SQL

Query

```
SELECT List_Of_Attributes
FROM List_Of_Tables
WHERE Condition
ORDER BY List_Of_Ordering_Attributes
GROUP BY List_Of_Grouping_Attributes
HAVING Condition
UNION | INTERSECT | EXCEPT
SELECT ...
```

Components

- List_Of_Attributes: a list of
  - attribute name (e.g. maker)
  - attribute name AS new_name (for renaming)
  - aggregation expression (e.g. SUM(price))
  - arithmetic expression (e.g. price * 2)
  which are separated by comma (* stands for ALL).
- List_Of_Tables: a (separated by comma) list of relation names (or table names) (e.g. product, PC).
- Condition: a Boolean expression built using
  - attribute names and
  - logical operators: AND, OR, NOT
  - arithmetic operators (+, -, *,/) on numeric valued attributes
  - comparison operators (> , <, =, >=, <=) or special comparison operator (e.g. LIKE) for strings

NOTE: Needs to pay attention to operations involving NULL values.

NULL value and UNKNOWN

- NULL: indicate unknown value (the price is unknown, the birthdate is unknown, etc.)
- Arithmetic operations with NULL as one of the arguments yield NULL result, e.g.,
  - 50 + NULL gives NULL
  - 10 * NULL gives NULL
- Boolean operations with NULL might yield UNKNOWN truth: see table on three-valued logic in the book (table 6.2)

Example – Projection/Selection

```
select * from product...
selct maker, speed from product...
selct model, speed from product...
selct model, speed, ram, hd from product...
```

Example – Join, Union, Intersection, Difference

```
select maker, speed from product, laptop...
select product.model, price from pc, product...
select product.model, price from laptop, product...
```

Example – Join, Union, Intersection, Difference

```
select maker, speed from product, laptop...
```

Example – Projection/Selection

```
select * from product...
select model, speed from product...
select model, speed, ram, hd from product...
```
Example - Subqueries

select maker from product, pc where
  product.model=pc.model
select distinct maker from product, pc where
  product.model=pc.model
select maker from product where product.model IN
  (select model from pc)
select distinct maker from product where
  product.model IN (select model from pc)
select model from printer where printer.price =
  (select max(price) from printer)