

## LAB 3 – Advanced Databases

### RAID, B-TREES, Constraints and Triggers

Dr. Pierpaolo Dondio  
3/10/2016

---

#### RAID

**Try to answer the following questions. Some of the questions can have different answers and require some assumptions. Justify your answer!**

1.

You have 10 disks, each of them with a capacity of 100GB. 8 are fast, with a transfer rate of 1000 Mbits/sec and 2 are slow, with a transfer rate of 500Mbits/sec. Your DB has a stable size of 750 GB.

Show how to implement different level of RAID (0,1,3,5,10,0+1) and for the ones that can be implemented compute:

1. The storage efficiency (disk space actually used for data / total disk space used)
2. The average read access time in an ideal situation (i.e. how many Mbits per second?)

You are not requested to use all the disks, but only the ones you need to accommodate your database of 750GB

2.

A RAID 4 configuration (parity disk at block level) is composed by 5 disks + the parity disk.

The time for reading a block is 1 second, writing 5 second. The database needs to modify (write):

a) A data spread over 2 blocks in the same stripe

List all the operations the RAID system is supposed to do to read the data and modify them taking into account the parity block.

b) Can you do another write operation at the same time you are performing a) ?

c) Can you do another read operation at the same time you are performing a) ?

d) How long does operation a) take?

Do the same exercise considering RAID 5 (parity block striped). Is there a difference?

Assume that each disk has an hardware controller so that it is possible to perform parallel read and write from the disks.

Remember that, even if part of the stripe is modified, the parity bit for that stripe has to be recomputed.

## **B-Trees**

a) Insert into a simple binary tree (it is not a b-tree, there are no balancing rules) the following data (respecting the order of arrivals):

2, 4, 5, 6, 8, 10, 9, 14, 16, 18, 7, 22, 1

b) Insert the same data into a B-Tree 2-3 (2 data for each node, 3 pointers, as seen in class).

c) Compare the two trees. Can you see a difference? What is the main advantage of the B-tree?

## Constraints and Triggers

**Note: in order to do this exercise you need to review triggers in ORACLE PL/SQL. Check the notes Advanced DB Week 3 – sections on trigger**

Create a database storing information about soccer results

Table TEAMS

TeamID	TeamName	TeamCountry
--------	----------	-------------

Table MATCHES

MatchID	TeamA_ID	TeamB_ID	Goal_A	Goal_B	Competition
---------	----------	----------	--------	--------	-------------

TeamID and MatchID are the primary keys. TeamID\_A and TeamID\_B are the foreign keys. They represent the team playing home (A) or away (B).

Insert the following data into the table Teams

1	Arsenal	England
2	Manchester United	England
3	Chelsea	England
4	Manchester City	England
5	Barcellona	Spain
6	Real Madrid	Spain
7	Getafe	Spain
8	Sevilla	Spain

Set the following constraints using oracle constraints (where possible) or triggers (where the normal constraints are not enough):

a) Using a trigger, create a table that logs the timestamps of all the insertion in the **table Teams**

On the table **Matches**:

b) Competition is either Champions League, Europa League, Premier League or La Liga .

c) Country is either Spain or England

d) Number of Goals is  $\geq 0$

e) Using a trigger, check that, if Premier League or La Liga is selected, the country of the two teams is correct (both England for Premier League and both Spain for La Liga).

f) Using a trigger, check that a team has no more than 3 home matches in the table matches.

Check your constraints and triggers by inserting some data!