Knowledge Querying (I)

一、RDF4J配置

示例代码：https://github.com/eclipse/rdf4j/tree/main/examples

注意须知：

1. 考虑到同学们电脑上有JAVA 8版本，无需删除，跟着环境配置教程进行即可。

2. **若电脑上已有java 11版本的同学**，可跳过“安装JDK”与“环境变量配置步骤”。

3. 本教程提供了Windows 64位操作系统和Mac操作系统的相关安装包，采用其它操作系统的同学请自行下载安装包，具体网址为：

Java JDK 11.0.13：https://www.oracle.com/java/technologies/downloads/#java11
Eclipse 2021-12 ：https://www.eclipse.org/downloads/packages/

环境配置—安装JDK【涉及到的安装包均已提供】

1. 双击安装包（Windows系统选择.exe后缀，Mac系统选择.tar.gz后缀，本示例将以Windows系统为例），点击“下一步”开始安装。

环境配置—安装JDK

2. 选择安装路径（请记录该安装路径，后续会用到），本示例采用的路径为 G:\java\JDK\jdk-11.0.13\

3. 点击下一步 继续安装

环境配置—安装JDK

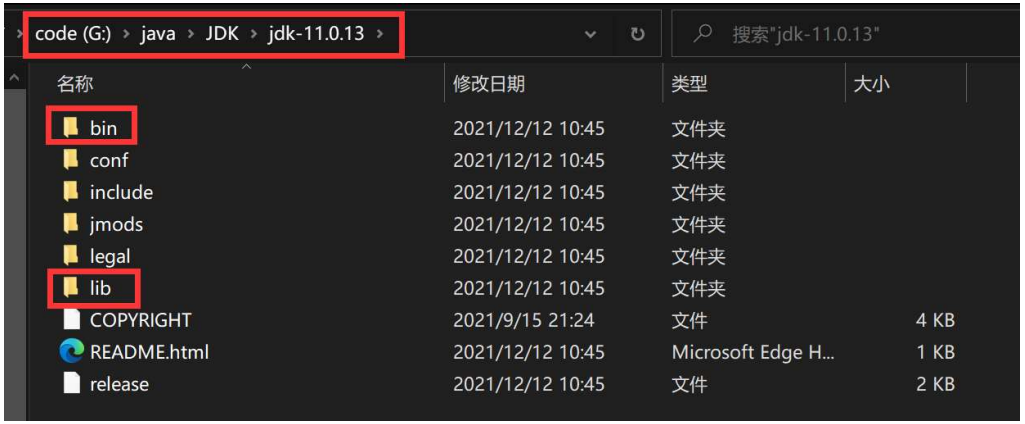
4. 等待JDK安装，点击“关闭”完成安装。

环境配置—环境变量配置

1. 找到对应路径。

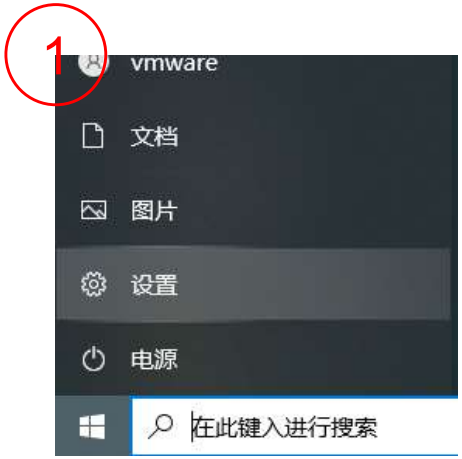
记录3个路径：

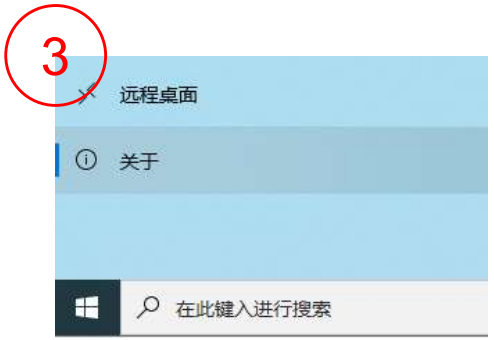
1) 安装JDK时的安装路径，对应后续步骤中的 JAVA_HOME
   – 本示例为 G:\java\JDK\jdk-11.0.13\
2) JDK安装路径下的lib文件，对应后续步骤中的 CLASSPATH
   – 本示例为 G:\java\JDK\jdk-11.0.13\lib
3) JDK安装路径下的bin文件，对应后续步骤中的 Path
   – 本示例为 G:\java\JDK\jdk-11.0.13\bin



环境配置—环境变量配置

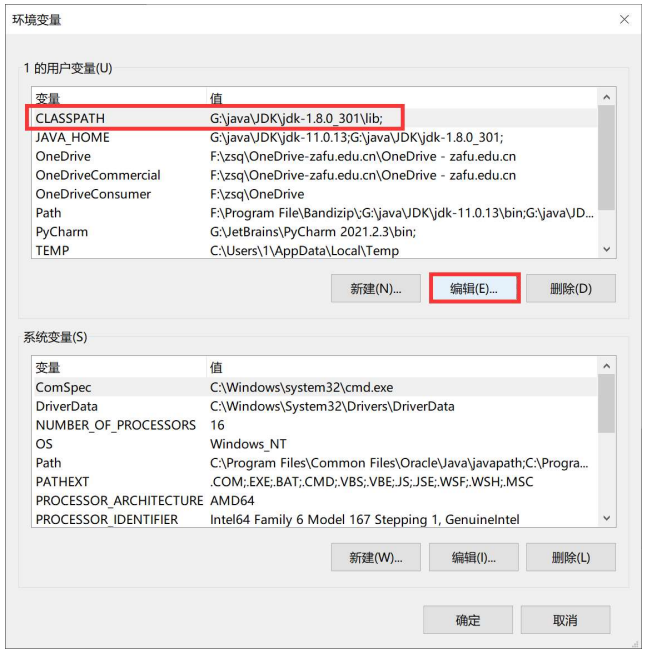
2. 打开 设置 --> 系统 --> 关于 --> 高级系统设置 --> 环境变量

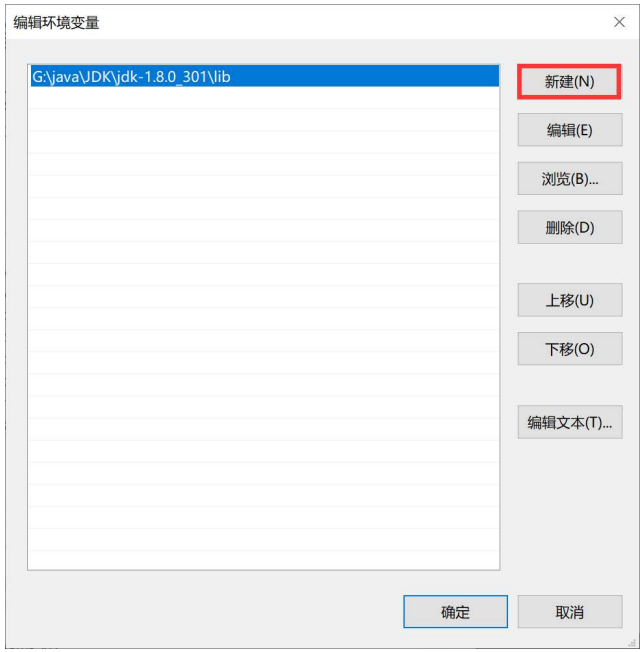


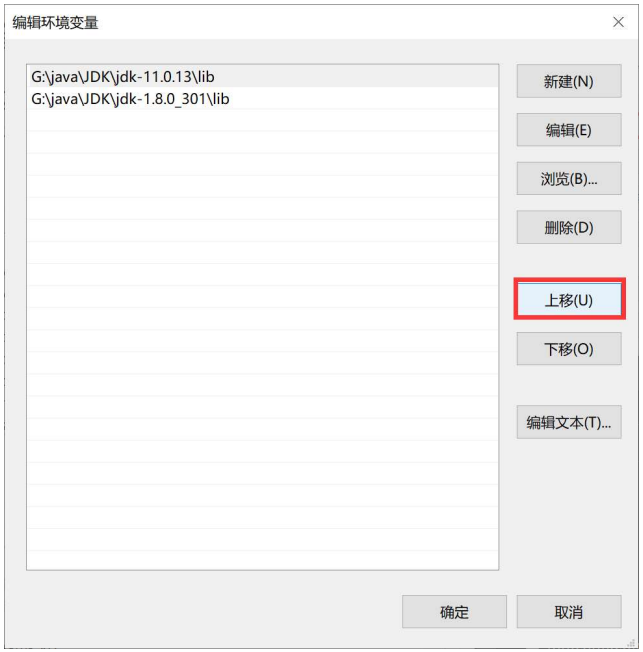


环境配置—环境变量配置

3. 编辑“CLASSPATH”环境变量，选中“CLASSPATH”，点击“编辑”，在弹出的窗口选择“新建”，然后输入步骤1中的记录值点“上移”，将新建的路径调整到最顶端。

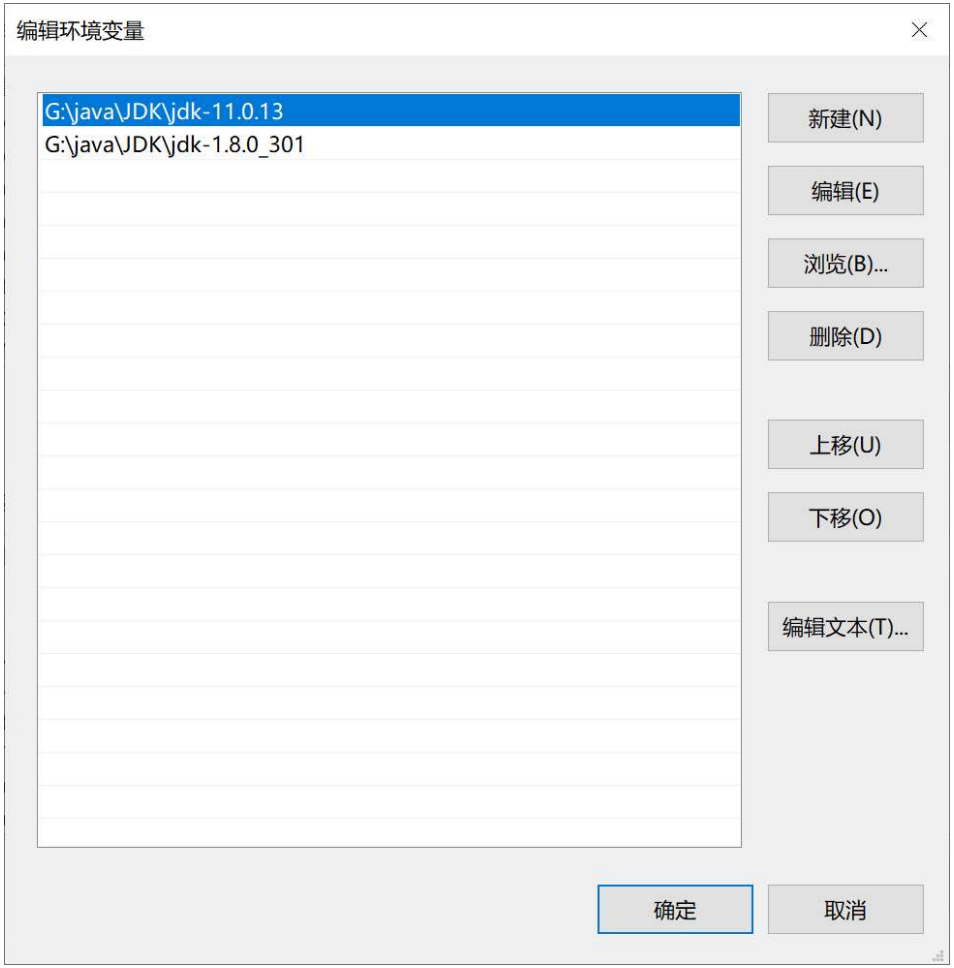


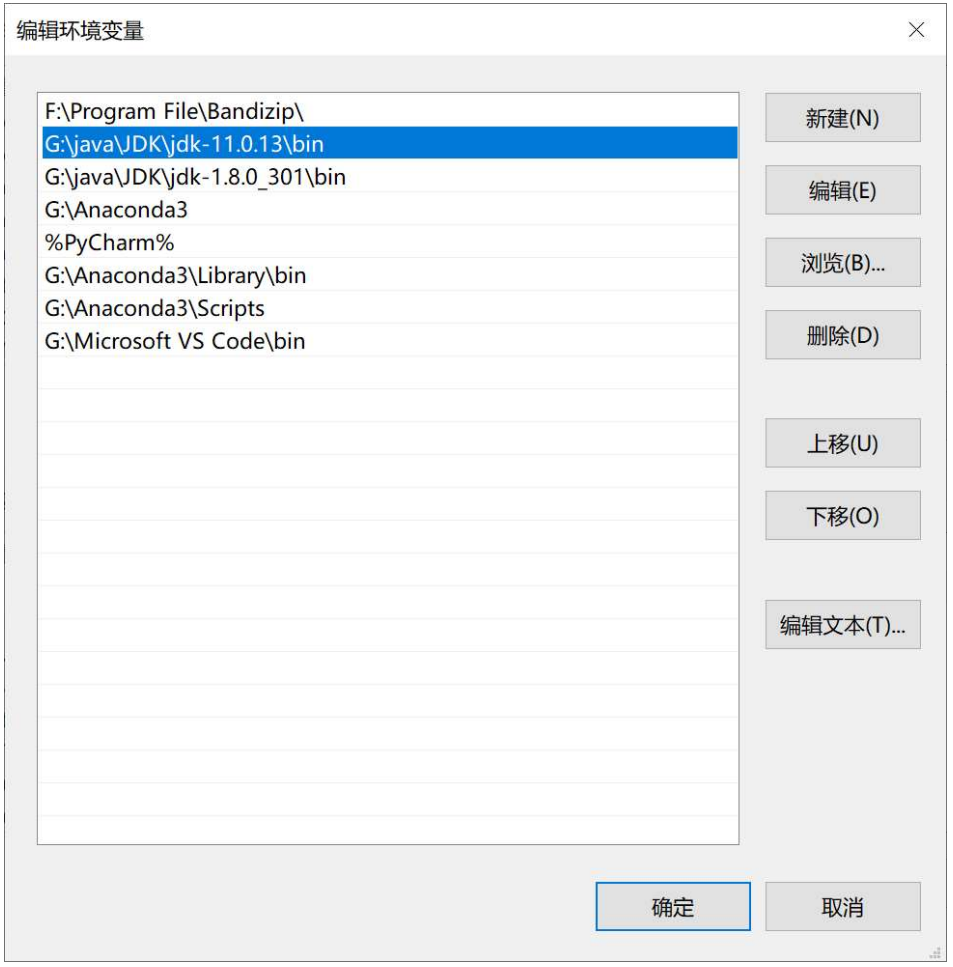




环境配置—环境变量配置

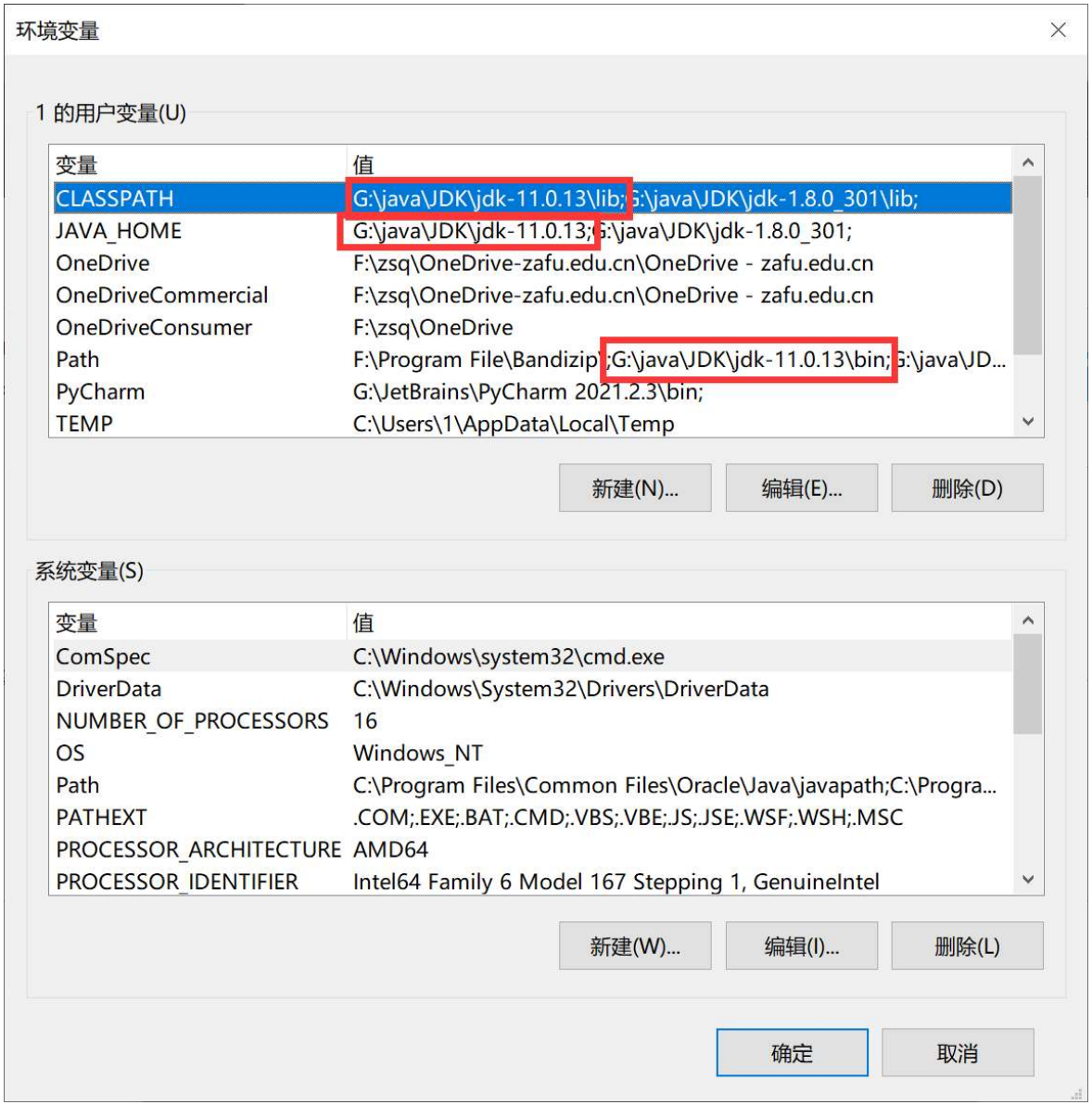
4. 依次编辑 “JAVA_HOME”和“Path”环境变量。





环境配置—环境变量配置

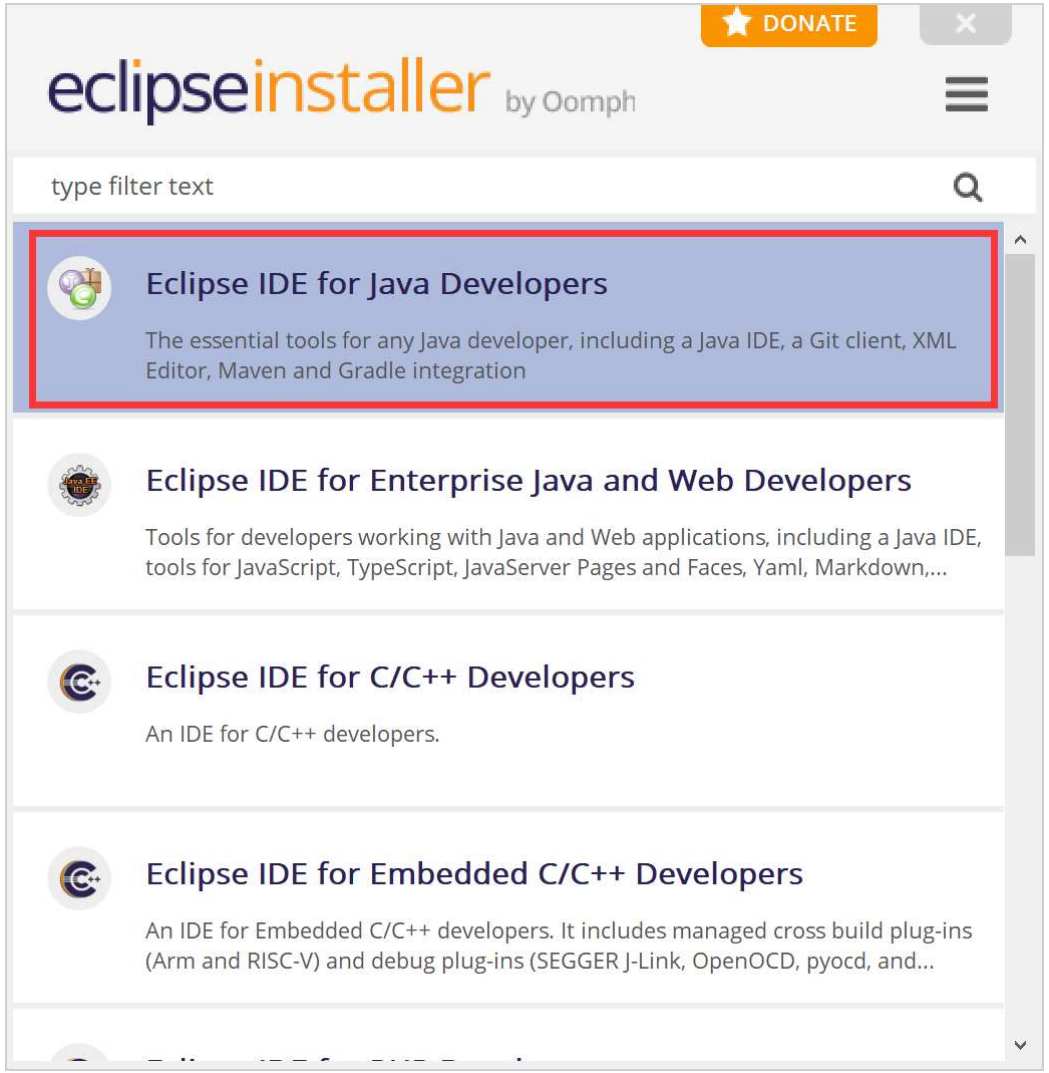
5. 最终完成界面如右图所示，点击“确定”



环境配置—安装IDE 【涉及到的安装包均已提供】

使用的IDE：Eclipse

1. 双击安装包（Windows系统选择.exe后缀，Mac系统选择.dmg后缀，本示例将以Windows系统为例），选择“Eclipse IDE for Java Developers”开始安装。



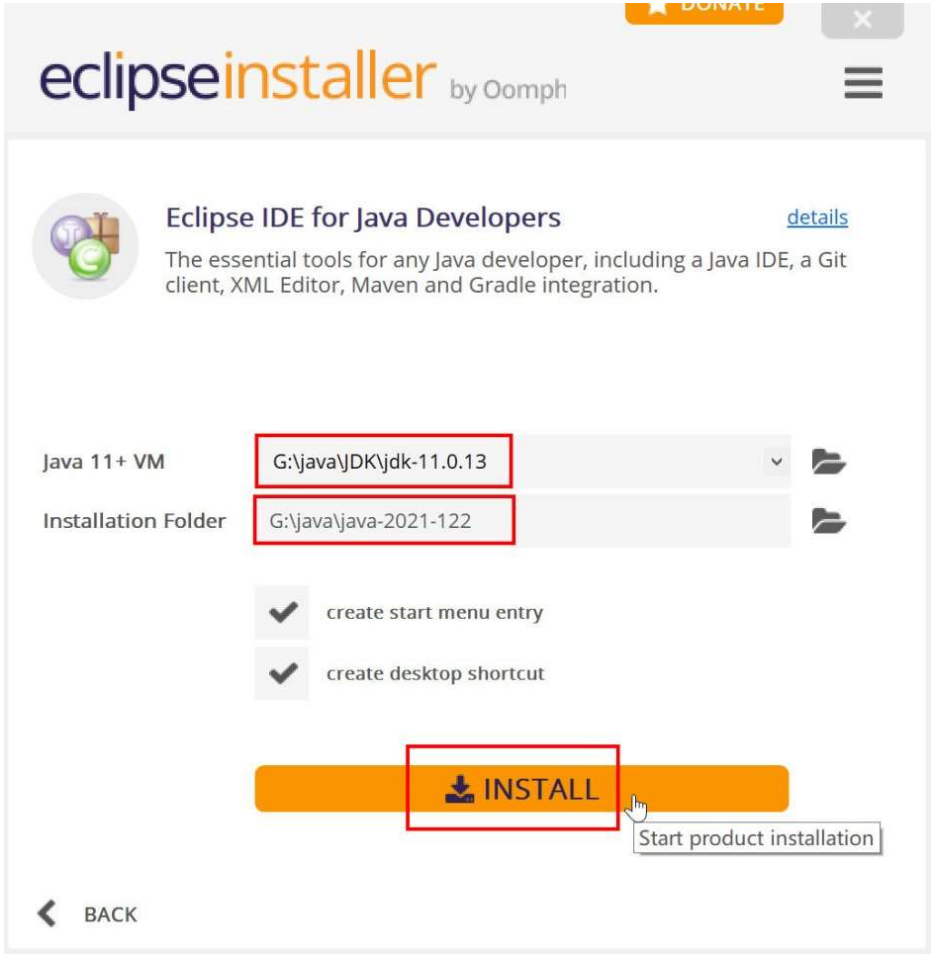
环境配置—安装IDE

2. 设置相关路径。

Java 11+ VM 处选择 JDK安装路径，

Installation Folder 为eclipse安装路径，可自由选择，本示例安装至G:\java\eclipseNew 路径下

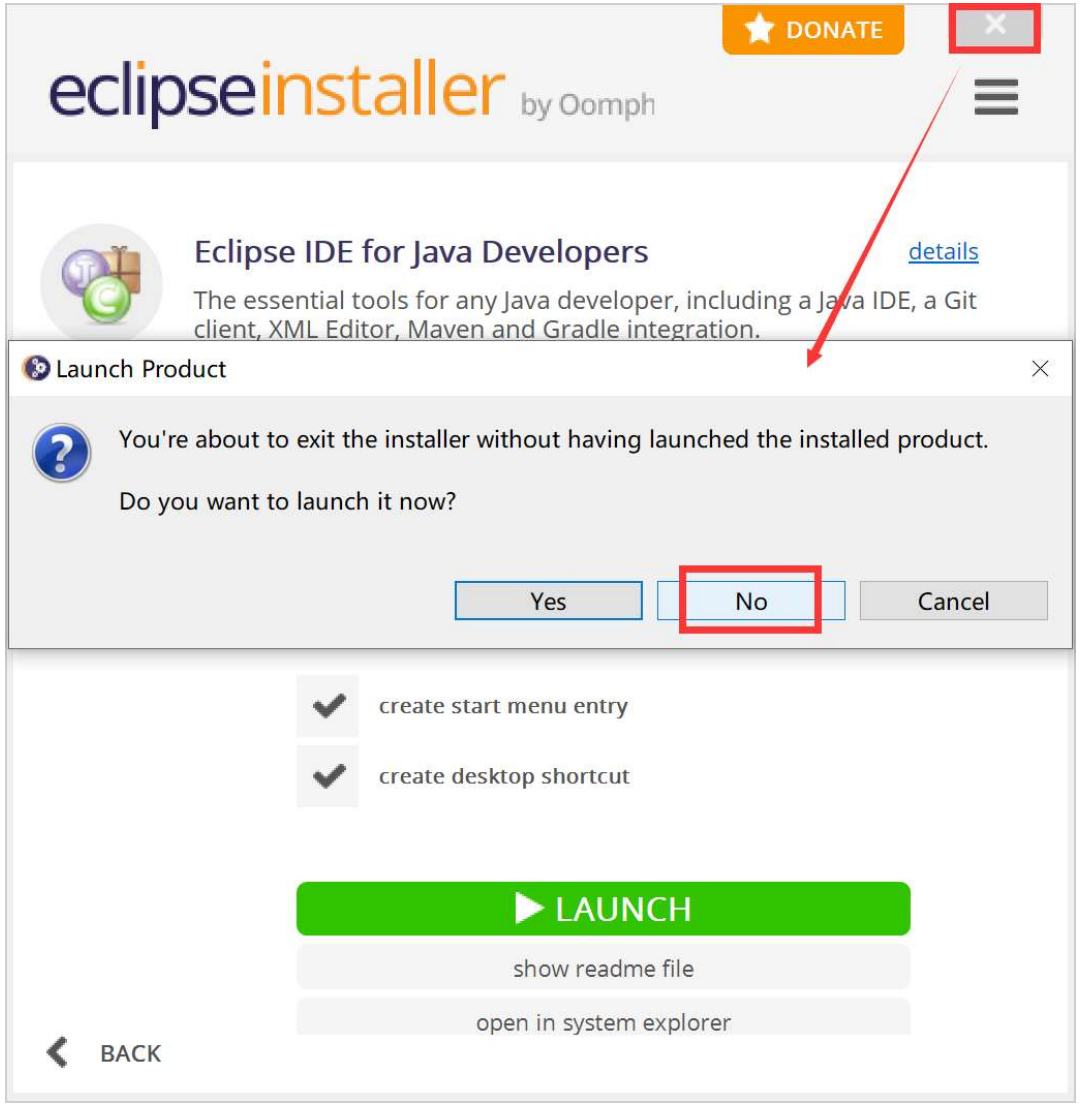
3. 点击“INSTALL”开始安装。



环境配置—安装IDE

4. 等待Eclipse安装，完成后不要直接运行程序。

点击关闭按钮，弹框选择“No”。



环境配置—安装IDE

5. 找到eclipse的安装位置，该目录下有一个“eclipse.ini”文件，用记事本打开，在“-vmargs”前添加两行代码，保存更改。

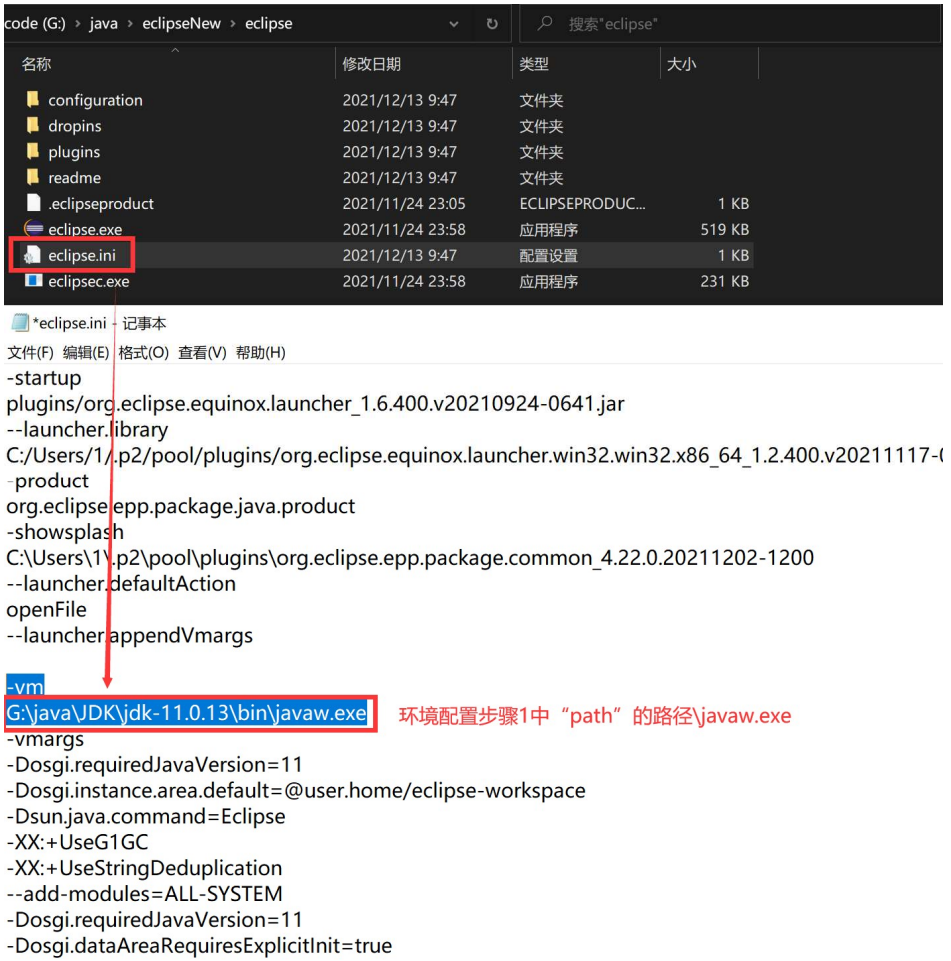
-vm

%path%\ javaw.exe

本示例为：

-vm

G:\java\JDK\jdk-11.0.13\bin\javaw.exe

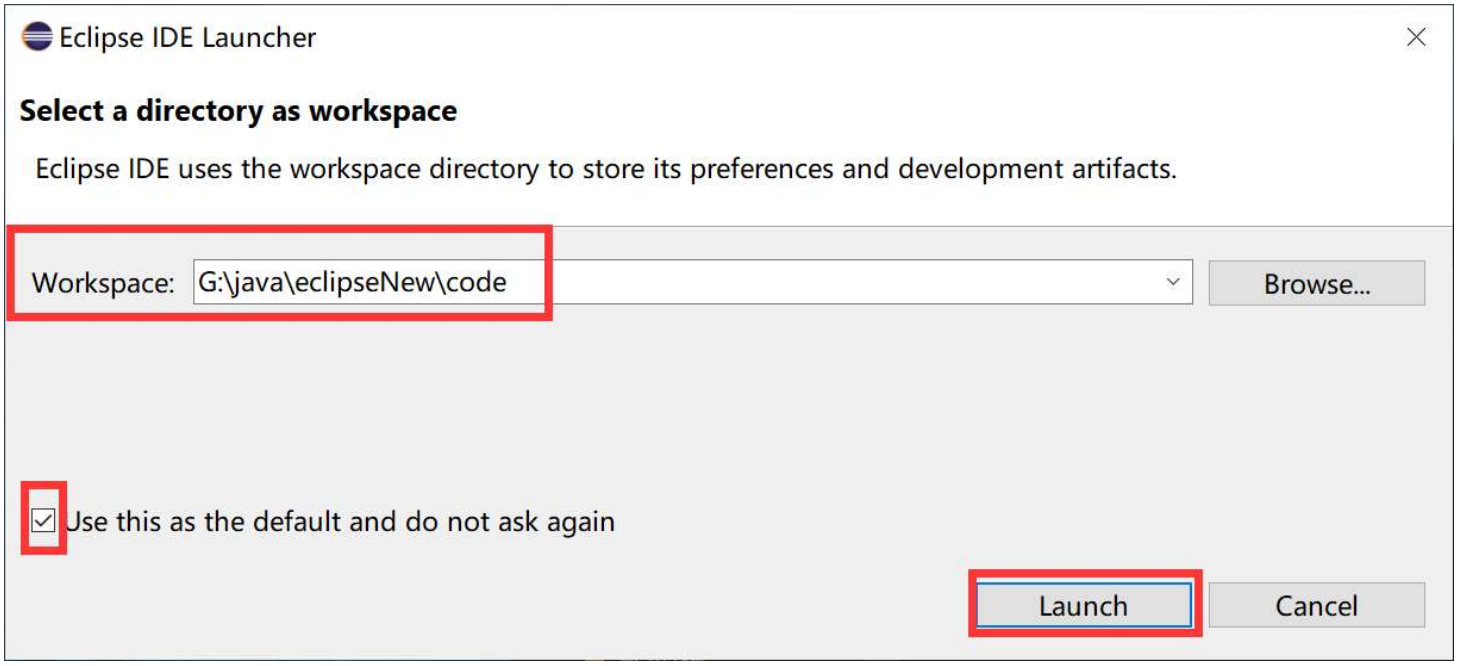


环境配置—Eclipse相关配置

1. 启动eclipse，配置workspace。

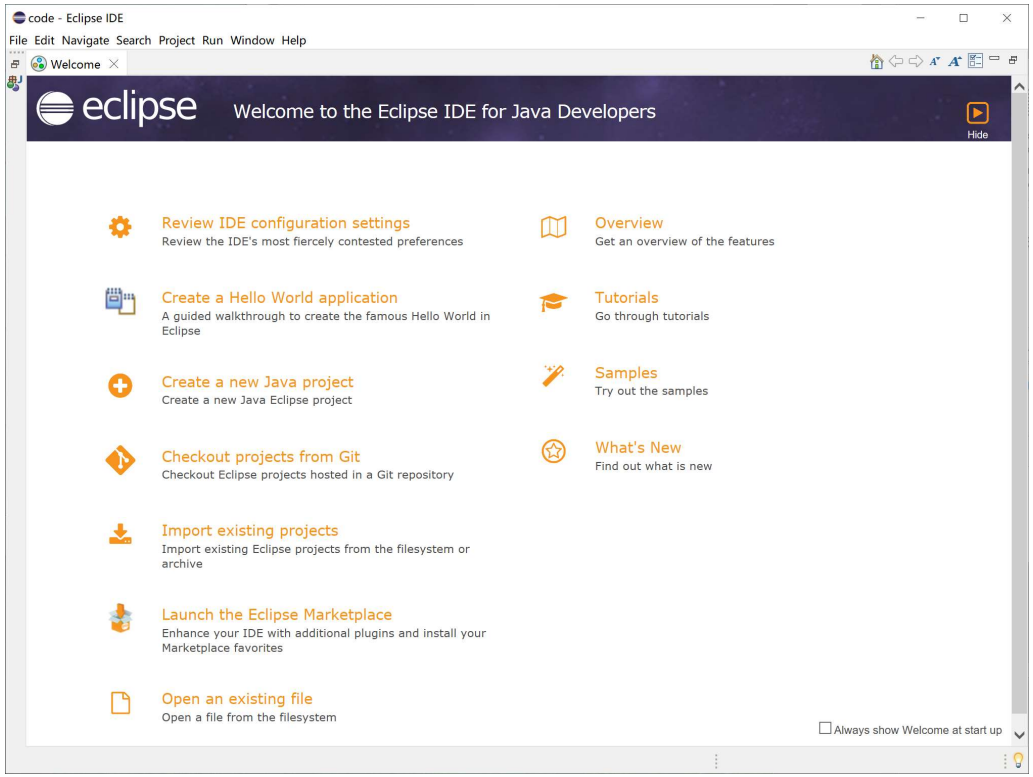
双击桌面快捷方式启动Eclipse。第一次启动时，需要提供工作空间目录（用于存放Eclipse存储所有项目数据和一些配置信息），可以自由选择/创建目录，或者直接接受默认目录。勾选“Use this as the default and do not ask again”，点击“Launch”

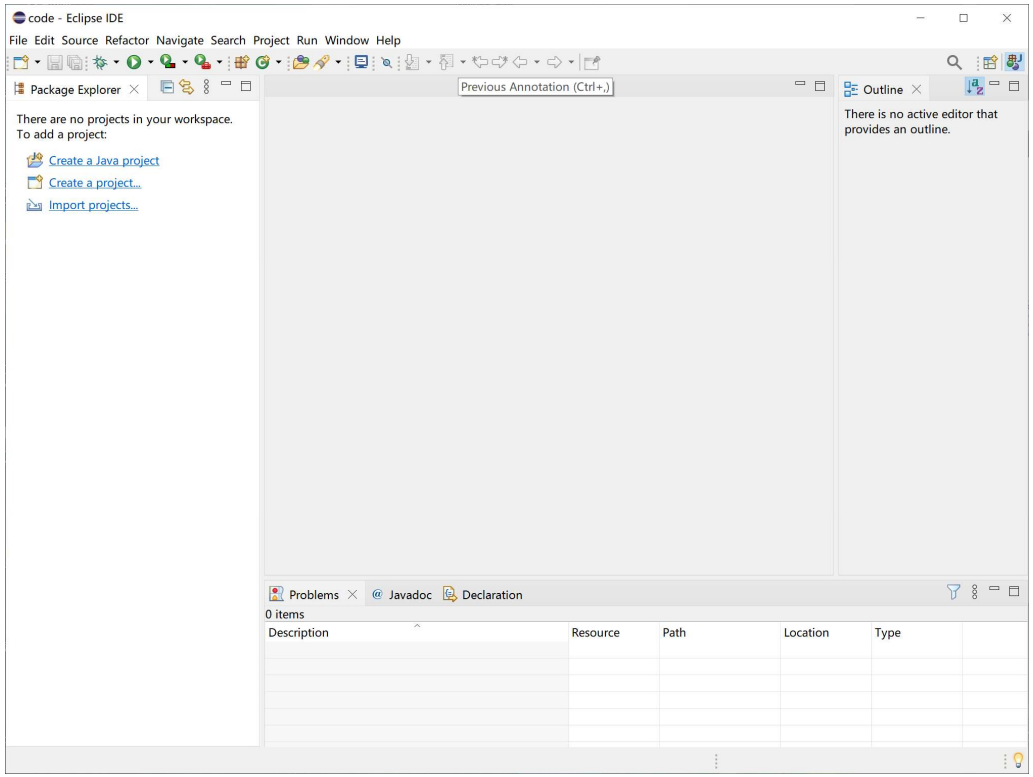
本示例将工作空间目录设置为 G:\java\eclipseNew\code



环境配置—Eclipse相关配置

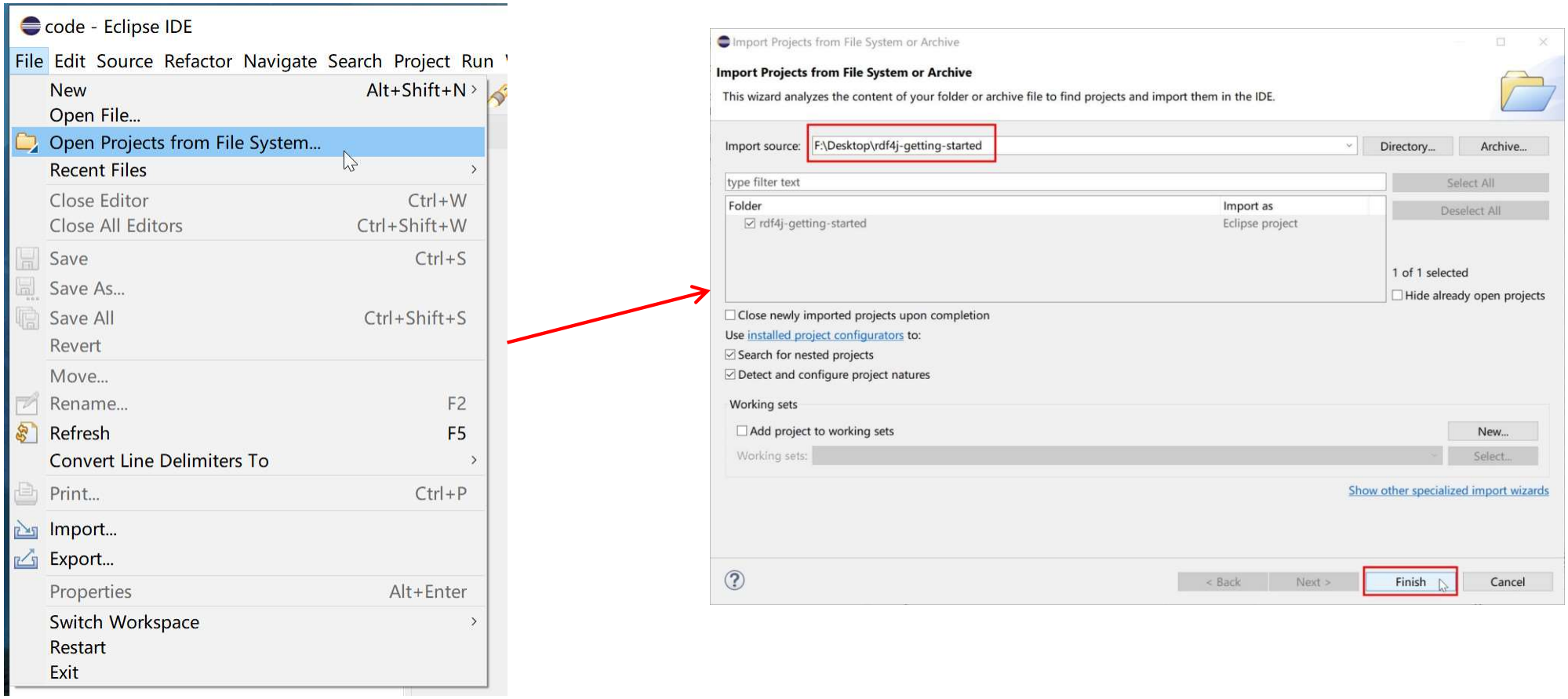
2. 第一次启动Eclipse会出现welcome页面，如左下图所示，关闭后如右下图所示。





环境配置—打开项目文件

1. 在顶部菜单栏中选择File→Open Projects from File System...
2. 选择下发的项目文件路径，点击“Finish”。

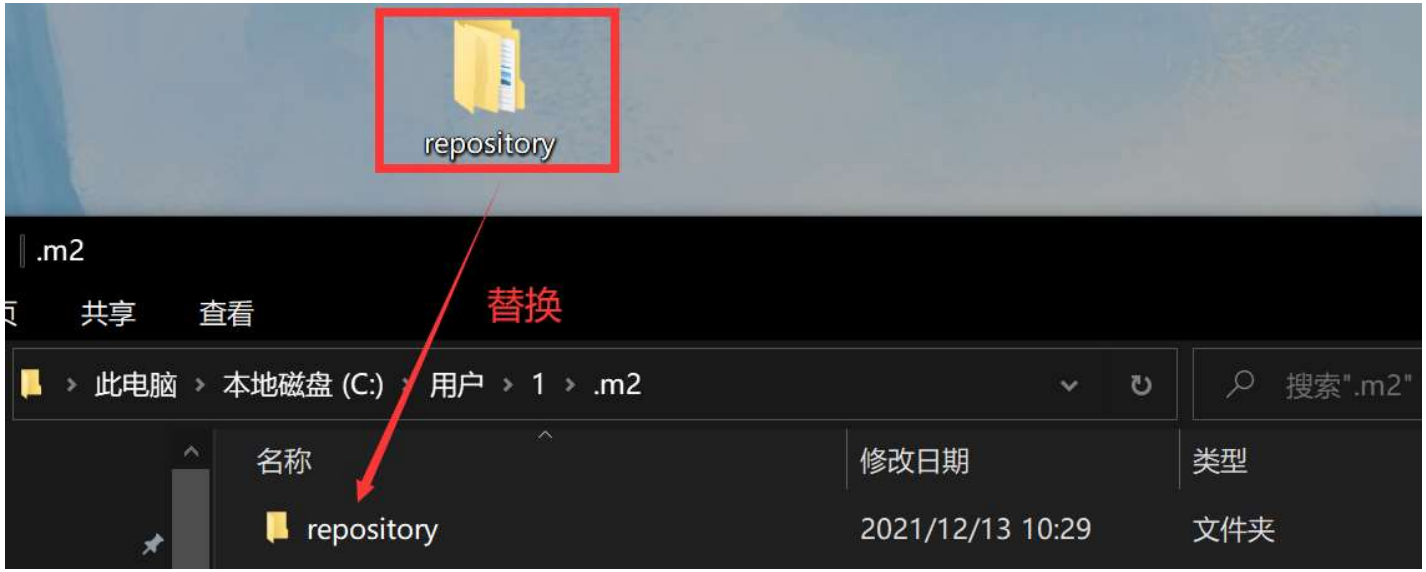


环境配置—打开项目文件

3. 直接替换本地Maven仓库。

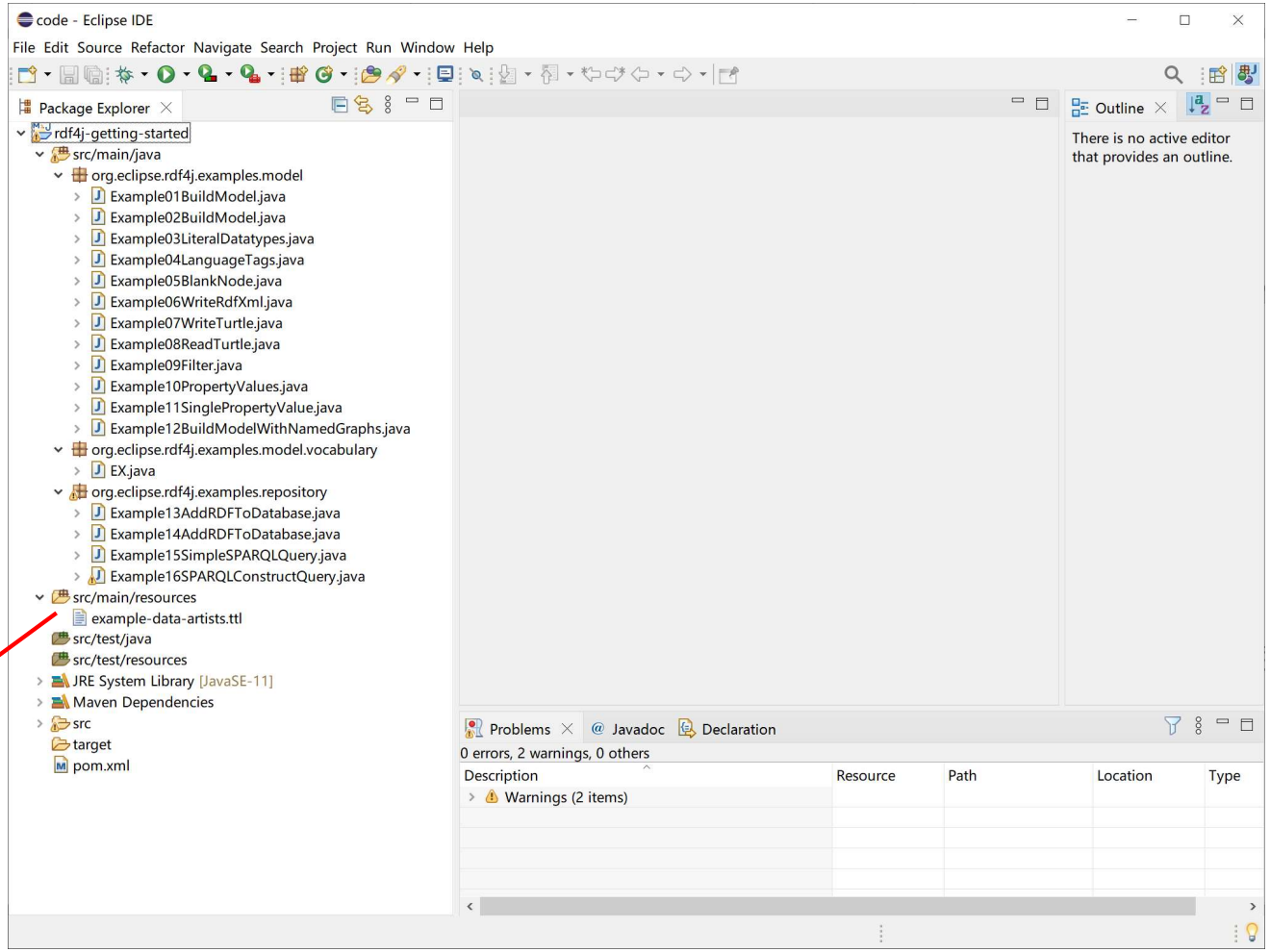
Maven项目将自动下载项目依赖的jar包，这个过程较慢。可将下发的“repository.zip”解压后替换本地Maven仓库中的repository。

本地Maven仓库默认位于C:\Users\用户名\.m2 文件夹下。



环境配置—打开项目文件

4. 成功打开的项目界面如右图所示。



example-data-artists.ttl
用于存放turtle数据

.TTL文件内容

example-data-artists.ttl - 记事本

文件(F) 编辑(E) 格式(O) 查看(V) 帮助(H)

```
@prefix ex: <http://example.org/> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
ex:Picasso a ex:Artist ;
            foaf:firstName "Pablo" ;
            foaf:surname "Picasso";
            ex:creatorOf ex:guernica ;
            ex:homeAddress _:node1 .

            _:node1  ex:street "31 Art Gallery" ;
                  ex:city "Madrid" ;
                  ex:country "Spain" .

ex:guernica a ex:Painting ;
          rdfs:label "Guernica";
          ex:technique "oil on canvas".

ex:VanGogh a ex:Artist ;
             foaf:firstName "Vincent" ;
          foaf:surname "van Gogh";
          ex:creatorOf ex:starryNight, ex:sunflowers, ex:potatoEaters .

ex:starryNight a ex:Painting ;
          ex:technique "oil on canvas";
          rdfs:label "Starry Night" .

ex:sunflowers a ex:Painting ;
          ex:technique "oil on canvas";
          rdfs:label "Sunflowers" .

ex:potatoEaters a ex:Painting ;
          ex:technique "oil on canvas";
          rdfs:label "The Potato Eaters" .
```

SPARQL SELECT查询

SPARQL查询语句：

```
PREFIX ex: <http://example.org/>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT ?s ?n
WHERE {
        ?s a ex:Artist;
                foaf:firstName ?n .
}
```

查询有名字的艺术家以及他们的名字

SPARQL SELECT查询

```
2⊕ * Copyright (c) 2016, 2017 Eclipse RDF4J contributors.
8  package org.eclipse.rdf4j.examples.repository;
9
10⊕ import java.io.IOException;
22
24⊕ * RDF Tutorial example 15: executing a simple SPARQL query on the database
28 public class Example15SimpleSPARQLQuery {
29
30⊖    public static void main(String[] args)
31            throws IOException {
32        // Create a new Repository.
33        Repository db = new SailRepository(new MemoryStore());
34
35        // Open a connection to the database
36        try (RepositoryConnection conn = db.getConnection()) {
37            String filename = "example-data-artists.ttl";
38            try (InputStream input = Example15SimpleSPARQLQuery.class.getResourceAsStream("/" + filename)) {
39                // add the RDF data from the inputstream directly to our database
40                conn.add(input, "", RDFFormat.TURTLE);
41            }
42
```

line 33　首先建立一个内存仓库db存取数据
line 36　建立一个仓库链接conn连接到内存仓库db
line 38　打开数据文件作为输入流input
line 40　将输入流input通过数据库连接conn加入到内存仓库db中

SPARQL SELECT查询

```
42
43          // We do a simple SPARQL SELECT-query that retrieves all resources of type `ex:Artist`,
44          // and their first names.
45          String queryString = "PREFIX ex: <http://example.org/> \n";
46          queryString += "PREFIX foaf: <" + FOAF.NAMESPACE + "> \n";
47          queryString += "SELECT ?s ?n \n";
48          queryString += "WHERE { \n";
49          queryString += "    ?s a ex:Artist; \n";
50          queryString += "       foaf:firstName ?n .";
51          queryString += "}";
52
53          TupleQuery query = conn.prepareTupleQuery(queryString);
54
```

line 45 - 51　　将SPARQL语句存入java字符串queryString中

line 53　　在conn中用SPARQL查询，并将三元组返回到query中

SPARQL SELECT查询

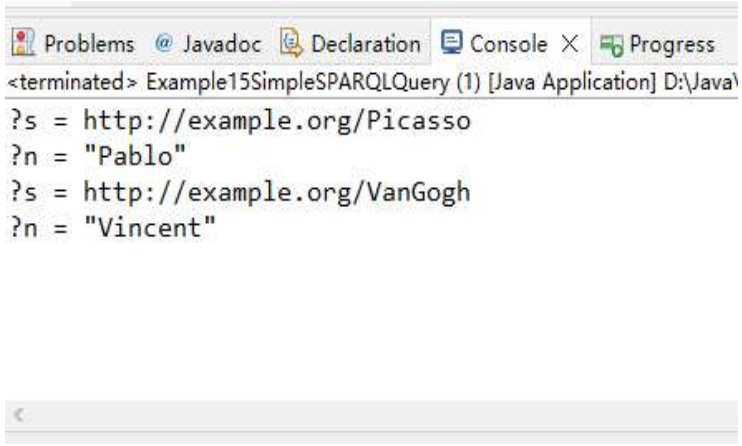
```
55              // A QueryResult is also an AutoCloseable resource, so make sure it gets closed when done.
56              try (TupleQueryResult result = query.evaluate()) {
57                  // we just iterate over all solutions in the result...
58                  for (BindingSet solution : result) {
59                      // ... and print out the value of the variable binding for ?s and ?n
60                      System.out.println("?s = " + solution.getValue("s"));
61                      System.out.println("?n = " + solution.getValue("n"));
62                  }
63              }
64          } finally {
65              // Before our program exits, make sure the database is properly shut down.
66              db.shutDown();
67          }
68      }
69  }
```

line 58-62　　输出查询到的结果
line 64-67　　关闭内存仓库db

SPARQL SELECT查询

右击 -> Run As -> Java Aplication 运行

查询返回结果：



三、作业

作业

1.针对下列自然语言，使用SPARQL查询语句返回结果：

(1) Who are the creators of Guernica and Sunflowers, respectively?

(2) List all the artists who live in Spain or other places.

(3) List all paintings, their names, and the corresponding techniques.