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# **Master of Science in Computer Science**

# **Distributed Systems Manual for Laboratory Practice**

# PART II - Remote Method Invocation Three Tier Application with a Database Server

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# **1. Document Purpose**

This document contains explanations on how to run the following programs: RMI Servers, RMI Client and Database Server.

For running the programs, a correct configuration of the running environment is necessary (path and classpath variables).

- Install JAVA JDK 21
- Install Apache Netbeans 21
- Install MySQL
- Install MySQL Workbench
- Set path system variable in the operating system

For running the programs, a correct configuration of the running environment is necessary (path variable).

System Properties							×
Computer Name	Hardware	Advanced	System Pro	tection	Remote		
You must be log Performance Visual effects, p					virtual mer	Ū	
User Profiles Desktop setting	gs related t	to your sign-ii	ו		S <u>e</u> tti	ngs	
Startup and Rec		ilure, and de	bugging infor	mation	Se <u>t</u> ti	ngs	
				Envir	o <u>n</u> ment Va	ariables	
		(	ОК	Cano	el	<u>A</u> pply	

Click on Environment Variables.

Variable	Value	
MOZ_PLUGIN_PATH	C:\Program Files (x86)\Foxit Software\Foxit PDF Reader\plugi	
OneDrive	C:\Users\Admin\OneDrive	
Path	C:\Users\Admin\AppData\Local\Programs\Python\Python312	
TEMP	C:\Users\Admin\AppData\Local\Temp	
TMP	C:\Users\Admin\AppData\Local\Temp	
	New <u>E</u> dit <u>D</u> elete	
ystem variables		
ystem variables Variable	Value	
Variable	Value	
Variable ComSpec	Value C:\Windows\system32\cmd.exe C:\Windows\System32\Drivers\DriverData	
Variable ComSpec DriverData	Value C:\Windows\system32\cmd.exe C:\Windows\System32\Drivers\DriverData	
Variable ComSpec DriverData NUMBER_OF_PROCESSORS	Value C:\Windows\system32\cmd.exe C:\Windows\System32\Drivers\DriverData 8	
Variable ComSpec DriverData NUMBER_OF_PROCESSORS OS	Value C:\Windows\system32\cmd.exe C:\Windows\System32\Drivers\DriverData 8 Windows_NT	
Variable ComSpec DriverData NUMBER_OF_PROCESSORS OS Path	Value C:\Windows\system32\cmd.exe C:\Windows\System32\Drivers\DriverData 8 Windows_NT C:\Program Files\Common Files\Oracle\Java\javapath;C:\Prog .COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;.JSE;.WSF;.WSH;.MSC	
Variable ComSpec DriverData NUMBER_OF_PROCESSORS OS Path PATHEXT	Value C:\Windows\system32\cmd.exe C:\Windows\System32\Drivers\DriverData 8 Windows_NT C:\Program Files\Common Files\Oracle\Java\javapath;C:\Prog .COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;.JSE;.WSF;.WSH;.MSC	
Variable ComSpec DriverData NUMBER_OF_PROCESSORS OS Path PATHEXT	Value C:\Windows\system32\cmd.exe C:\Windows\System32\Drivers\DriverData 8 Windows_NT C:\Program Files\Common Files\Oracle\Java\javapath;C:\Prog .COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;.JSE;.WSF;.WSH;.MSC	~

Find the Path system variable and click Edit.

Edit environment variable	×
C:\Program Files\Common Files\Oracle\Java\javapath	New
C:\ProgramData\Oracle\Java\javapath	
C:\Users\Admin\Desktop\ORACLE\bin	<u>E</u> dit
%SystemRoot%\system32	
%SystemRoot%	<u>B</u> rowse
%SystemRoot%\System32\Wbem	
%SYSTEMROOT%\System32\WindowsPowerShell\v1.0\	Delete
%SYSTEMROOT%\System32\OpenSSH\	
	Move <u>U</u> p
	wove <u>op</u>
	Maya Daym
	Move D <u>o</u> wn
	Edit <u>t</u> ext
ОК	Cancel

Select New and set the value of the variable to the directory where you have installed Java, for example:

C:\Program Files\Java\jdk-21\bin

Move the item up as follows:

Edit environment variable	×
C:\Program Files\Java\jdk-21\bin	New
C:\Program Files\Common Files\Oracle\Java\javapath	
C:\ProgramData\Oracle\Java\javapath	<u>E</u> dit
C:\Users\Admin\Desktop\ORACLE\bin	
%SystemRoot%\system32	Browse
%SystemRoot%	
%SystemRoot%\System32\Wbem	Delete
%SYSTEMROOT%\System32\WindowsPowerShell\v1.0\	Delete
%SYSTEMROOT%\System32\OpenSSH\	
	Move <u>U</u> p
	wove <u>o</u> p
	Maria Davia
	Move D <u>o</u> wn
	Edit <u>t</u> ext
ОК	Cancel

Download and Install MySQL Server

MySQL Community Server 8.3.0

https://dev.mysql.com/downloads/installer/

After you download use MySQL Server Instance Config Wizard

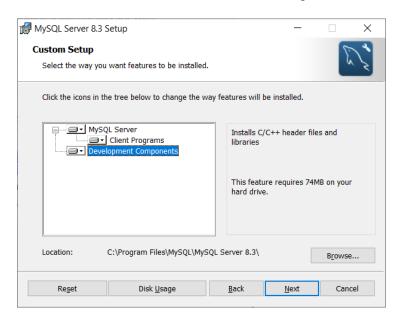
🚮 MySQL Server 8.3 Setup	×			
Jer Jer	Welcome to the MySQL Server 8.3 Setup Wizard The Setup Wizard will install MySQL Server 8.3 on your computer. Click Next to continue or Cancel to exit the Setup Wizard.			
MySQL.	Copyright (c) 2000, 2024, Oracle and/or its affiliates.			
🛃 MySQL Server 8.3 Setup	- 🗆 X			
End-User License Agreen Please read the following licer	2.			
Licensing Information	User Manual			
MySQL 8.3.0 Community				
-				
Introduction				
license	ation User Manual contains Oracle's product			
and other licensing information, including licensing				

and other licensing information, including licensing information for third-party software which may be included in this v I accept the terms in the License Agreement <u>Print Back Next</u> Cancel

Choose the Custom configuration as follows:

🞲 MySQL Server 8.3 Setup - 🗆 🗙
Choose Setup Type Choose the setup type that best suits your needs
Iypical Installs the most common program features. Recommended for most users.
Custom Allows users to choose which program features will be installed and where they will be installed. Recommended for advanced users.
Complete All program features will be installed. Requires the most disk space.
Back Next Cancel

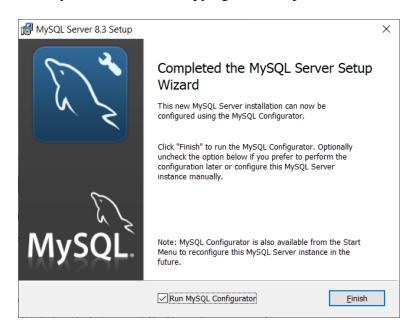
Install all on local hard drive in the following window:



Proceed with next step as follows:

🕼 MySQL Server 8.3 Setup		_		×
Installing MySQL Server 8.3			E.	X
Please wait while the Setup Wizard installs My	SQL Server 8.3.			
Status:				
	Pack	Novt	Cano	
	<u>B</u> ack	Next	Cance	el

When you have finished copying the files, proceed with the configuration as follows:



Click finish and continue with the configuration instance as follows:

MySQL Configurator	- 🗆 X
MySQL Configurator MySQL Server 8.3.0	Welcome to the MySQL Server Configurator
Welcome	
Data Directory	
Type and Networking	v 2
Accounts and Roles	
Windows Service	
Server File Permissions	With this wizard you will be able to configure your recent MySQL Server installation. Simply click Next when you are ready to proceed.
Logging Options	
Advanced Options	
Sample Databases	
Apply Configuration	
Configuration Complete	
	<u>N</u> ext > <u>C</u> ancel
New configuration MySQL Serve	r 8.3.0 .::

Choose the path of data storage:

MySQL Configurator		×
MySQL Configurator MySQL Server 8.3.0	Data Directory	
Welcome	Enter the path to the data directory to begin with the configuration process (if the path does not exist it will be created):	
Data Directory	C:\ProgramData\MySQL\MySQL Server 8.3\	
Type and Networking		
Accounts and Roles		
Windows Service		
Server File Permissions		
Logging Options		
Advanced Options		
Sample Databases		
Apply Configuration		
Configuration Complete		
	< <u>Back</u> <u>Next</u> > <u>Cancel</u>	
New configuration MySQL Server	8.3.0	.:

Choose Developer settings as follows:

MySQL Configurator				-		×
MySQL Configurator MySQL Server 8.3.0	Type and Networl Server Configuration Type Choose the correct server co define how much system re	onfiguration type fo sources are assigned			setting wil	I
Welcome	Config Type: Developmen	t Computer			$\sim$	
Data Directory	Connectivity					
Type and Networking	Use the following controls to	1 A A A A A A A A A A A A A A A A A A A				
Accounts and Roles	TCP/IP		3306	X Protocol Port:	33060	
		Firewall ports for ne				
Windows Service	Named Pipe	Pipe Name:	MYSQL			
Server File Permissions	Shared Memory	Memory Name:	MYSQL			
Sample Databases	Advanced Configuration					
Apply Configuration	Select the check box below and logging options for this		nfiguration pages v	vhere you can set	advanced	
Configuration Complete	Show Advanced an	d Logging Options				
			< <u>B</u> ack	<u>N</u> ext >	<u>C</u> ancel	
New configuration MySQL Server 8	3.3.0 Data Directory: C:\P	rogramData\MySQI	MySQL Server 8.3	3\		.::

Choose the root password in the next window as follows (password: admin).

NySQL Configurator				- 🗆 X
WySQL Configurator MySQL Server 8.3.0  Welcome Data Directory Type and Networking Accounts and Roles  Windows Service	place. MySQL Root Password: Repeat Password:		e remember to store this passw	ord in a secure
	MySQL User Accounts			
Server File Permissions	Create MySQL user account consists of a set of privilege		id applications. Assign a role to	the user that
Sample Databases	MySQL User Name	Host	User Role	Add User
Apply Configuration				<u>E</u> dit User
Configuration Complete				Delete
			< Back Next >	Cancel
			<u>Next</u>	
New configuration MySQL Server	8.3.0 Data Directory: C:\Pr	ogramData\MySC	QL\MySQL Server 8.3\	.:

Configure MySQL as a service as follows:

MySQL Configurator	- 🗆 X
MySQL Configurator MySQL Server 8.3.0	Windows Service Configure MySQL Server as a Windows Service Windows Service Details
Welcome	Please specify a Windows Service name to be used for this MySQL Server instance. A unique name is required for each instance.
Data Directory	Windows Service Name: MySQL83
Type and Networking	Start the MySQL Server at System Startup
Accounts and Roles	
Windows Service	Run Windows Service as The MySQL Server needs to run under a given user account. Based on the security requirements of your system you need to pick one of the options below.
Server File Permissions	Standard System Account
Sample Databases	Recommended for most scenarios.
Apply Configuration	O Custom User
Configuration Complete	An existing user account can be selected for advanced scenarios.
	< <u>B</u> ack <u>N</u> ext > <u>C</u> ancel
New configuration MySQL Se	erver 8.3.0 Data Directory: C:\ProgramData\MySQL\MySQL Server 8.3\

### Grant rights to the users as follows:

MySQL Configurator	- 🗆 X
MySQL Configurator MySQL Server 8.3.0	Server File Permissions MySQL Configurator can secure the server's data directory by updating the permissions of files and folders located at:
Welcome Data Directory Type and Networking Accounts and Roles Windows Service	C:\ProgramData\MySQL\MySQL Server 8.3\ Do you want MySQL Configurator to update the server file permissions for you? Yes, grant full access to the user running the Windows Service (if applicable) and the administrators group only. Other users and groups will not have access. Yes, but let me review and configure the level of access. No, I will manage the permissions after the server configuration.
Server File Permissions	
Sample Databases Apply Configuration Configuration Complete	
Neuros	< <u>Back</u> <u>Next</u> > <u>Cancel</u>
New configuration MyS	QL Server 8.3.0 Data Directory: C:\ProgramData\MySQL\MySQL Server 8.3\

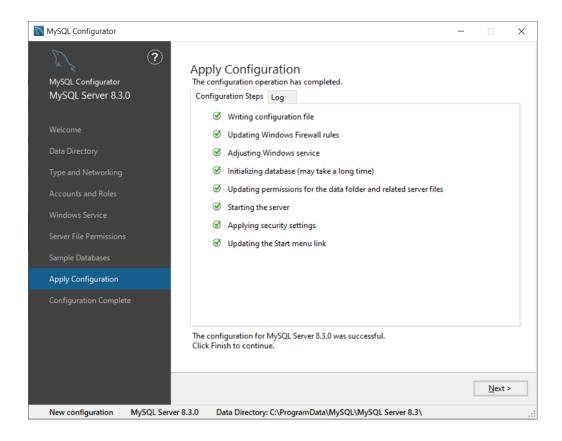
You may choose to install sample databases or not:

MySQL Configurator	
MySQL Configurator MySQL Server 8.3.0	Sample Databases MySQL databases samples can be installed or removed as part of this configuration. These samples provide test data to use when developing applications for the MySQL ecosystem.
Welcome Data Directory Type and Networking Accounts and Roles Windows Service	Select the databases that should be created:   Create Sakila database  Create World database
Server File Permissions Sample Databases Apply Configuration	
Configuration Complete	
	< <u>B</u> ack <u>N</u> ext > <u>C</u> ancel

In the final window wait for the setup program to complete all the points as follows:

MySQL Configurator		_		×
MySQL Configurator MySQL Server 8.3.0 MySQL Server 8.3.0				
Welcome       Writing configuration file         Welcome       Updating Windows Firewall rules         Data Directory       Adjusting Windows service         Type and Networking       Initializing database (may take a log         Accounts and Roles       Updating permissions for the data for         Windows Service       Starting the server         Server File Permissions       Updating the Start menu link         Sample Databases       Start menu link				
Apply Configuration				
Configuration Complete	Execute Next	>	<u>C</u> ancel	
New configuration MySQL Server 8.3.0 Data Directory: C:\ProgramData\MySQ	QL\MySQL Server 8.3\			.::

If all steps were executed correctly, the following window should appear:



You may want to copy the log of the setup procedure as follows:

MySQL Configurator	_		×
MySQL Configurator MySQL Server 8.3.0	Configuration Complete The configuration procedure has been completed.		
Welcome	C <u>o</u> py Log to Clipboard		
Data Directory			
Type and Networking	Refer to the following documentation to get the most out of your MySQL Server installation:		
Accounts and Roles	MySQL Reference Manual		
Windows Service			
Server File Permissions			
Sample Databases			
Apply Configuration			
Configuration Complete			
		<u>F</u> inis	h
New configuration MySQL Ser	ver 8.3.0 Data Directory: C:\ProgramData\MySQL\MySQL Server 8.3\		

To verify that all has been setup correctly and the service is working fine go to Services and check the MySQL service as follows:

Type Services in the search bar of Windows:

Best match			
System			
Apps			
Component Services	>		
Settings			
오 Use online <b>services</b> with Narrator	>		
A) Do not allow Microsoft to use your voice to improve speech services	>		
Search work and web			
${\cal P}$ services - See work and web results	>		
𝒫 services msc	>		
𝒫 services app	>		
Indra - Results			
Global Partner Services Portal	>		
∽ services	äŧ		

Go to Services:

Check that MySQL 8.3 is running as a service:

Microsoft Office Click-to-Run Service	Manages res Runn	ning Automatic	Local System
🥋 Microsoft Passport	Provides pro	Manual (Trigg	Local System
Microsoft Passport Container	Manages loc	Manual (Trigg	Local Service
🖏 Microsoft Software Shadow Copy Provider	Manages so	Manual	Local System
Microsoft Storage Spaces SMP	Host service	Manual	Network Se
Altore Install Service	Provides infr Runn	ning Manual	Local System
🏟 Microsoft Update Health Service	Maintains U	Disabled	Local System
🖏 Microsoft Windows SMS Router Service.	Routes mess	Manual (Trigg	Local Service
🏟 Mozilla Maintenance Service	The Mozilla	Manual	Local System
WySQL83	Runr	ning Automatic	Network Se
🖏 Natural Authentication	Signal aggre	Manual (Trigg	Local System
🖏 Net.Tcp Port Sharing Service	Provides abil	Disabled	Local Service
🏟 Netlogon	Maintains a	Manual	Local System
Retwork Connected Devices Auto-Setup	Network Co	Manual (Trigg	Local Service

# Install the MySQL Workbench.

You can create the database in two ways:

- 1. By commands in the MySQL console
- 2. By graphical user interface in MySQL Workbench

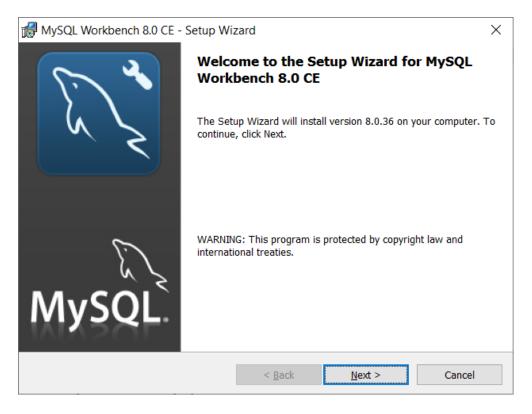
Download MySQL Workbench

MySQL Workbench 8.0.36

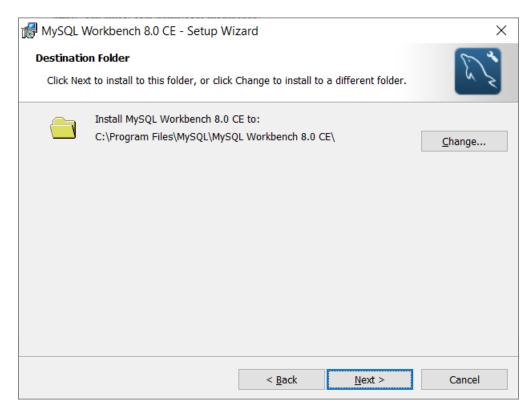
https://dev.mysql.com/downloads/workbench/

Run the setup file

Continue with next on the following window:



### Choose a setup folder:



Choose Custom in the following window:

🕼 MySQL Workb	ench 8.0 CE - Setup Wizard X
Setup Type Choose the setu	up type that best suits your needs.
Please select a	setup type.
© <u>Complete</u>	All program features will be installed. (Requires the most disk space.)
O Custom	Choose which program features you want installed and where they will be installed. Recommended for advanced users.
	< <u>B</u> ack <u>N</u> ext > Cancel

Choose to install all from local hard drive in the following window:

🕼 MySQL Workbench 8.0 CE - Setup Wizard	×
Custom Setup Select the program features you want installed.	
Click on an icon in the list below to change how a feature is inst	Talled. Feature Description Place a Shortcut to MySQL Workbench in your Startmenus MySQL Folder This feature requires 5KB on your hard drive.
Install to:	<u>C</u> hange
<u>H</u> elp <u>S</u> pace < <u>B</u> ack	<u>N</u> ext > Cancel

Continue with Install in the next window:

🕼 MySQL Workbench 8.0 CE - Setup Wizard	X
Ready to Install the Program The wizard is ready to begin installation.	S. J.
If you want to review or change any of your installation settings, click Back. Click the wizard. Current Settings:	Cancel to exit
Setup Type: Custom	
Destination Folder: C:\Program Files\MySQL\MySQL Workbench 8.0 CE\	
< <u>B</u> ack Install	Cancel

The setup program will complete the installation procedure and you should see the following window:

🔀 MySQL Workbench 8.0 CE -	Setup Wizard	$\times$
Solution of the second	Wizard Completed Setup has finished installing MySQL Workbench 8.0 CE.	
MySQL		
Launch MySQL Workbench now	v < <u>B</u> ack <u>Finish</u> Cancel	

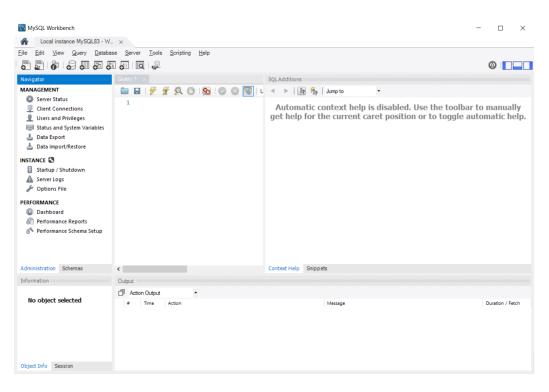
Click Finish and the program will start as follows:

		- 0	×
Scripting Help			
/elcome to	) MySQL	Workbench	×
MySQL Workbench is the official g create and browse your databas design and run SQL queries to work	raphical user interface (GUI) tool se schemas, work with database c with stored data. You can also n	l for MySQL. It allows you to design, objects and insert data as well as nigrate schemas and data from other	
Browse Documentation >	Read the Blog >	Discuss on the Forums >	
nections 🕀 🕲		۹ Filter connection	S
MySQL83			
	/elcome to MySQL Workbench is the official g create and browse your databas design and run SQL queries to work datab	/elcome to MySQL         MySQL Workbench is the official graphical user interface (GUI) too create and browse your database schemas, work with database design and run SQL queries to work with stored data. You can also r database vendors to your MySQL dat         Browse Documentation >       Read the Blog >         nections ⊕ S	/elcome to MySQL Workbench         MySQL Workbench is the official graphical user interface (GUI) tool for MySQL. It allows you to design, create and browse your database schemas, work with database objects and insert data as well as design and run SQL queries to work with stored data. You can also migrate schemas and data from other database vendors to your MySQL database.         Browse Documentation >       Read the Blog >       Discuss on the Forums >         nections $\odot$ 1100000000000000000000000000000000000

If you click on Local instance you will see the following:

MySQL Wo	arkbench – 🗆	×
File Edit \	View Database Tools Scripting Help	
	Welcome to MySQL Workbench	×
	MySQL Workbench is th create and browse yo design and run SQL quer Browse Documentation MySQL Connections ⓒ ⓒ	
	Local instance MySQL83 Toot Toot Too Too Too Too Too T	

Insert the root password we used during installation of MySQL. You should see the following window:



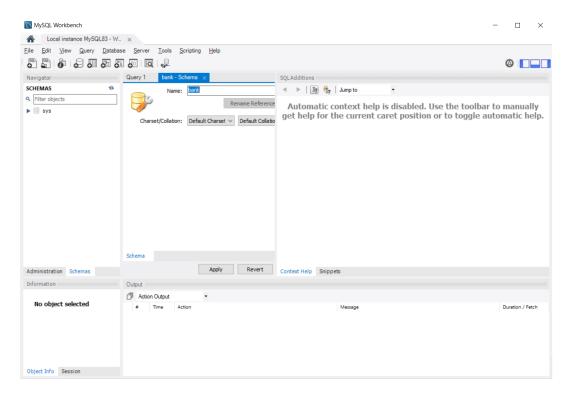
On the left panel, click on Schemas:

NySQL Workbench		-	- 🗆 ×
A Local instance MySQL83 - W	×		
<u>File Edit View Query Database</u>	e <u>S</u> erver <u>T</u> ools <u>S</u> cripting <u>H</u> elp		
8 5 6 6 6 6			Ø 🔲
Navigator		SQLAdditions	
SCHEMAS 🚸	🖿 🖬   🗲 🛒 👰 💿   💁   📀 😒 🗐   L	◄ ▷   122 152 1000 -	
α Filer objects ► 🗟 \$y\$	1	Automatic context help is disabled. Use the toolbar t get help for the current caret position or to toggle aut	
Administration Schemas	<	Context Help Snippets	
Information			
	Action Output -		
No object selected	# Time Action	Message	Duration / Fetch
Object Info Session			

Click with the right button of the mouse on the left panel and select create schema:

MySQL Workbench		- 🗆 X
	3-W_ × latabase Server Tools Scripting Help 한 중집 중대 [전] 나동프	
Nevigator SCHEMAS Q. [Fiter objects ) Sys Load Sp Create 1 Refresh	Outry 1 ×       SQLAdditions         Image: SQLAdditions       SQLAdditions         Image: SQLAdditions       Image: SQLAdditions	I. Use the toolbar to manually
Administration Schemas	< Context Help Snippets	
Information		
	fill Action Output	

Name the database as Bank as follows:



Click Apply in the following window:

Apply SQL Script to Database	×
Review SQL Script Apply SQL Script	Review the SQL Script to be Applied on the Database
	1 CREATE SCHEMA `bank` ; 2
	< >>
747/1	Back Apply Cancel

In the next window, click Finish and you will see the following:

Local instance MySQL83 - W File Edit View Query Databas	se <u>S</u> erver <u>T</u> ools <u>S</u> cripting <u>H</u> elp	
Navigator SCHEMAS & C Filter objects Dank Tables Views Stored Procedures Functions Sys	Query 1 bank - Schama × Name: bank Rename Refer Charset/Collation: Default Charset ~ Default Co	and functions from the old schema name to the new one.

Go the tables and create three tables with the following data:

### Table Account

Fields: IdAccount (int), Balance (float)

Navigator SCHEMAS Filter objects Bank Dank Tables Views Storec Crea Storec Crea Storec Crea Storec Crea Storec Crea Tables Tables Crea Tables Crea Tables Crea Tables Crea Tables Crea Tables Crea Tables Crea Crea Tables Crea	Query 1		References Refactor model, cl and functions from	te of the schema here. You can use any combination of changing all references found in view, triggers, stored procedures in the old schema name to the new one. et and its collation selected here will be used when no other
ST I I I I I I I I I I I I I I I I I I I	ate Table rch Table Data le Data Import Wizard	Name: bank Rename F	References Refactor model, cl and functions from	changing all references found in view, triggers, stored procedures in the old schema name to the new one.
Vigator HEMAS Filter objects bank Tables Storec Storec Function Sys Tables Tables Tables Tables Tables Tables	Query 1 b ate Table ate Table Like + rch Table Data le Data Import Wizard	Name: bank Rename F	References Refactor model, cl and functions from	changing all references found in view, triggers, stored procedures in the old schema name to the new one.
Filter objects bank Tables Tobes Storec Crea Storec Crea Sys Sear Tabl	ate Table ate Table Like • rch Table Data le Data Import Wizard	Name: bank Rename F	References Refactor model, cl and functions from	changing all references found in view, triggers, stored procedures in the old schema name to the new one.
Filter objects bank Tables Views Storec Finction Sys Table Tables Tables Creation Storec Creation Creation Storec Creation	ate Table ate Table Like , rch Table Data le Data Import Wizard	Rename F	References Refactor model, cl and functions from	changing all references found in view, triggers, stored procedures in the old schema name to the new one.
<ul> <li>⇒ bank</li> <li>➡ Tables</li> <li>➡ Views</li> <li>➡ Storec</li> <li>➡ Function</li> <li>⇒ sys</li> <li>➡ Tables</li> </ul>	ate i able ate Table Like • rch Table Data le Data Import Wizard		and functions from	m the old schema name to the new one.
Tables Views Crea Storec Crea Function sys Sear Tabl	ate i able ate Table Like • rch Table Data le Data Import Wizard	ollation: Default Charsel V Defau	The deside	
Views Creater	ate i able ate Table Like • rch Table Data le Data Import Wizard	oliabon: Default Charsel V Defau	uit Collabol 🗸	
sys Tabl	rch Table Data le Data Import Wizard			
sys Sear Tabl	le Data Import Wizard			
Refr	resh All			
dministration Schemas	Schema			
ormation				Apply Reven
ySQL Workbench Local instance MySQL83 - W_ ×				- 0
Edit View Query Database S	Server Tools Scripting Help			
				© [
rigator Que	ry 1 bank - Schema account - Table	Schema: bank	SQLAdd	aribans ▶   ]]gn 1∰gn   Jump to
Filter objects		set v Default Collation v Engine: InnoD8	~ Aut	tomatic context help is disabled. Use the toolbar to manua
Tables	Comments:		get f	help for the current caret position or to toggle automatic h
Stored Procedures Functions Sys Col	iumn Name Datatype	PK NN UQ B UN ZF AI G	Default/Expression	
•	IdAccount INT Balance FLOAT		Delautycapresson	
	Street Mercure			
	Column Name:	Data Type:		
Cha	Comments:		Stored	
			Not Null Unique Unsigned Zero Fill	
		Auto Increment		
Colt	umns Indexes Foreign Keys Triggers	Partitioning Options		
	umns indexes Poreign Keys inggers	Partitioning Uptions	Apply Revert Context	t Help Shippets
inistration Schemas				
mation Schemas Outp	put			
ormation Schemas Outp	put Action Output • # Time Action		Message	Duration / F



Table Customer Fields: IdCustomer(int), Name (Varchar), Surname (Varchar)

	5 6 G G .								Ø [	
		account - Table	ustomer - Table 🛞						SQLAdditions	
bjects	Table Name:	Customer		Schema:	bank			~	< >   By Ap   Jump to	
ojecta ik	Charset/Collation:	Default Charset 🗸	Default Collation ~	Engine:	InnoDB			~	Automatic context help is disabled. Use the toolbar to manual	
Tables account									get help for the current caret position or to toggle automatic	
Views	Comments:									
Stored Procedures Functions	Column Name	Datatype	PK NN UQ B	UN 27	AI G	Default/Expre				
	¥ IdCustomer	INT				Delautycxpr	cooluri			
	<ul> <li>Name</li> <li>Surname</li> </ul>	VARCHAR(45) VARCHAR(45)								
Column Name:			6666							
	Column Name:		Data Type:							
	Charset/Collation: Default Charse	et 😒 Default Collation	n 🗹 Default:							
	Comments:		Storage:	O Virtua		Stored				
				Primar		NotNull	Unique			
				Binary		Unsigned	Zero Fill			
				Auto 1	ncrement	Generated				
ation Schemas	Columns Indexes Foreign Key	s Triggers Partition	ing Options							
							Apply	Revert	Context Help Snippets	
	Output									
na: bank	🗇 Action Output 🔹									
	# Time Action							essage	Duration /	
	<ul> <li>1 16:21:56 Apply changes</li> <li>2 16:26:35 Apply changes</li> </ul>							anges applied		
	<ul> <li>2 16:26:35 Apply changes</li> </ul>	to account					Ch	anges applied		

### Table AccountCustomer Fields: IdAccount, IdCustomer

										3
lavigator	Query 1 bank - Schema	account - Table cu	stomer - Table	countcust	omer - Tab	ale ×			SQLAdditions	
CHEMAS %	Table Name:	accountcustomer		Schema:	hask			~	≪ ⊳   🔯 🎭   Jumpto 🔸	
Filter objects	÷			schema:	_					
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Tables								~	get help for the current caret position of to toggie autom	acie neip
customer	Comments:							~		
Views Stored Procedures	Column Name	Datatype	PK NN UQ B	IN 7	F AI	G Default/Ex	pression	_		
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sys 🗐 sys	IdCustomer	INT								
				-						
	Column Name: IdCustomer		Data Type:	VARCHA	R.(45)					
	Charset/Collation: Default Charse	t 🗸 Default Collation	n 🗸 Default:							
	Comments:		Storage:	O Virtua	1	Stored				
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	2 16.26.35 Apply changes							inges applied		
	<ul> <li>3 16:27:55 Apply changes 1</li> </ul>							inges applied		
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Your database should now have three tables as follows:

e Edit View Query Databas	e Server Tools Scripting Help		
			Ø <b>–</b>
avigator	Query 1 bank - Schema x		SQLAdditions
CHEMAS 🚸	Name: bank	Specify the name of the schema hera. You can use any combination of	< ⊳   🛐 👫   Jump to •
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dministration Schemas	Schema	Apply Rever	t Context Help Shippets
No object selected	Action Output •		
	Time Action     1 16:21:56 Apply changes to bank     2 16:26:35 Apply changes to account	Message Changes ap Changes ap	

Download Apache Netbeans IDE 21 and setup the full program with all features on the local drive.

# 2. Developing the RMI Client and Server

When you finish this exercise, you will have run your first RMI sytem.

It consists of three major parts:

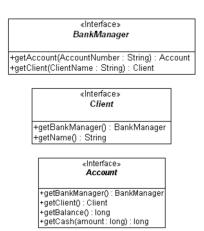
- The **RMI Registry** that hold references to the remote services.
- The **RMI host server** program that creates the remote services, registers them with the registry and waits for client requests.
- The **RMI client program.** A program that obtains references to remote service object from the RMI registry and then uses those services.

### 2.1 Fundamentals of RMI

This exercise will introduce you to the definition of RMI remote services using Java interfaces.

Educational goals:

- Introduce the UML Description of a banking system
- Complete the Java source code for the system interfaces



These are the interfaces to develop in the project.

File Account.java

import java.rmi.Remote; import java.rmi.RemoteException;

public interface Account extends Remote

```
// Add method to return master BankManager
```

// Add method to return Client of this account

// Add method to return balance of this account

// Add method to withdraw cash from this account
}

\_\_\_\_\_

File BankManager.java

import java.rmi.Remote; import java.rmi.RemoteException;

public interface BankManager extends Remote
 {
 // Add method to return an Account service
 // Add method to return a Client service
 }

-----

File Client.java

import java.rmi.Remote; import java.rmi.RemoteException;

public interface Client extends Remote

// Add method to return master BankManager

// Add method to return the name of this client
}

### 2.2 Development of a Simple Banking System

In this part you will run your first RMI system. It is based on the Banking System that you started in the previous lab session.

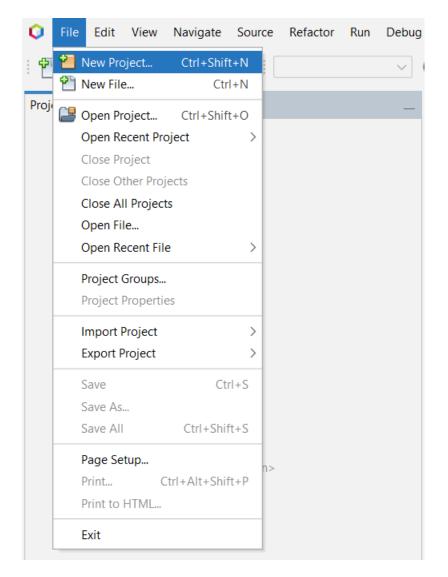
Educational goals:

- Run a server that starts the RMI Registry and supports remote RMI objects
- Implement an RMI client that uses remote services.

The **RMI Registry** manages the publication of the RMI remote services. You have to run a server program that creates the actual remote services, and finally, finish coding the program BankUser, which will use the RMI remote services.

### **Step 1: Code Development**

Create a new project in NetBeans as follows, in File, select New Project.

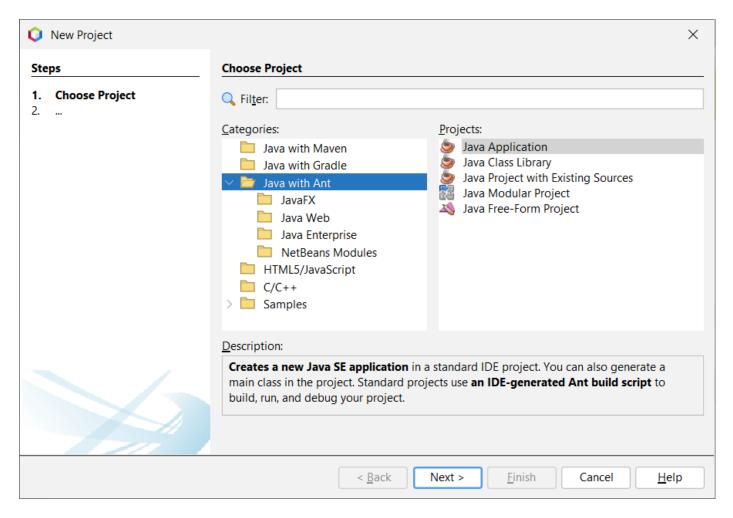


In the following window select Java with Ant and Java Application.

🗘 New Project	>	<					
Steps	Choose Project						
<ol> <li>Choose Project</li> <li></li> </ol>	Q Filter:						
	Categories:       Projects:         Java with Maven       Java Application         Java with Gradle       Java Class Library         Java FX       Java Web         Java Enterprise       Java Enterprise         NetBeans Modules       HTML5/JavaScript         C/C++       Samples						
	Description:						
	<b>Creates a new Java SE application</b> in a standard IDE project. You can also generate a main class in the project. Standard projects use <b>an IDE-generated Ant build script</b> to build, run, and debug your project.						
	< <u>B</u> ack Next > Einish Cancel <u>H</u> elp						

Then enter the name of the project and the respective project folder as follows:

🟮 New Java Application			×
Steps	Name and Location	n	
<ol> <li>Choose Project</li> <li>Name and Location</li> </ol>	Project <u>N</u> ame:	RMI3TIERDB	
	Project Location:	C:\Users\Admin\Desktop\UNYT\DISTYS\DISTSYS 2024\LESSON 4	Br <u>o</u> wse
	Project Folder:	nin\Desktop\UNYT\DISTYS\DISTSYS 2024\LESSON 4\RMI3TIERDB	
		Folder for Storing Libraries	
	Libraries Folde		Bro <u>w</u> se
		Different users and projects can share the same compilation libraries (see Help for details).	
	Create Main Cl	ass rmi3tierdb.RMI3TIERDB	
		< <u>B</u> ack Next > <u>Finish</u> Cancel	Help



The project is now ready for code development as shown in the right panel as follows:

칮 File Edit View Navigate Source Refactor Run De	bug
i 💾 🔚 📲 🦉 i 🏷 🥥 🦉	2 (
Projects × Files Services	_
<ul> <li>MISTIERDB</li> <li>Source Packages</li> <li>default package&gt;</li> <li>Libraries</li> </ul>	
Navigator ×	_
Develop the following code in Netbeans:	
DbAccess.java	
import java.sql.*; public class DbAccess {	

```
private Connection conn;
private Statement s;
```

```
public boolean initializeConnection(String SERVER, String DATABASE, String USER_ID,
        String PASSWORD) throws ClassNotFoundException, SQLException {
        try {
```

```
String path = ("jdbc:mysql://" + SERVER + "/" + DATABASE + "?user="
         + USER ID + "&password=" + PASSWORD);
    conn = DriverManager.getConnection(path);
    s = conn.createStatement();
    return true;
  } catch (SQLException e) {
    return false;
  } catch (Exception e) {
    e.printStackTrace();
    return false;
  }
}
public void CreateConnection() {
  if (conn == null)
                     try {
    initializeConnection("localhost", "bank", "root", "admin");
  } catch (Exception e) {
    e.printStackTrace();
  }
}
public Connection getConnection() {
  return conn;
ł
public void closeConnection() {
  try {
    conn.close();
  } catch (Exception e) {
    e.printStackTrace();
  }
}
public void closeStatement() {
  try {
    s.close();
  } catch (Exception e) {
    e.printStackTrace();
  }
```

#### Database.java

import java.sql.Connection; import java.sql.ResultSet; import java.sql.Statement; import java.util.ArrayList;

public class Database {

private static DbAccess dba = new DbAccess();
private static Connection conn;

```
conn = dba.getConnection();
            }
            public static void main(String args[])
                      CreateConnection();
                      System.out.println("The customer with this account is: " + getCustomerId(3).getFirst());
            }
      public static ArrayList<Integer> getCustomerId(int idAccount){
        ArrayList<Integer> ids = new ArrayList<Integer>();
                                  try {
                                             Statement s = conn.createStatement();
                                             String sql = "Select IdCustomer from accountcustomer where IdAccount ="" +
idAccount + """;
                                             ResultSet r = s.executeQuery(sql);
                                             while(r.next()){
                                                        ids.add(r.getInt("IdCustomer"));
                                             }
                                  } catch (Exception ex) {
                                             ex.printStackTrace();
                                  }
                                 return ids;
      }
}
```

#### Account.java

```
import java.rmi.Remote;
import java.rmi.RemoteException;
```

```
public interface Account extends Remote {
    // Add method to return master BankManager
    public BankManager getBankManager()
        throws RemoteException;
```

```
// Add method to return Client of this account
public Client getClient()
    throws RemoteException;
```

// Add method to return balance of this account
public long getBalance()
 throws RemoteException;

// Add method to withdraw cash from this account
public long getCash (long amount)
 throws NoCashAvailableException, RemoteException;
}

#### Client.java

```
import java.rmi.Remote;
import java.rmi.RemoteException;
```

public interface Client extends Remote {

```
// Add method to return master BankManager
public BankManager getBankManager()
    throws RemoteException;
```

```
// Add method to return the name of this client
public String getName()
    throws RemoteException;
}
```

#### BankManager.java

import java.rmi.Remote; import java.rmi.RemoteException;

public interface BankManager extends Remote {

```
// Add method to return an Account service
public Account getAccount(String accountNumber)
    throws RemoteException;
```

```
// Add method to return a Client service
public Client getClient(String clientName)
throws RemoteException;
```

public int testConn() throws RemoteException;

}

#### AccountImpl.java

import java.io.Serializable; import java.rmi.RemoteException;

public class AccountImpl implements Account, Serializable {

```
private BankManager bankManager;
private Client
                client;
private long
                balance;
private String
                accountNumber;
// public constructor
public AccountImpl (
  BankManager bankManager,
  Client client,
  String accountNumber) {
 this.bankManager = bankManager;
 this.client
             = client;
 this.balance = 0:
 this.accountNumber = accountNumber;
}
```

public void deposit(long amount) {

```
balance += amount;
 }
 @Override
 public BankManager getBankManager()
   throws RemoteException {
  return bankManager;
 }
 @Override
 public Client getClient()
   throws RemoteException {
  return client;
 }
 @Override
 public long getBalance()
   throws RemoteException {
  return balance;
 }
 @Override
 public long getCash(long amount)
   throws NoCashAvailableException, RemoteException {
  if (amount > balance) {
   throw new NoCashAvailableException();
  }
  balance = balance - amount;
  return amount;
 }
}
```

#### ClientImpl.java

import java.io.Serializable; import java.rmi.RemoteException;

public class ClientImpl implements Client, Serializable {

```
private BankManager bankManager;
private String clientName;
// public constructor
public ClientImpl(BankManager bm, String name) {
    this.bankManager = bm;
    this.clientName = name;
  }
@Override
public BankManager getBankManager()
    throws RemoteException {
    return bankManager;
  }
```

@Override
public String getName()

```
throws RemoteException {
  return clientName;
  }
}
```

#### BankManagerImpl.java

import java.io.Serializable; import java.rmi.RemoteException; import java.rmi.server.UnicastRemoteObject;

public class BankManagerImpl extends UnicastRemoteObject implements BankManager, Serializable {

```
// public No-argument constructor
 public BankManagerImpl()
   throws java.rmi.RemoteException {
  super();
  testConn();
 }
 @Override
 public Account getAccount(String accountNumber)
   throws RemoteException {
  return null; // to be implemented
 }
 @Override
 public Client getClient(String clientName)
   throws RemoteException {
  return null; // to be implemented
 }
 @Override
 public int testConn(){
   Database.CreateConnection();
   return Database.getCustomerId(1).get(0);
 }
}
```

#### NoCashAvailableException.java

```
public class NoCashAvailableException extends Exception {
}
```

#### BankSystemServer.java

import java.rmi.RemoteException; import java.rmi.registry.LocateRegistry;

```
import java.rmi.registry.Registry;
public class BankSystemServer {
  public static void main(String args[]) {
     try {
              System.setProperty("java.security.policy","file:./security.policy");
       System.setProperty("java.rmi.server.hostname","192.168.14.202");
       Registry registry = LocateRegistry.createRegistry(1099);
       registry.rebind("BankManagerImpl", new BankManagerImpl());
     } catch (RemoteException remoteException) {
       System.err.println(
            "Failure during object export to RMI: "
            + remoteException);
     }
     System.out.println("Server started.");
     System.out.println("Enter <CR> to end.");
     try {
       int i = System.in.read();
     } catch (Exception exception) {
     System.exit(0);
  }
}
```

#### BankUser.java

```
import java.rmi.*;
import java.rmi.registry.LocateRegistry;
import java.rmi.registry.Registry;
```

```
public class BankUser {
    public static void main(String[] args) {
        BankManager bm;
        try {
            Registry registry = LocateRegistry.getRegistry("localhost", 1099);
            bm = (BankManager) registry.lookup("BankManagerImpl");
            System.out.println("Testing connection with ID oustomer for IDAccount = 1: " + bm.testConn());
        } catch (NotBoundException notBoundException) {
            System.err.println("Not Bound: " + notBoundException);
        } catch (RemoteException remoteException) {
            System.err.println("Remote Exception: " + remoteException);
        }
    }
}
```

### **Step 2:** Compile the code following these steps:

In order to connect Java with MySQL we need the following connector:

```
mysql-connector-j-8.3.0.jar
```

Download such connector from the following site:

https://dev.mysql.com/downloads/connector/j/

as platform independent file which is a zip file inside which you will find the file mysql-connector-j-8.3.0.jar. Copy such file in the main folder of the NetBeans project folder as follows:

DISTYS >	DISTYS > DISTSYS 2024 > LESSON 4 > RMI3TIERDB							
	Name	Date modified						
*	hbproject	31/03/2024 17:04 31/03/2024 17:05						
*	e build	31/03/2024 17:04						
*	manifest.mf mysql-connector-j-8.3.0	31/03/2024 17:04 13/12/2023 03:08						

Add the connector to the libraries of the project in Netbeans as follows:

🗘 File Edit Vi	ew Navigate Source Ref	actor Run Debug
1 1	🖢 i 🍤 🥐 i 🤇 <def< td=""><td>ault config&gt; 🗸 🗸</td></def<>	ault config> 🗸 🗸
Projects × Files	Services	_
RMI3TIERDB Source Pa Concerta	New >	
> 😬 <defa &gt; 📴 Libraries</defa 	Build Clean and Build Clean Generate Javadoc	
	Run Debug Profile Test Alt+F6	
	Run Selenium Tests Execute Java Shell Set Configuration >	
	Open Required Projects > Close	
Database.java - Nav Members Solution Database Database () CreateCo	Rename Move Copy Delete Delete	
getCusto     getCusto     getCusto     main(Stri     conn : Co	FindCtrl+FInspect and TransformOpen in TerminalOpen in SystemVersioningHistory	nteger>
	Properties	

Click with right of the mouse on the Project. Select Properties and in the next window select Libraries:

Project Properties - RMI3TIERDB				×
<u>C</u> ategories:	1			
<ul> <li>Sources</li> </ul>	<u>J</u> ava Platform:	JDK 21 (Default)	<u> </u>	anage Platforms
<ul> <li>Libraries</li> <li>✓ Ø Build</li> </ul>	Libr <u>a</u> ries Folder:			B <u>r</u> owse
<ul> <li>Compiling</li> </ul>				
<ul> <li>Packaging</li> </ul>	Compile F	Processor Run Compile Tests Run Tests		
<ul> <li>Deployment</li> </ul>				
<ul> <li>Documenting</li> </ul>	Compile-time	Libraries:		
Run	Modulepath		+	Edit
Application	Classpath		+	
<ul> <li>Web Start</li> <li>License Headers</li> </ul>				Remo <u>v</u> e
<ul> <li>Formatting</li> </ul>				Move Up
<ul> <li>Hints</li> </ul>				
				Move <u>D</u> own
	Compile-time	libraries are propagated to all library categories.		
	✓ Build Depen	dencies		
		ОК	Cano	el <u>H</u> elp

Click on the right + symbol of the Classpath item as follows, and select Add Jar/Folder:

Q	Pro	ject Properties - RMI3TIERDB				>
Cat	ego	ories:				
	0	Sources	Java Platform:	JDK 21 (Default)	<u>~</u> [	Manage Platforms
~	0	Libraries Build Compiling Packaging Deployment Documenting	Libraries Folder: Compile P Compile-time I	Processor Run Compile Tests Run Tests		Browse
~	0 0 0 0	Run Application Web Start License Headers Formatting Hints	Modulepath Classpath			+ Edit + Romovo Add Project Add Library Add JAR/Folder
			Compile-time I	libraries are propagated to all library categories.		

 $\times$ 

Cancel

Help

Compile-time libraries are propagated to all library categories.

## Select relative path:

Add JAR/Folder			×
<b>e</b> a	Look <u>I</u> n:	RMI3TIERDB	✓ ♠ ➡ ₩ Ⅲ
Recent Items	📕 nbproject		Reference as
	📕 src		<u>R</u> elative Path:
	🔮 mysql-cor	nnector-j-8.3.0	mysql-connector-j-8.3.0.jar
Desktop			O Path from <u>V</u> ariable:
			<no suitable="" td="" variab<=""></no>
Documents			Absolute Path:
			C:\Users\Admin\Desktop\UNYT\E
This PC	File <u>N</u> ame:	mysql-connector-j-8.3.0.jar	
<b></b>	Files of <u>T</u> ype:	Classpath Entry (folder, ZIP or JAR file)	~
Network			Open Cancel

You should see the following window:

Project Properties - RMI3TIERDB <u>Categories:</u>				×
<ul> <li>Sources</li> </ul>	Java Platform:	JDK 21 (Default)	<u> </u>	<u>Aanage</u> Platforms
<ul> <li>Libraries</li> <li>Build</li> <li>Compiling</li> <li>Packaging</li> <li>Deployment</li> </ul>	- · · -	Processor Run Compile Tests Run Tests		B <u>r</u> owse
<ul> <li>Documenting</li> <li>Run</li> <li>Application</li> <li>Web Start</li> <li>License Headers</li> <li>Formatting</li> <li>Hints</li> </ul>	Compile-time I Modulepath Classpath	connector-j-8.3.0.jar	+	Edit Remove Move Up Move Down
	Compile-time	libraries are propagated to all library categories.		
		ОК	Car	ncel <u>H</u> elp

Test the connection with MySQL as follows by using the following classes:

### DbAccess.java and Database.java

To test the connection insert some data in the database as follows:

Click with the right button of the mous on the table account and then click on Select Rows as follows:

MySQL Workbench	ySQL83 - W_ ×
2007 STATES (2017) 1 2775	ry Database Server Tools Scripting Help
Navigator	
SCHEMAS Q Filter objects V B bank V Tables	<ul> <li>Image: Select * FROM bank.account;</li> </ul>
account     account     custome     Views     Stored Proc     Functions	Select Rows - Limit 1000 Table Inspector Copy to Clipboard Table Data Export Wizard
sys	Table Data Import Wizard Send to SQL Editor Create Table.
	Create Table Like
	Drop Table Truncate Table
	Search Table Data Refresh All
Administration Schemas	

Double click on the fields of the table directly and fill in the data as follows:

	8 🥖	TA	0 8 0 6	🗑 🛛 Limit to 1000	rows 🔹 🌟 💈	/ Q. 11 🗉		
	1 • SE	LECT * FRO	M bank.account;					
<								>
Re	sult Grid	🛛 🛟 Filter	Rows:	Edit: 🛃 🔜	Export/Import:	Wrap Cell Conte	nt: <u>1A</u>	
	IdAccount	Balance						
	1	1000						Result Grid
	2	2000						[
1	3	3000						
	NULL	NULL						Form
								Editor
								Field Types
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								~

In the above window and the following one, click on Apply and the data will be saved into the table:



Repeat the same operations for the other two tables as follows:

## Table customer

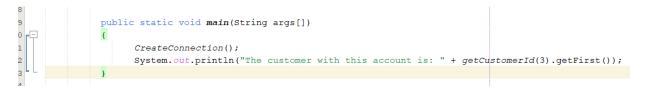
10	6	Ö																
	Que	ry 1	ban	ik - Sch	ema	account	custo	omer ×										
	6		1	8	10	80 0	0	Limit	to 1000 r	ows	•   🚖		0	1 7	)			
	1	. •	SELE	CT *	FROM ba	ank.custo	mer;											
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	Res	ult Grid		<b>()</b> F	Filter Rows	52		Edit: [	⊿ 🖦		Export/In	nport:	8	Wrap	Cell Cont	ent: 🚹		
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## Table accountcustomer:

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0		8   🗲	7 🔍 🛛	9   🏡   📀		Limit to 1000	rows	-   🏡   -	🧳 Q	1 7			
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			IdCustomer										Result Grid
			1										
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		NULL	NULL										Form
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													$\sim$
	untcu	stomer 1 ×									Apply		Revert

Now test the connection of the Java programs with the query to find out the customer to which account 3 belongs to.

In the Database class, you will find these statements:



If you run the class, you will see the following result as per the data in the database:



## 3. Run the server and the client

### 3.1 Run the server RMI Registry program.

Open a command line and move to the directory that will contain your code from this exercise.

From that location, run the server with the following command. You will get an error due to the absence of the JDBC connector missing as follows:

Command Prompt	_		×
(c) Microsoft Corporation. All rights reserved.			^
C:\Users\Admin>cd C:\Users\Admin\Desktop\UNYT\DISTYS\DISTSYS 2024\LESSON 4\RMI3TIERDB\build\classes			
<pre>C:\Users\Admin\Desktop\UNYT\DISTYS\DISTSYS 2024\LESSON 4\RMI3TIERDB\build\classes&gt;java BankSystemServer java.sql.SQLException: No suitable driver found for jdbc:mysql://localhost/bank?user=root&amp;password=admin</pre>		is null	
at BankManagerImpl.testConn(BankManagerImpl.java:27) at BankManagerImpl. <init>(BankManagerImpl.java:9)</init>			
at BankSystemServer.main(BankSystemServer.java:11)			
C:\Users\Admin\Desktop\UNYT\DISTYS\DISTSYS 2024\LESSON 4\RMI3TIERDB\build\classes>_			~

Copy the JDBC connector under the directory of the java classes for easiness of invocation in the command line as follows:

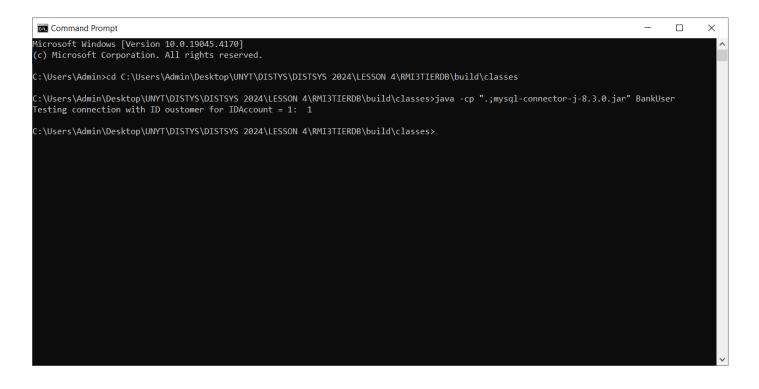
> UNYT > DISTYS > DISTSYS 2024 > LESSON 4 > RMI3TIERDB > build > classes								
Name	Date modified	Туре	Size					
Account.class	01/04/2024 14:21	CLASS File	1 KB					
AccountImpl.class	01/04/2024 14:21	CLASS File	2 KB					
BankManager.class	01/04/2024 14:21	CLASS File	1 KB					
BankManagerImpl.class	01/04/2024 14:21	CLASS File	1 KB					
BankSystemServer.class	01/04/2024 14:21	CLASS File	2 KB					
BankUser.class	01/04/2024 14:21	CLASS File	2 KB					
Client.class	01/04/2024 14:21	CLASS File	1 KB					
ClientImpl.class	01/04/2024 14:21	CLASS File	1 KB					
Database.class	01/04/2024 14:21	CLASS File	3 KB					
DbAccess.class	01/04/2024 14:21	CLASS File	3 KB					
NoCashAvailableException.class	01/04/2024 14:21	CLASS File	1 KB					
🕌 mysql-connector-j-8.3.0	13/12/2023 03:08	Executable Jar File	2,438 KB					

Now you can launch again the program as follows using the classpath option of Java as follows:



#### Do not close this window!

Open another cmd window and invoke now the client as follows:



# 4. Run the database server, the RMI server and the client in three different computers.

First open the database class DbAccess and change the IP of the database server as follows:

```
4
5
         public void CreateConnection() {
6
7
8
              if (conn == null)
  Ē
                      try {
                  initializeConnection("localhost", "bank", "root", "admin");
2
              } catch (Exception e) {
2
                  e.printStackTrace();
1
              }
2
         }
2
```

Instead of localhost you should put the IP of the database server for example 192.168.1.65 if you are working in LAN:



Then you need to run BankUser from a different IP of where the BankSystemServer is running. In BankUser you should replace localhost with the IP of the machine where you are running BankSystemServer.

10 🛱	try {
11	Registry registry = LocateRegistry.getRegistry("localhost", 1099);
12	<pre>bm = (BankManager) registry.lookup("BankManagerImpl");</pre>
13	System.out.println("Testing connection with ID oustomer for IDAccount = 1: " + bm.testConn());
13 14 🗖	<pre>} catch (NotBoundException notBoundException) {</pre>

Change the IP as follows if for example the BankSystemServer is running on 192.168.1.45.

try {									
Reg	istry r	egistry =	- Locate	Regist	ry.getF	Regist	<b>ry("</b> 192 <b>.</b> 168.	.1.45	; 1099);
bm	= (Bank	Manager)	registr	y.look	up ("Ban	kManag	gerImpl");		
Sys	tem. <i>out</i>	.println(	"Testin	g conn	ection	with 1	ID oustomer	for	IDAccount =
۱ catch	(Not Bo	undEvcent	ion not	BoundE	vcentio	un) /			

You should then run the two programs normally and you will see execution of the distributed application over the three computers is achieved successfully.

In addition create the following file in the rood directory of the project:

Filename: security.policy

Content of the file as follows:

grant {

// Allow everything for now

permission java.security.AllPermission;

};

## As follows:

۶	DISTYS >	Þ	DISTSYS 2024	>	LESSON 4	>	<b>RMI3TIERDB</b>	>	
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			_	
	Name	Date modified	Туре	Size
*	📜 build	06/04/2024 18:48	File folder	
*	📙 dist	06/04/2024 18:48	File folder	
	📜 nbproject	31/03/2024 17:04	File folder	
*	📕 src	01/04/2024 15:01	File folder	
*	📜 test	31/03/2024 17:55	File folder	
	💽 build	31/03/2024 17:04	Microsoft Edge HT	4 KB
	command line	03/04/2024 09:59	Text Document	1 KB
	manifest.mf	31/03/2024 17:04	MF File	1 KB
	近 mysql-connector-j-8.3.0	13/12/2023 03:08	Executable Jar File	2,438 KB
	security.policy	06/04/2024 18:42	POLICY File	1 KB