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More SQL

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TA section 4

1 AGGREGATE OPERATIONS

SQL supports five aggregate operations, which can be applied on any column, say A, of a relation:

- `COUNT ([DISTINCT] A)` : The number of (unique) values in the A column.
- `SUM ([DISTINCT] A)`: The sum of all (unique) values in the A column.
- `AVG ([DISTINCT] A)`: The average of all (unique) values in the A column.
- `MAX (A)`: The maximum value in the A column
- `MIN (A)`: The minimum value in the A column

1: Count the number of different sailor names

```
SELECT COUNT (DISTINCT S.sname)
FROM Sailors S
```

2 The GROUP BY and HAVING Clauses

```
SELECT [DISTINCT] select-list
FROM from-list
WHERE qualification
GROUP BY grouping-list
HAVING group-qualification
```

So far we have applied aggregate operations to all rows in a relation. We often want to apply aggregate operations to each of a number of **groups** of a row in a relation.

2: Find the age of the youngest sailor for each rating level

```
SELECT S.rating, MIN (S.age)
FROM Sailors S
GROUP BY S.rating
```

- `GROUP By X` means **put all those with the same value for X in the one group**
- `GROUP By X, Y` means **put all those with the same values for both X and Y in the one group**
- Each column that appears in **select-list** must also appear in the **grouping-list**. This is because each row in the result of the query corresponds to one *group*, which is a collection of rows that agree on values of columns in **grouping-list**.

- If `GROUP BY` is ommited, the entire table is regarded as a single group
- `HAVING` applies a selection criteria to the groups. It can be used to select groups which satisfy a given condition. Think of it as a `WHERE` clause for the returned groups
- A column appearing in the **group-qualification** for `HAVING` must also appear in **grouping-list** for `GROUP BY`
- In general `WHERE` clause is evaluating before `HAVING`. The `WHERE` clause acts as a pre filter where as `HAVING` clause as a post filter.
- The difference between `HAVING` and `WHERE` in SQL is that the `WHERE` cannot be used with aggregates, but `HAVING` can. The `WHERE` clause works on row's data, not on aggregated data.

3 EXERCISES

Tables used in this note:
Sailors(sid: integer, sname: string, rating: integer, age: real);
Boats(bid: integer, bname: string, color: string);
Reserves(sid: integer, bid: integer, day: date).

(1) For each red boat, find the number of reservations for this boat.

(2) Find the average age of sailors for each rating level that has at least two sailors.

(3) Find age of the youngest sailor with age $\geq$ 18, for each rating with at least 2 sailors between 18 and 60.

(4) Find the average age of sailors who are of voting age (i.e. at least 18 yrs old) for each rating level that has at least two sailors.

(5) Find the ratings for which the average age of sailors is the minimum over all ratings.

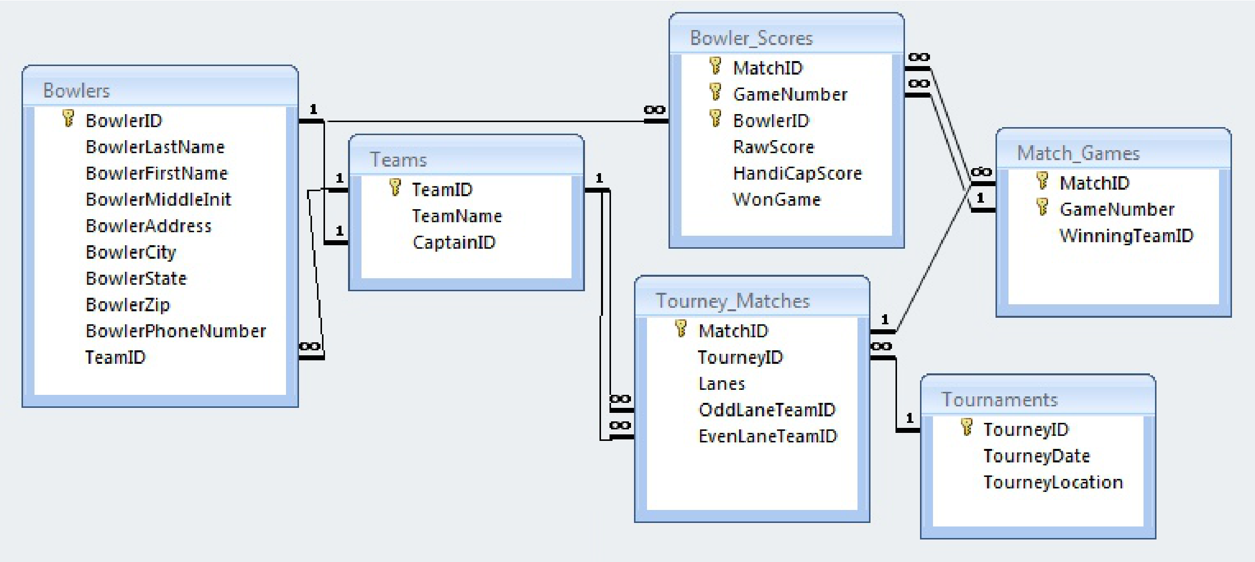
4 INNER Joins

`table1 INNER JOIN table2 ON table1.col1 = table2.col2`

- Creates a virtual table matching rows to the columns specified after `ON`.
- `INNER` can be omitted.
- If a row is cannot be matched in the other table, then it does not appear in the result virtual table.
- Multiple matches will creat a row for *every pair* of matches.

5 EXERCISES

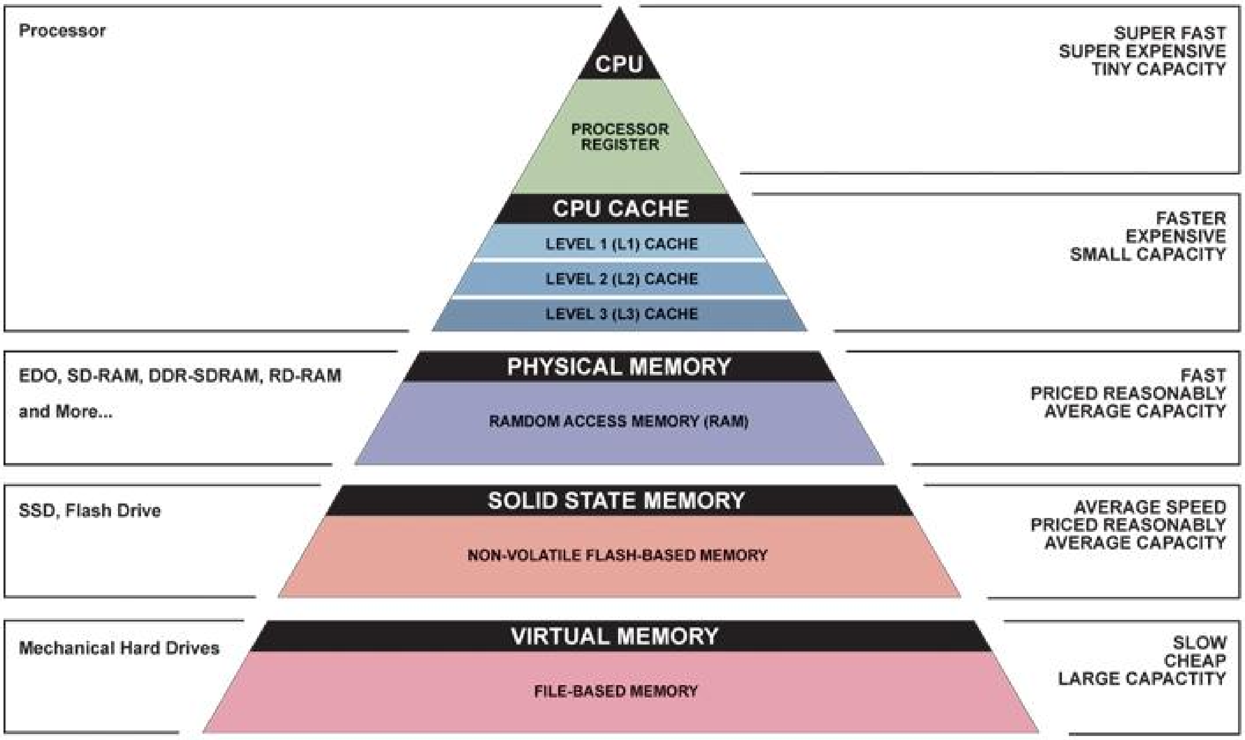
BowlingLeague.sqlite:



(1) Print a schedule of all the team matchups over the whole season (Date, Location, OddTeamName, EvenTeamName).

(2) Print game results for Tournament 1, including match ID, game number, team names, bowler names, and raw score.

6 The Memory/Storage Hierarchy


Processor
CPU
PROCESSOR REGISTER
SUPER FAST
SUPER EXPENSIVE
TINY CAPACITY
CPU CACHE
LEVEL 1 (L1) CACHE
LEVEL 2 (L2) CACHE
LEVEL 3 (L3) CACHE
FASTER
EXPENSIVE
SMALL CAPACITY
EDO, SD-RAM, DDR-SDRAM, RD-RAM
and More...
PHYSICAL MEMORY
RAMDOM ACCESS MEMORY (RAM)
FAST
PRICED REASONABLY
AVERAGE CAPACITY
SSD, Flash Drive
SOLID STATE MEMORY
NON-VOLATILE FLASH-BASED MEMORY
AVERAGE SPEED
PRICED REASONABLY
AVERAGE CAPACITY
Mechanical Hard Drives
VIRTUAL MEMORY
FILE-BASED MEMORY
SLOW
CHEAP
LARGE CAPACITY