# Exercício

Considere as seguintes relações:

> estudantes(enum: integer, enome: string, cidade string, turma integer);
>
> turmas(turma integer, designacao: string, ano integer);

Existem 1000 estudantes, dos quais 100 são de Braga. Existem 50 turmas, das quais 10 são do primeiro ano.
Admite-se que não há índices, chaves de ordenação e que as operações intermédias são gravadas em disco. O custo da escrita final é ignorado e os tuplos são sempre acedidos uma única vez. Admite-se também que $t_1$ e $t_2$ são tabelas e $card(t)$ é a cardinalidade da tabela $t$. A tabela seguinte ilustra a forma como deve ser calculado o custo de uma operação relacional em termo do número de acessos ao disco.

| Expressão | Custo |
|---|---|
| $t_1$ | $card(t_1)$ se $t_1$ é um operando simples |
| $t_1$ | $custo(t_1)$ se $t_1$ é uma operação |
| $t_1 \otimes t_2$ | $card(t_1) * card(t_2) + custo(t_1) + custo(t_2)$ |
| $t_1 \bowtie_{A_i} t_2$ | $card(t_1) + card(t_2) + custo(t_1) + custo(t_2)$ |
| $\sigma_{Cond}(t_1)$ | $card(t_1) + custo(t_1)$ |
| $\Pi_{A_i,\ldots,A_j} t_1$ | $custo(t_1)$ |

Calcule o custo das seguintes operações, considerando as cardinalidades explicitadas em epígrafe:

| N | Expressão | Custo |
|---|---|---|
| 1 | $estudantes \otimes turmas$ | |
| 2 | $estudantes \bowtie_{turma} turmas$ | |
| 3.1 | $\sigma_{cidade='braga'} estudantes$ | |
| 3.2 | $\sigma_{ano=1} turmas$ | |
| 3.3 | $\Pi_{enum,enome}(\sigma_{cidade='braga'}(estudantes))$ | |
| 4 | $\sigma_{cidade='braga' \wedge ano=1 \wedge estudantes.turma=turmas.turma}$ $(estudantes \otimes turmas)$ | |
| 5 | $\sigma_{cidade='braga' \wedge ano=1}(estudantes \bowtie_{turma} turmas)$ | |
| 6 | $\sigma_{cidade='braga'}(estudantes) \bowtie_{turma} \sigma_{ano=1}(turmas)$ | |

# Why and when should I backup my database?

Backup and recovery is one of the most important aspects of a DBA's job. If you lose your company's data, you could very well lose your job. Hardware and software can always be replaced, but your data may be irreplaceable!
Normally one would schedule a hierarchy of daily, weekly and monthly backups, however consult with your users before deciding on a backup schedule.

Backup frequency normally depends on the following factors:

- Rate of data change/ transaction rate
- Database availability/ Can you shutdown for cold backups?
- Criticality of the data/ Value of the data to the company
- Read-only tablespace needs backing up just once right after you make it read-only
- If you are running in archivelog mode you can backup parts of a database over an extended cycle of days
- If archive logging is enabled one needs to backup archived log files timeously to prevent database freezes
- Etc.

Carefully plan backup retention periods. Ensure enough backup media (tapes) are available and that old backups are expired in-time to make media available for new backups. Off-site vaulting is also highly recommended.
Frequently test your ability to recover and document all possible scenarios. Remember, it's the little things that will get you. Most failed recoveries are a result of organizational errors and miscommunication.

# The following methods are valid for backing-up an Oracle database:

- Export/Import - Exports are "logical"database backups in that they extract logical definitions and data from the database to a file.
- Cold or Off-line Backups - shut the database down and backup up ALL data, log, and control files.
- Hot or On-line Backups - If the database is available and in ARCHIVELOG mode, set the tablespaces into backup mode and backup their files. Also remember to backup the control files and archived redo log files.
- RMAN Backups - while the database is off-line or on-line, use the "rman"utility to backup the database.

# What is the difference between online and offline backups?

A hot (or on-line) backup is a backup performed while the database is open and available for use (read and write activity). Except for Oracle exports, one can only do on-line backups when the database is ARCHIVELOG mode.
A cold (or off-line) backup is a backup performed while the database is off-line and unavailable to its users. Cold backups can be taken regardless if the database is in ARCHIVELOG or NOARCHIVELOG mode.
It is easier to restore from off-line backups as no recovery (from archived logs) would be required to make the database consistent. Nevertheless, on-line backups are less disruptive and doesn't require database downtime. Point-in-time recovery (regardless if you do on-line or off-line backups) is only available when the database is in ARCHIVELOG mode.

# What is import/export and why does one need it?

Oracle's export (exp) and import (imp) utilities are used to perform logical database backup and recovery. When exporting, database objects are dumped to a binary file which can then be imported into another Oracle database. These utilities can be used to move data between different machines, databases or schema. However, as they use a proprietary binary file format, they can only be used between Oracle databases. One cannot export data and expect to import it into a non-Oracle database. Various parameters are available to control what objects are exported or imported. To get a list of available parameters, run the exp or imp utilities with the help=yes parameter.

The export/import utilities are commonly used to perform the following tasks:

- Backup and recovery (small databases only, say $< +50$GB, if bigger, use RMAN instead)
- Move data between Oracle databases on different platforms (for example from Solaris to Windows)
- Reorganization of data/ eliminate database fragmentation (export, drop and re-import tables)
- Upgrade databases from extremely old versions of Oracle (when in-place upgrades are not supported by the Database Upgrade Assistant any more)
- Detect database corruption. Ensure that all the data can be read
- Transporting tablespaces between databases
- Etc.

# How does one use the import/export utilities?

Look for the imp and exp executables in your $ORACLE_HOME/bin directory.

One can run them interactively, using command line parameters, or using parameter files.

Look at the imp/exp parameters before starting.

These parameters can be listed by executing the following commands: exp help=yes or imp help=yes.

The following examples demonstrate how the imp/exp utilities can be used:

```
exp scott/tiger file=emp.dmp log=emp.log
tables=emp rows=yes indexes=no

exp scott/tiger file=emp.dmp tables=(emp,dept)

imp scott/tiger file=emp.dmp full=yes

imp scott/tiger file=emp.dmp fromuser=scott
touser=scott tables=dept
```

Using a parameter file:

```
exp userid=scott/tiger@orcl parfile=export.txt
```

... where export.txt contains:

```
BUFFER=10000000
FILE=account.dmp
FULL=n
OWNER=scott
GRANTS=y
COMPRESS=y
```