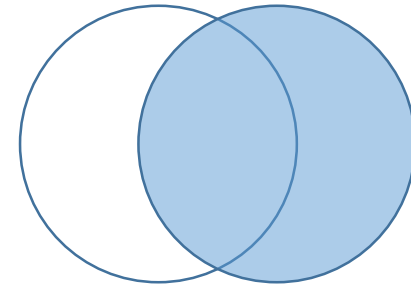
# Résumé sur les jointures



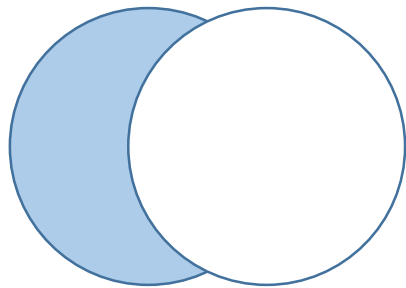
Left Join



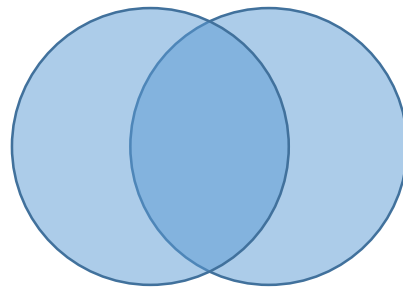
Inner Join



Right Join



Except



Full Join

# Expressions de bases

| Fonction            | GROUP BY   |  |              |        |              |   |        |    |   |      |     |   |        |    |   |      |    |
|---------------------|--|--|--------------|--------|--------------|---|--------|----|---|------|-----|---|--------|----|---|------|----|
| But                 | Permet de grouper plusieurs résultats et d'utiliser une fonction d'agrégation. |  |              |        |              |   |        |    |   |      |     |   |        |    |   |      |    |
| Exemple             | Gain   | <table><tr><th>ID</th><th>Prénom</th><th>Rémunération</th></tr><tr><td>1</td><td>Pierre</td><td>50</td></tr><tr><td>2</td><td>Paul</td><td>105</td></tr><tr><td>3</td><td>Pierre</td><td>75</td></tr><tr><td>4</td><td>Paul</td><td>12</td></tr></table> | ID           | Prénom | Rémunération | 1 | Pierre | 50 | 2 | Paul | 105 | 3 | Pierre | 75 | 4 | Paul | 12 |
|                     | ID   | Prénom   | Rémunération |        |              |   |        |    |   |      |     |   |        |    |   |      |    |
|                     | 1  | Pierre   | 50           |        |              |   |        |    |   |      |     |   |        |    |   |      |    |
| 2                   | Paul   | 105  |              |        |              |   |        |    |   |      |     |   |        |    |   |      |    |
| 3                   | Pierre   | 75   |              |        |              |   |        |    |   |      |     |   |        |    |   |      |    |
| 4                   | Paul   | 12   |              |        |              |   |        |    |   |      |     |   |        |    |   |      |    |
| SQL                 | <pre>SELECT Prénom, sum(Rémunération) FROM Gain GROUP BY Prénom</pre>          |  |              |        |              |   |        |    |   |      |     |   |        |    |   |      |    |
| Algèbre relationnel | Pas d'équivalent dans l'algèbre « basique ».                                   |  |              |        |              |   |        |    |   |      |     |   |        |    |   |      |    |

| ID | Prénom | SUM(Rémunération) |
|----|--------|-------------------|
| 1  | Pierre | 115               |
| 2  | Paul   | 117               |

| ID | Prénom | SUM(Rémunération) |
|----|--------|-------------------|
| 1  | Pierre | 115               |
| 2  | Paul   | 117               |

# Expressions de bases

| Fonction | HAVING  |  |  |        |              |                   |        |      |     |      |     |   |        |    |   |      |    |  |
|----------|---|--|--|--------|--------------|-------------------|--------|------|-----|------|-----|---|--------|----|---|------|----|--|
| But      | Similaire à un WHERE mis à part que l'on peut utiliser des fonctions d'agrégat. |  |  |        |              |                   |        |      |     |      |     |   |        |    |   |      |    |  |
| Exemple  | Gain  | <table><thead><tr><th>ID</th><th>Prénom</th><th>Rémunération</th></tr></thead><tbody><tr><td>1</td><td>Pierre</td><td>50</td></tr><tr><td>2</td><td>Paul</td><td>105</td></tr><tr><td>3</td><td>Pierre</td><td>75</td></tr><tr><td>4</td><td>Paul</td><td>12</td></tr></tbody></table> | ID   | Prénom | Rémunération | 1                 | Pierre | 50   | 2   | Paul | 105 | 3 | Pierre | 75 | 4 | Paul | 12 |  |
|          | ID  | Prénom   | Rémunération   |        |              |                   |        |      |     |      |     |   |        |    |   |      |    |  |
|          | 1   | Pierre   | 50   |        |              |                   |        |      |     |      |     |   |        |    |   |      |    |  |
|          | 2   | Paul   | 105  |        |              |                   |        |      |     |      |     |   |        |    |   |      |    |  |
| 3        | Pierre  | 75   |  |        |              |                   |        |      |     |      |     |   |        |    |   |      |    |  |
| 4        | Paul  | 12   |  |        |              |                   |        |      |     |      |     |   |        |    |   |      |    |  |
|          | SQL   | SELECT Prénom, SUM (Rémunération)<br>FROM Gain GROUP BY Prénom<br>HAVING SUM (Rémunération) >116   |  |        |              |                   |        |      |     |      |     |   |        |    |   |      |    |  |
|          | Algèbre relationnel   | Pas d'équivalent dans l'algèbre<br>« basique ».  |  |        |              |                   |        |      |     |      |     |   |        |    |   |      |    |  |
|          |   |  | <table><thead><tr><th>ID</th><th>Prénom</th><th>SUM(Rémunération)</th></tr></thead><tbody><tr><td>2</td><td>Paul</td><td>117</td></tr></tbody></table> | ID     | Prénom       | SUM(Rémunération) | 2      | Paul | 117 |      |     |   |        |    |   |      |    |  |
| ID       | Prénom  | SUM(Rémunération)  |  |        |              |                   |        |      |     |      |     |   |        |    |   |      |    |  |
| 2        | Paul  | 117  |  |        |              |                   |        |      |     |      |     |   |        |    |   |      |    |  |

| ID | Prénom | SUM(Rémunération) |
|----|--------|-------------------|
| 2  | Paul   | 117               |

# Les fonctions

- Certains concepts ont été ajoutés afin de pouvoir faciliter la manipulation de ces données
  - Les fonctions **scalaires** permettent d'adapter les résultats via des requêtes élaborées. On peut par exemple :
    - Afficher les enregistrements en majuscules ;
    - Concaténer les chaînes de caractères ;
    - Etc.
  - Les fonctions **d'agrégat** permettent d'effectuer des statistiques de bases sur les tables. On peut par exemple :
    - Calculer la moyenne sur un ensemble d'enregistrement ;
    - Compter le nombre d'enregistrement sur une table ;
    - Calculer la somme sur un ensemble d'enregistrement ;
    - Etc.

# Exemples de fonctions scalaires

| Fonction      | UPPER  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|---------------|--|--|------------|--------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|--|--|
| But           | Convertit le texte d'un champ en majuscules  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Exemple       | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> | Identifiant  | Prénom     | Nom    | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |  |  |
|               | Identifiant  | Prénom   | Nom        | Taille | Sexe   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|               | 1  | Pierre   | Or         | 1.80   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|               | 2  | Paul   | Ni         | 1.70   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| 3             | Jacqueline   | Car  | 1.49       | f      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Avec fonction | SELECT UPPER(Nom) FROM Personne  | <table><tr><th>UPPER(Nom)</th></tr><tr><td>OR</td></tr><tr><td>NI</td></tr><tr><td>CAR</td></tr></table> | UPPER(Nom) | OR     | NI     | CAR  |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| UPPER(Nom)    |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| OR            |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| NI            |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| CAR           |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Sans fonction | SELECT Nom FROM Personne   | <table><tr><th>Nom</th></tr><tr><td>Or</td></tr><tr><td>Ni</td></tr><tr><td>Car</td></tr></table>        | Nom        | Or     | Ni     | Car  |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Nom           |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Or            |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Ni            |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Car           |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |



# Exemples de fonctions scalaires

| Fonction      | LOWER  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|---------------|--|--|------------|--------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|--|--|
| But           | Convertit le texte d'un champ en minuscules  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Exemple       | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> | Identifiant  | Prénom     | Nom    | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |  |  |
|               | Identifiant  | Prénom   | Nom        | Taille | Sexe   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|               | 1  | Pierre   | Or         | 1.80   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|               | 2  | Paul   | Ni         | 1.70   | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| 3             | Jacqueline   | Car  | 1.49       | f      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Avec fonction | SELECT LOWER(Nom) FROM Personne  | <table><tr><th>LOWER(Nom)</th></tr><tr><td>or</td></tr><tr><td>ni</td></tr><tr><td>car</td></tr></table> | LOWER(Nom) | or     | ni     | car  |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| LOWER(Nom)    |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| or            |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| ni            |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| car           |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Sans fonction | SELECT Nom FROM Personne   | <table><tr><th>Nom</th></tr><tr><td>Or</td></tr><tr><td>Ni</td></tr><tr><td>Car</td></tr></table>        | Nom        | Or     | Ni     | Car  |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Nom           |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Or            |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Ni            |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Car           |  |  |            |        |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |

# Exemples de fonctions scalaires

| Fonction      | LENGTH   |   |             |             |        |     |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|---------------|--|---|-------------|-------------|--------|-----|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|
| But           | Retourne la longueur d'un champ  |   |             |             |        |     |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Exemple       | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> |   |             | Identifiant | Prénom | Nom | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |
|               | Identifiant  | Prénom  | Nom         | Taille      | Sexe   |     |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|               | 1  | Pierre  | Or          | 1.80        | m      |     |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|               | 2  | Paul  | Ni          | 1.70        | m      |     |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|               | 3  | Jacqueline  | Car         | 1.49        | f      |     |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Avec fonction | SELECT LENGTH(Nom) FROM<br>Personne  | <table><tr><th>Length(Nom)</th></tr><tr><td>2</td></tr><tr><td>2</td></tr><tr><td>3</td></tr></table> | Length(Nom) | 2           | 2      | 3   |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Length(Nom)   |  |   |             |             |        |     |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 2             |  |   |             |             |        |     |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 2             |  |   |             |             |        |     |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 3             |  |   |             |             |        |     |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Sans fonction | SELECT Nom FROM Personne   | <table><tr><th>Nom</th></tr><tr><td>Or</td></tr><tr><td>Ni</td></tr><tr><td>Car</td></tr></table>     | Nom         | Or          | Ni     | Car |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Nom           |  |   |             |             |        |     |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Or            |  |   |             |             |        |     |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Ni            |  |   |             |             |        |     |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Car           |  |   |             |             |        |     |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |

# Exemples de fonctions scalaires

| Fonction        | ROUND  |            |     |   |                 |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|-----------------|--|------------|-----|---|-----------------|--------|------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|
| But             | Arrondis le champ souhaité.  |            |     |   |                 |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Exemple         | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> |            |     |   | Identifiant     | Prénom | Nom  | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |
|                 | Identifiant  | Prénom     | Nom | Taille  | Sexe            |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|                 | 1  | Pierre     | Or  | 1.80  | m               |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|                 | 2  | Paul       | Ni  | 1.70  | m               |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|                 | 3  | Jacqueline | Car | 1.49  | f               |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Avec fonction   | SELECT ROUND(Taille,0) FROM<br>Personne  |            |     | <table><tr><th>Round(Taille,0)</th></tr><tr><td>2</td></tr><tr><td>2</td></tr><tr><td>1</td></tr></table> | Round(Taille,0) | 2      | 2    | 1      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Round(Taille,0) |  |            |     |   |                 |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 2               |  |            |     |   |                 |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 2               |  |            |     |   |                 |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 1               |  |            |     |   |                 |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Sans fonction   | SELECT Taille FROM Personne  |            |     | <table><tr><th>Taille</th></tr><tr><td>1.80</td></tr><tr><td>1.70</td></tr><tr><td>1.49</td></tr></table> | Taille          | 1.80   | 1.70 | 1.49   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Taille          |  |            |     |   |                 |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 1.80            |  |            |     |   |                 |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 1.70            |  |            |     |   |                 |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 1.49            |  |            |     |   |                 |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |

# Exemples de fonctions d'agrégat

| Fonction      | Average  |   |             |         |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|---------------|--|---|-------------|---------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|--|--|
| But           | Retourne la moyenne d'un ensemble donné.   |   |             |         |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Exemple       | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> | Identifiant   | Prénom      | Nom     | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |  |  |
|               | Identifiant  | Prénom  | Nom         | Taille  | Sexe   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|               | 1  | Pierre  | Or          | 1.80    | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|               | 2  | Paul  | Ni          | 1.70    | m      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
|               | 3  | Jacqueline  | Car         | 1.49    | f      |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Avec fonction | SELECT avg(Taille) FROM Personne   | <table><tr><th>Avg(Taille)</th></tr><tr><td>1,66333</td></tr></table>                                     | Avg(Taille) | 1,66333 |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Avg(Taille)   |  |   |             |         |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| 1,66333       |  |   |             |         |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Sans fonction | SELECT Taille FROM Personne  | <table><tr><th>Taille</th></tr><tr><td>1.80</td></tr><tr><td>1.70</td></tr><tr><td>1.49</td></tr></table> | Taille      | 1.80    | 1.70   | 1.49 |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| Taille        |  |   |             |         |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| 1.80          |  |   |             |         |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| 1.70          |  |   |             |         |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |
| 1.49          |  |   |             |         |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |  |  |

# Exemples de fonctions d'agrégat

| Fonction      | Sum  |            |   |             |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|---------------|--|------------|---|-------------|-------------|--------|------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|
| But           | Retourne la somme de l'ensemble donné.   |            |   |             |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Exemple       | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> |            |   |             | Identifiant | Prénom | Nom  | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |
|               | Identifiant  | Prénom     | Nom   | Taille      | Sexe        |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|               | 1  | Pierre     | Or  | 1.80        | m           |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|               | 2  | Paul       | Ni  | 1.70        | m           |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|               | 3  | Jacqueline | Car   | 1.49        | f           |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Avec fonction | SELECT sum(Taille) FROM Personne   |            | <table><tr><th>Sum(Taille)</th></tr><tr><td>4,99</td></tr></table>  | Sum(Taille) | 4,99        |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Sum(Taille)   |  |            |   |             |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 4,99          |  |            |   |             |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Sans fonction | SELECT Taille FROM Personne  |            | <table><tr><th>Taille</th></tr><tr><td>1.80</td></tr><tr><td>1.70</td></tr><tr><td>1.49</td></tr></table> | Taille      | 1.80        | 1.70   | 1.49 |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Taille        |  |            |   |             |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 1.80          |  |            |   |             |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 1.70          |  |            |   |             |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 1.49          |  |            |   |             |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |

# Exemples de fonctions d'agrégat

| Fonction      | Max / Min  |            |   |        |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|---------------|--|------------|---|--------|-------------|--------|------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|
| But           | Retourne le maximum / minimum de l'ensemble donné.   |            |   |        |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Exemple       | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> |            |   |        | Identifiant | Prénom | Nom  | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |
|               | Identifiant  | Prénom     | Nom   | Taille | Sexe        |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|               | 1  | Pierre     | Or  | 1.80   | m           |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|               | 2  | Paul       | Ni  | 1.70   | m           |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|               | 3  | Jacqueline | Car   | 1.49   | f           |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Avec fonction | SELECT max(Taille) FROM Personne   |            | <table><tr><th>Max(taille)</th></tr><tr><td>1,80</td></tr></table>  |        | Max(taille) | 1,80   |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Max(taille)   |  |            |   |        |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 1,80          |  |            |   |        |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Sans fonction | SELECT Taille FROM Personne  |            | <table><tr><th>Taille</th></tr><tr><td>1.80</td></tr><tr><td>1.70</td></tr><tr><td>1.49</td></tr></table> |        | Taille      | 1.80   | 1.70 | 1.49   |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Taille        |  |            |   |        |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 1.80          |  |            |   |        |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 1.70          |  |            |   |        |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 1.49          |  |            |   |        |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |

# Exemples de fonctions d'agrégat

| Fonction      | Count  |            |   |               |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|---------------|--|------------|---|---------------|-------------|--------|------|--------|------|---|--------|----|------|---|---|------|----|------|---|---|------------|-----|------|---|
| But           | Retourne le nombre d'entrées de l'ensemble donné.  |            |   |               |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Exemple       | <table><tr><th>Identifiant</th><th>Prénom</th><th>Nom</th><th>Taille</th><th>Sexe</th></tr><tr><td>1</td><td>Pierre</td><td>Or</td><td>1.80</td><td>m</td></tr><tr><td>2</td><td>Paul</td><td>Ni</td><td>1.70</td><td>m</td></tr><tr><td>3</td><td>Jacqueline</td><td>Car</td><td>1.49</td><td>f</td></tr></table> |            |   |               | Identifiant | Prénom | Nom  | Taille | Sexe | 1 | Pierre | Or | 1.80 | m | 2 | Paul | Ni | 1.70 | m | 3 | Jacqueline | Car | 1.49 | f |
|               | Identifiant  | Prénom     | Nom   | Taille        | Sexe        |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|               | 1  | Pierre     | Or  | 1.80          | m           |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|               | 2  | Paul       | Ni  | 1.70          | m           |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
|               | 3  | Jacqueline | Car   | 1.49          | f           |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Avec fonction | SELECT count(Taille) FROM Personne   |            | <table><tr><th>Count(taille)</th></tr><tr><td>3</td></tr></table>   | Count(taille) | 3           |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Count(taille) |  |            |   |               |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 3             |  |            |   |               |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Sans fonction | SELECT Taille FROM Personne  |            | <table><tr><th>Taille</th></tr><tr><td>1.80</td></tr><tr><td>1.70</td></tr><tr><td>1.49</td></tr></table> | Taille        | 1.80        | 1.70   | 1.49 |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| Taille        |  |            |   |               |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 1.80          |  |            |   |               |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 1.70          |  |            |   |               |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |
| 1.49          |  |            |   |               |             |        |      |        |      |   |        |    |      |   |   |      |    |      |   |   |            |     |      |   |