### PARALLEL AND DISTRIBUTED SYSTEMS

## SQL assignment

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- Q0. Can you describe the series of steps to open a database for querying?
  - 1. Open MySQL and type your password:

```
mysql -u root -p
```

2. In order to explore the available databases, type:

```
mysql> show databases;
```

3. To choose a specific database, for instance called A, type:

```
mysql> use A;
```

Q1. What is the purpose of this query?

```
mysql> SELECT * from Sources;
```

It provides us with all the table entries of the table called *Sources*.



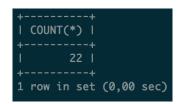
#### Q2. Get 5 GenBank ids and corresponding descriptions.

mysql> SELECT gbId, description FROM Descriptions LIMIT 5;

#### Q3. What is the purpose of this query?

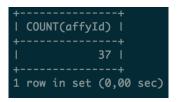
mysql> SELECT count(\*) from LocusLinks;

It counts the total number of entries in the table *LocusLinks*.



#### Q4. How many different Affy ids are in the expression data?

mysql> SELECT COUNT(affyId) FROM Data;



Q5. What is the expression level of Affy id  $U95-32123_at$  in experiment number 1?

mysql> SELECT level FROM Data WHERE affyId="U95-32123\_at" AND exptId=1;

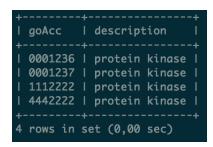
```
+----+
| level |
+-----+
| 128 |
+-----+
1 row in set (0,00 sec)
```

Q6. Find all the gene descriptions, along with their GenBank ids containing the word "Human"?

mysql> SELECT \* FROM Descriptions WHERE description LIKE "%Human%";

Q7. What *Gene Ontology descriptions* (and corresponding *accession*) contain the phrase "protein kinase"? Answer should be provided in ascending order of accessions.

```
mysql> SELECT * FROM GO_Descr WHERE description LIKE "%protein kinase%"
mysql> ORDER BY goAcc ASC;
```



Q8. Which AffyId of table Data correspond to sequences in Targets table with the phrase "kinase" in their description?

```
mysql> SELECT Data.affyId FROM Data, Targets, Descriptions
mysql> WHERE Data.affyId=Targets.affyId
mysql> AND Targets.gbId=Descriptions.gbId
mysql> AND Descriptions.description LIKE "%kinase%";
Empty set (0,00 sec)
```

Use the following command:

```
LOAD DATA INFILE 'file.tsv' INTO TABLE Targets;
```

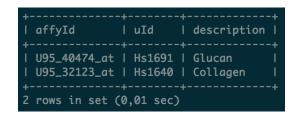
To add a new entry in Descriptions with the string "kinase" and the gbId="M18228". Now repeat the query again.

Repeating the same query again is still showing 0 results. There is an affyId corresponding to the gbId that we have introduced (M18228), but that affyId is not in the Data table.

Empty set (0,00 sec)

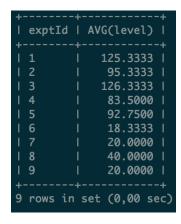
Q9. Get two affyId, uId and descriptions in LocusDescr in reverse alphabetical order of descriptions.

```
mysql> SELECT Targets.affyId, UniSeqs.uId, LocusDescr.description
mysql> FROM LocusDescr, LocusLinks, Targets, UniSeqs
mysql> WHERE UniSeqs.gbId=LocusLinks.gbId AND Targets.gbId=LocusLinks.gbId
mysql> AND LocusLinks.linkId=LocusDescr.linkId ORDER BY description DESC LIMIT 2;
```



Q10. How would you find the average expression level of each experiment in Data?

mysql> SELECT exptId, AVG(level) FROM Data GROUP BY exptId;



# Q11. What is the average expression level of each array probe (affyId) across all experiments?

mysql> SELECT affyId, AVG(level) FROM Data GROUP BY affyId;

affyId	++   AVG(level)					
31315_at	-+   250.0000					
31324_at	91.0000					
31325_at	89.0000					
31356_at	91.0000					
31362_at	l 260.0000 l					
31510_s_at	257.0000					
5321_at	90.0000					
5322_at	90.0000					
5323_at	90.0000					
5324_at	l 73.5000 l					
5325_at	90.0000					
AFFX-BioB-3_at	97.0000					
AFFX-BioB-5_at	l 20.0000 l					
AFFX-BioB-M_at	l 62.8000 l					
AFFX-HSAC07/X00351_M_at	l 86.0000 l					
AFFX-HUMBAPDH/M33197_3_st	l 277.0000 l					
AFFX-HUMTFFR/M11507_at	90.0000					
AFFX-M27830_3_at	271.0000					
AFFX-MurIL10_at	I 6.6667 I					
AFFX-MurIL2_at	l 20.0000 l					
AFFX-MurIL4_at	49.0000					
U95-32123_at	128.0000					
U98-40474_at	57.0000					
++ 23 rows in set (0,00 sec)						

#### Q12. What is the purpose of the following query?

```
mysql> SELECT Data.affyId, Data.level, Data.exptId, DataCopy.affyId,
mysql> DataCopy.level, DataCopy.exptId
mysql> FROM Data, Data DataCopy
mysql> WHERE Data.level > 10 * DataCopy.level
mysql> AND Data.affyId=DataCopy.affyId
mysql> AND Data.affyId LIKE "AFFX%"
mysql> LIMIT 10;
```

From the table called "Data" it takes the entries with an affyId beginning with the string "AFFX". Then, it selects those whose levels are ten times higher than the levels of other experiments of the same affyId. Finally, it shows up the first ten matchs.

affyId	l level	exptId		   level	exptId
AFFX-BioB-M_at AFFX-BioB-M_at AFFX-BioB-M_at AFFX-BioB-M_at	214   214   214	5   5   5	+   AFFX-BioB-M_at   AFFX-BioB-M_at   AFFX-BioB-M_at	l 20 l 20 l 20	3     7     9
3 rows in set (0,0		+	+	+	++

#### Q13. Write a query to provide three different descriptions for all gbId in table Targets.

There are four tables containing descriptions. Therefore, there are 4 possible combinations and 4 possible outputs, depending on which three tables are chosen (*Descriptions*, *LocusDescr*, *GO\_Descr* or *UniDescr*). One of the possibilities is the following one:

```
mysql> SELECT Targets.gbId, Descriptions.description AS General_Description,
mysql> LocusDescr.description AS Locus_Description,
mysql> GO_Descr.description AS GO_Description
mysql> FROM Targets, Descriptions, LocusDescr, LocusLinks, GO_Descr, Ontologies
mysql> WHERE Descriptions.gbId=Targets.gbId
mysql> AND Targets.gbId=LocusLinks.gbId AND LocusLinks.linkId=LocusDescr.linkId
mysql> AND LocusLinks.linkId=Ontologies.linkId
mysql> AND Ontologies.goAcc=GO_Descr.goAcc;
```

```
+----+
| gbId | General_Description | Locus_Description | GO_Description |
+-----+
| S75295 | Glucan | Glucan | Glucan Enz |
+----+
1 row in set (0,00 sec)
```

Q14. Write a query to provide all gene ontology ( $GO\_descr$ ) descriptions related with all species in table Species sorted alphabetically and providing the first five results. Export the query to a tab-separated-file with the command:

```
mysql> SELECT * FROM TABLE INTO OUTFILE 'data.out';

mysql> SELECT GO_Descr.description, Targets.species
mysql> FROM GO_Descr, Ontologies, LocusLinks, Targets
mysql> WHERE GO_Descr.goAcc=Ontologies.goAcc
mysql> AND Ontologies.linkId=LocusLinks.linkId
mysql> AND LocusLinks.gbId=Targets.gbId
mysql> ORDER BY GO_Descr.description ASC LIMIT 5
mysql> INTO OUTFILE '14.out';
```