

1. Введение

3. JAR архивы

Формат JAR



JAR (Java ARchive) – формат архива обычно используемый для того чтобы собрать вместе class файлы Java и связанные с ними метаданные и ресурсы в один файл для распространения приложения или библиотеки на платформе Java.



JAR файл позволяет эффективно развёртывать набор классов и связанных ресурсов. Содержимое JAR файла может быть сжато, что вместе с возможностью загрузить всё приложение или библиотеку за один раз делает загрузку JAR файла более удобным чем загрузку большого количества несжатых файлов приложения или библиотеки.



JAR файлы используют формат файлов ZIP и имеют расширение jar. Пользователи могут создавать JAR архивы используя утилиту jar.exe которая поставляется в JDK.



Для создания JAR файлов можно использовать zip, но порядок записей в заголовке zip файла важен, так как манифест должен идти первым.

Простое приложение “Привет калькулятор!”

```
package org.cud.hello;

public class HelloCalc {

    public static void main(String[] args) {

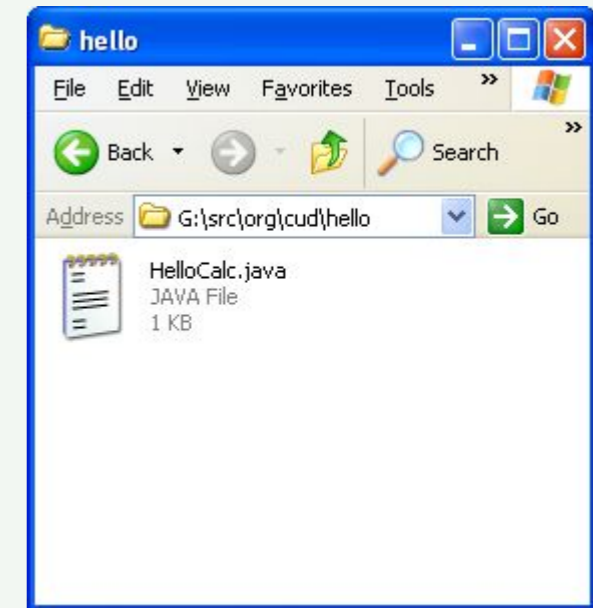
        System.out.println("Hello Calculator");
        Calculator calculator = new Calculator();
        System.out.println("2+3+4 = " + calculator.sum(2, 3, 4));
    }
}

class Calculator {

    public int sum(int... numbers) {

        int total = 0;

        for (int i : numbers) {
            total += i;
        }
        return total;
    }
}
```



КОМПИЛЯЦИЯ

```
G:\>dir src\org\cud\hello
Volume in drive G has no label.
Volume Serial Number is 3400-744D
```

```
Directory of G:\src\org\cud\hello
```

```
11/13/2012  05:02 PM    <DIR>          .
11/13/2012  05:02 PM    <DIR>          ..
11/13/2012  05:17 PM                420 HelloCalc.java
                1 File(s)          420 bytes
                2 Dir(s)  42,080,108,544 bytes free
```

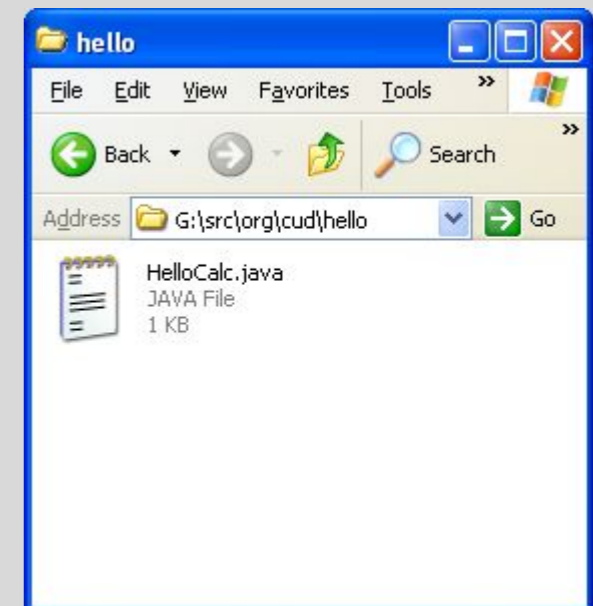
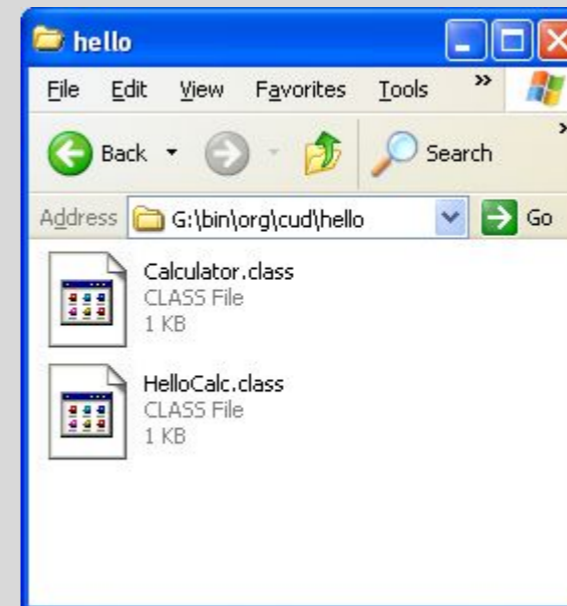
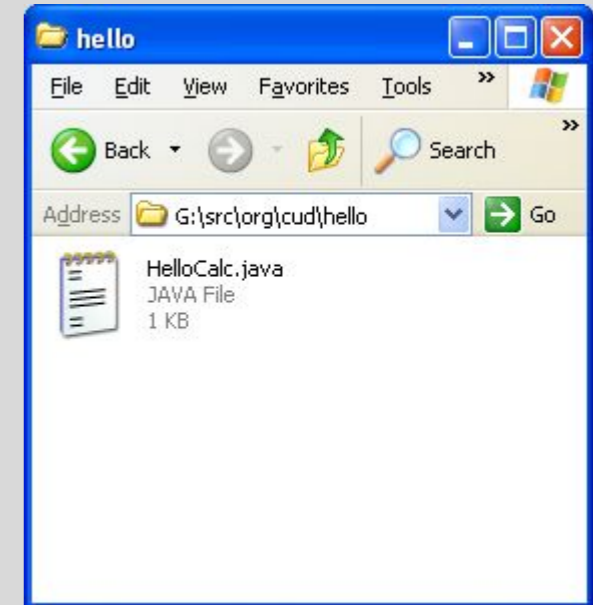
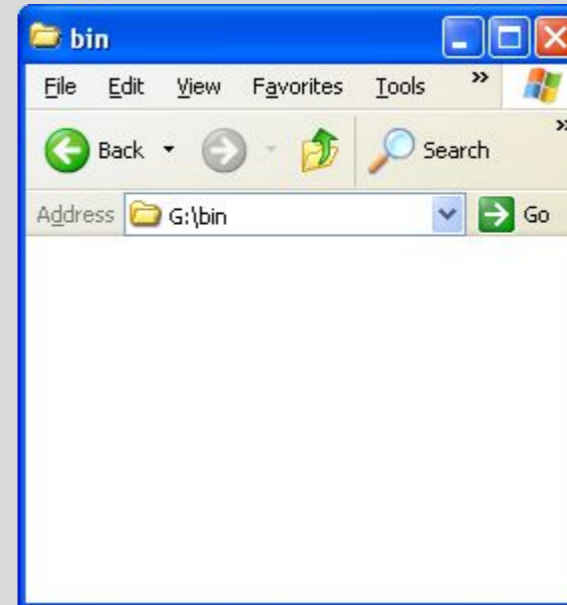
```
G:\>javac -d bin src\org\cud\hello\HelloCalc.java
```

```
G:\>dir bin\org\cud\hello
Volume in drive G has no label.
Volume Serial Number is 3400-744D
```

```
Directory of G:\bin\org\cud\hello
```

```
11/13/2012  05:18 PM    <DIR>          .
11/13/2012  05:18 PM    <DIR>          ..
11/13/2012  05:20 PM                369 Calculator.class
11/13/2012  05:20 PM                760 HelloCalc.class
                2 File(s)          1,129 bytes
                2 Dir(s)  42,080,108,544 bytes free
```

```
G:\>
```



Создание JAR файла

```
G:\bin>dir
Volume in drive G has no label.
Volume Serial Number is 3400-744D

Directory of G:\bin

11/14/2012  11:15 AM    <DIR>          .
11/14/2012  11:15 AM    <DIR>          ..
11/14/2012  09:42 AM    <DIR>          org
                0 File(s)            0 bytes
                3 Dir(s)  42,079,842,304 bytes free

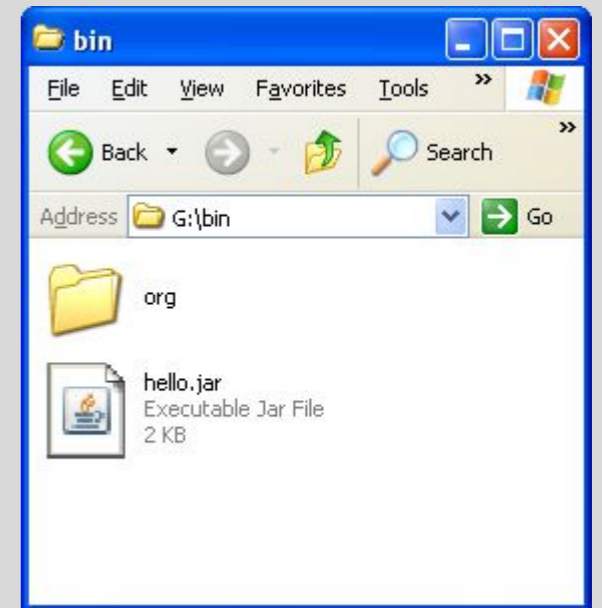
G:\bin>jar cfv hello.jar org
added manifest
adding: org/(in = 0) (out= 0) (stored 0%)
adding: org/cud/(in = 0) (out= 0) (stored 0%)
adding: org/cud/hello/(in = 0) (out= 0) (stored 0%)
adding: org/cud/hello/Calculator.class(in = 369) (out= 301) (deflated 18%)
adding: org/cud/hello/HelloCalc.class(in = 760) (out= 460) (deflated 39%)

G:\bin>dir
Volume in drive G has no label.
Volume Serial Number is 3400-744D

Directory of G:\bin

11/14/2012  11:15 AM    <DIR>          .
11/14/2012  11:15 AM    <DIR>          ..
11/14/2012  11:15 AM                1,688 hello.jar
11/14/2012  09:42 AM    <DIR>          org
                1 File(s)            1,688 bytes
                3 Dir(s)  42,079,838,208 bytes free

G:\bin>
```



Создание JAR файла из другой директории

```
G:\>dir
Volume in drive G has no label.
Volume Serial Number is 3400-744D

Directory of G:\

11/14/2012  11:16 AM    <DIR>          bin
11/14/2012  09:41 AM    <DIR>          src
               0 File(s)                0 bytes
               2 Dir(s)  42,079,825,920 bytes free

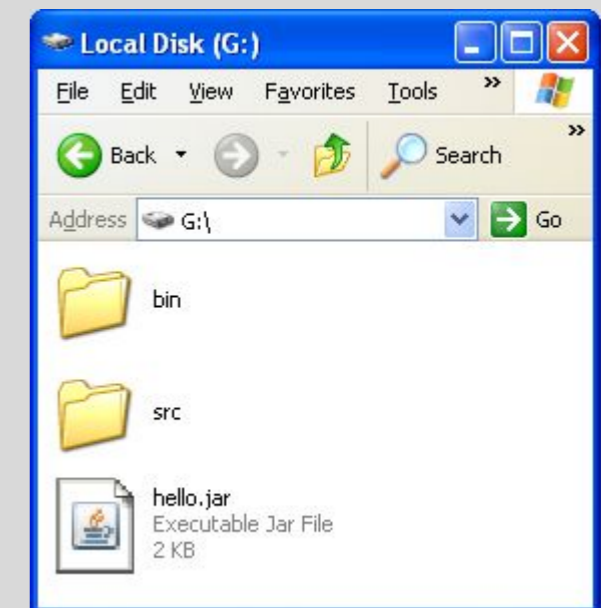
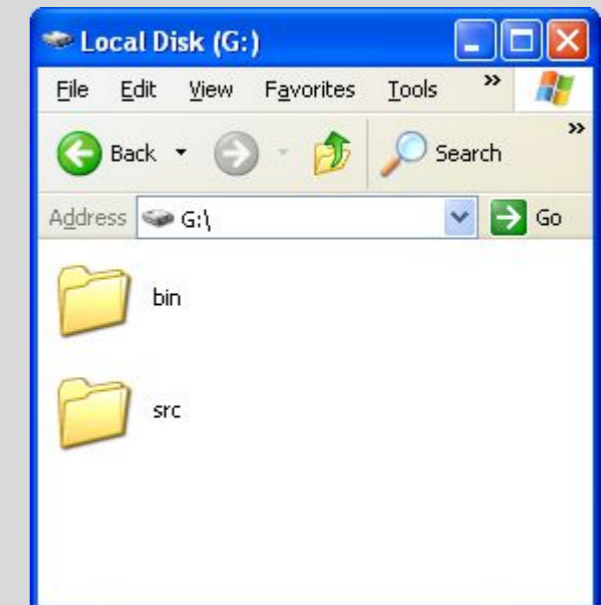
G:\>jar cvf hello.jar -C bin org
added manifest
adding: org/(in = 0) (out= 0)(stored 0%)
adding: org/cud/(in = 0) (out= 0)(stored 0%)
adding: org/cud/hello/(in = 0) (out= 0)(stored 0%)
adding: org/cud/hello/Calculator.class(in = 369) (out= 301)(deflated 18%)
adding: org/cud/hello/HelloCalc.class(in = 760) (out= 460)(deflated 39%)

G:\>dir
Volume in drive G has no label.
Volume Serial Number is 3400-744D

Directory of G:\

11/14/2012  11:16 AM    <DIR>          bin
11/14/2012  11:20 AM           1,688 hello.jar
11/14/2012  09:41 AM    <DIR>          src
               1 File(s)                1,688 bytes
               2 Dir(s)  42,079,821,824 bytes free

G:\>
```



Использование JAR архива

```
G:\>dir
Volume in drive G has no label.
Volume Serial Number is 3400-744D

Directory of G:\

11/14/2012  11:16 AM    <DIR>          bin
11/14/2012  11:20 AM                1,688 hello.jar
11/14/2012  09:41 AM    <DIR>          src
                1 File(s)        1,688 bytes
                2 Dir(s)  42,079,821,824 bytes free

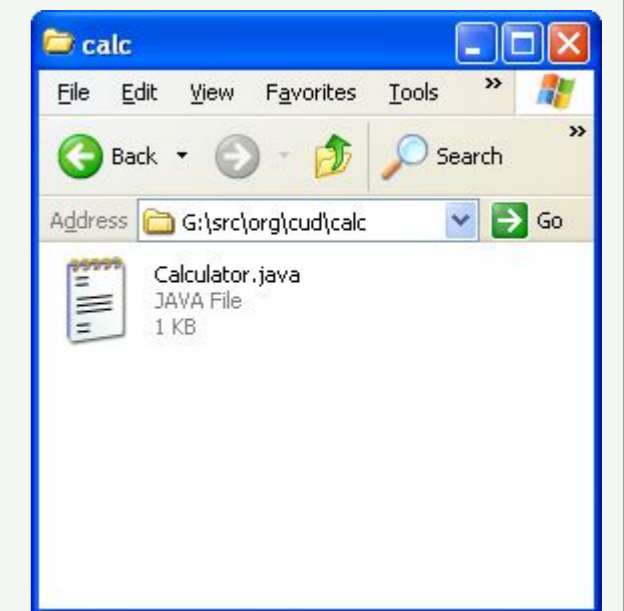
G:\>java -classpath hello.jar org.cud.hello.HelloCalc
Hello Calculator
2+3+4 = 9

G:\>
```

Библиотека

Библиотека “Калькулятор!”

```
package org.cud.calc;  
  
public class Calculator {  
  
    public int sum(int... numbers) {  
  
        int total = 0;  
  
        for (int i : numbers) {  
            total += i;  
        }  
        return total;  
    }  
}
```



Компиляция и создание JAR архива

```
G:\>javac -d bin src\org\cud\calc\Calculator.java

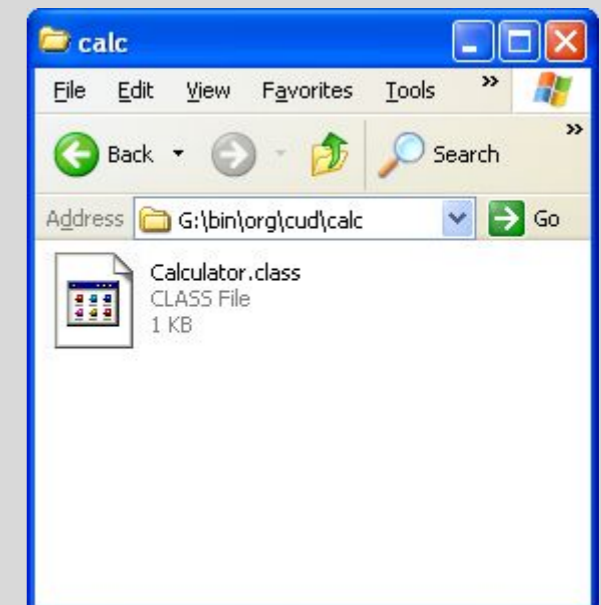
G:\>dir bin\org\cud\calc
Volume in drive G has no label.
Volume Serial Number is 3400-744D

Directory of G:\bin\org\cud\calc

11/14/2012  11:54 AM    <DIR>          .
11/14/2012  11:54 AM    <DIR>          ..
11/14/2012  11:58 AM                369 Calculator.class
               1 File(s)                369 bytes
               2 Dir(s)  42,079,776,768 bytes free

G:\>jar -cfv bin/calculator.jar -C bin .
added manifest
adding: calculator.jar(in = 111) (out= 64) (deflated 42%)
adding: org/(in = 0) (out= 0) (stored 0%)
adding: org/cud/(in = 0) (out= 0) (stored 0%)
adding: org/cud/calc/(in = 0) (out= 0) (stored 0%)
adding: org/cud/calc/Calculator.class(in = 369) (out= 300) (deflated 18%)

G:\>
```



Простое приложение “Привет калькулятор!”

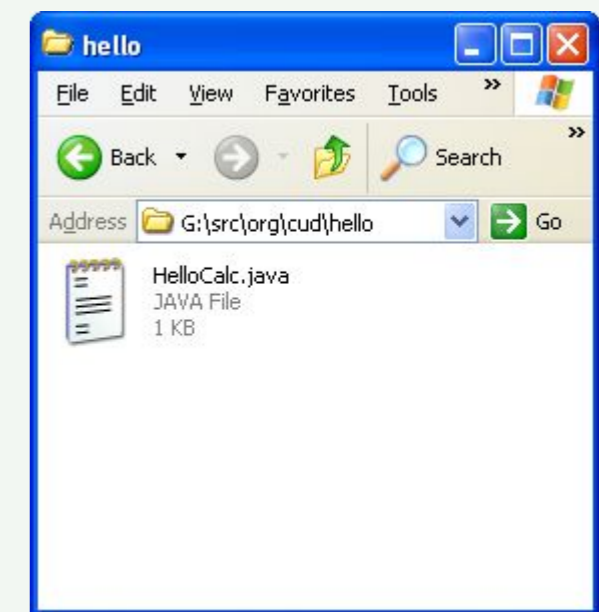
```
package org.cud.hello;

import org.cud.calc.Calculator;

public class HelloCalc {

    public static void main(String[] args) {

        System.out.println("Hello Calculator");
        Calculator calculator = new Calculator();
        System.out.println("2+3+4 = " + calculator.sum(2, 3, 4));
    }
}
```



Компиляция и запуск

```
G:\>javac -d bin -cp bin\calculator.jar src\org\cud\hello\HelloCalc.java
```

```
G:\>dir bin\org\cud\hello
```

```
Volume in drive G has no label.  
Volume Serial Number is 3400-744D
```

```
Directory of G:\bin\org\cud\hello
```

```
11/14/2012  11:54 AM    <DIR>          .  
11/14/2012  11:54 AM    <DIR>          ..  
11/14/2012  12:08 PM                759 HelloCalc.class  
             1 File(s)                759 bytes  
             2 Dir(s)  42,079,776,768 bytes free
```

```
G:\>dir bin
```

```
Volume in drive G has no label.  
Volume Serial Number is 3400-744D
```

```
Directory of G:\bin
```

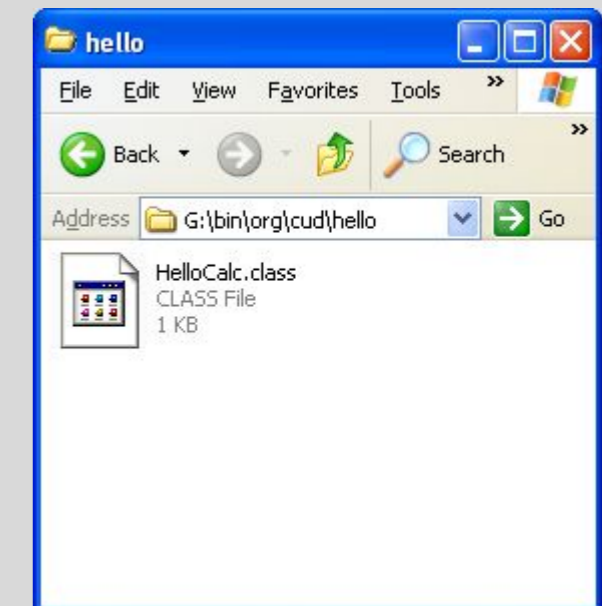
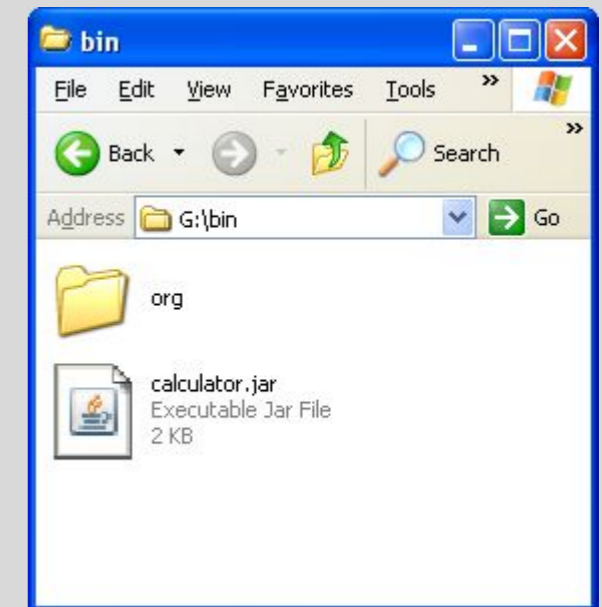
```
11/14/2012  11:58 AM    <DIR>          .  
11/14/2012  11:58 AM    <DIR>          ..  
11/14/2012  11:59 AM                1,972 calculator.jar  
11/14/2012  11:54 AM    <DIR>          org  
             1 File(s)                1,972 bytes  
             3 Dir(s)  42,079,776,768 bytes free
```

```
G:\>java -cp bin;bin\calculator.jar org.cud.hello.HelloCalc
```

```
Hello Calculator
```

```
2+3+4 = 9
```

```
G:\>
```



Создание JAR архива приложения и запуск

```
G:\>jar -cfv bin/hello.jar -C bin org\cud\hello\HelloCalc.class
added manifest
adding: org/cud/hello/HelloCalc.class(in = 759) (out= 461) (deflated 39%)
```

```
G:\>dir bin
```

```
Volume in drive G has no label.
Volume Serial Number is 3400-744D
```

```
Directory of G:\bin
```

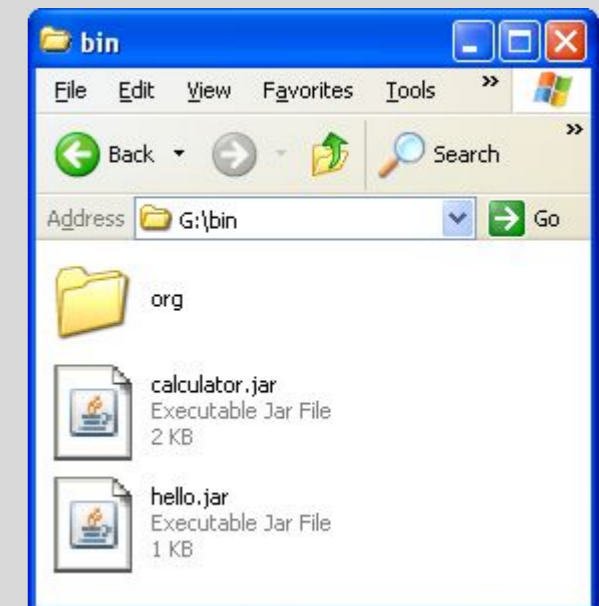
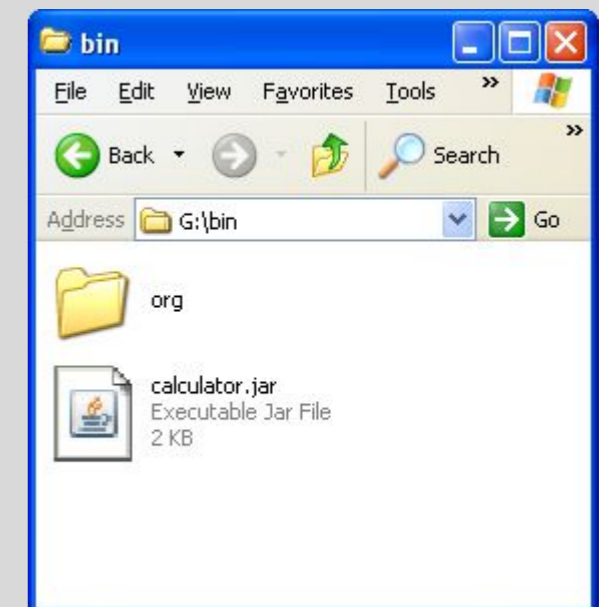
```
11/14/2012  12:14 PM    <DIR>          .
11/14/2012  12:14 PM    <DIR>          ..
11/14/2012  11:59 AM                1,972 calculator.jar
11/14/2012  12:16 PM                956 hello.jar
11/14/2012  11:54 AM    <DIR>          org
                2 File(s)        2,928 bytes
                3 Dir(s)  42,079,768,576 bytes free
```

```
G:\>java -cp bin\hello.jar;bin\calculator.jar org.cud.hello.HelloCalc
```

```
Hello Calculator
```

```
2+3+4 = 9
```

```
G:\>
```



Манифест

Манифест



JAR файл может содержать манифест – файл META-INF/MANIFEST.MF. Записи в манифесте определяют как JAR файл может использоваться. Каждая запись находится на отдельной строке и состоит из пары заголовков, значение разделённых двоеточием. Запись Classpath: может использоваться для указания других JAR файлов для загрузки с текущим JAR файлом. Эта запись состоит из списка абсолютных или относительных путей к другим JAR файлам. Запись Main-Class: может использоваться для указания точки входа приложения для создания исполняемых JAR файлов.



Хотя запись Classpath: в манифесте должна была упростить использование JAR файлов, на практике её использование оказалось очень хрупким, поскольку расположения JAR файлов не должно меняться.

Исполняемые JAR архивы

Простое приложение “Привет калькулятор!”

```
package org.cud.hello;

public class HelloCalc {

    public static void main(String[] args) {

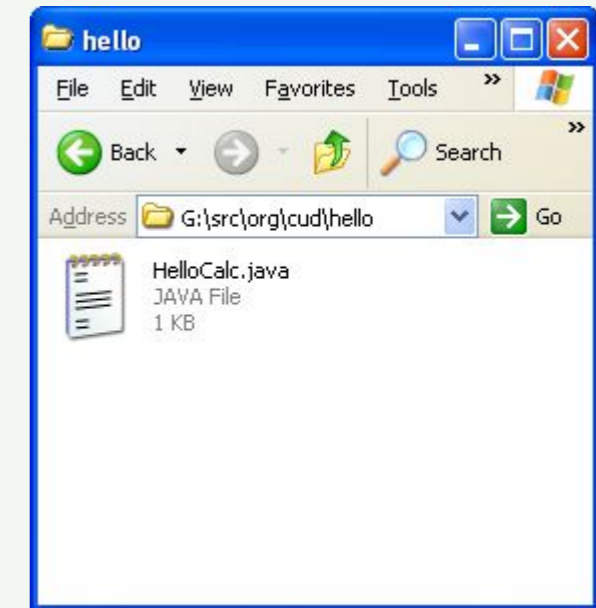
        System.out.println("Hello Calculator");
        Calculator calculator = new Calculator();
        System.out.println("2+3+4 = " + calculator.sum(2, 3, 4));
    }
}

class Calculator {

    public int sum(int... numbers) {

        int total = 0;

        for (int i : numbers) {
            total += i;
        }
        return total;
    }
}
```



КОМПИЛЯЦИЯ

```
G:\>dir src\org\cud\hello
Volume in drive G has no label.
Volume Serial Number is 3400-744D

Directory of G:\src\org\cud\hello

11/13/2012  05:02 PM    <DIR>          .
11/13/2012  05:02 PM    <DIR>          ..
11/13/2012  05:17 PM                420 HelloCalc.java
                1 File(s)          420 bytes
                2 Dir(s)  42,080,108,544 bytes free

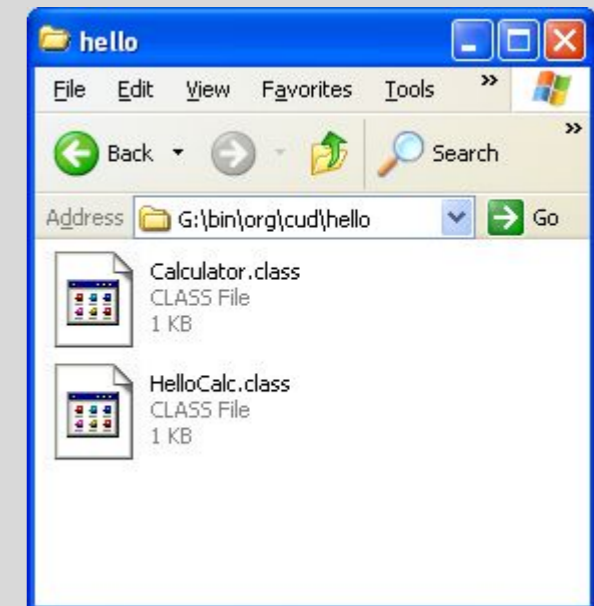
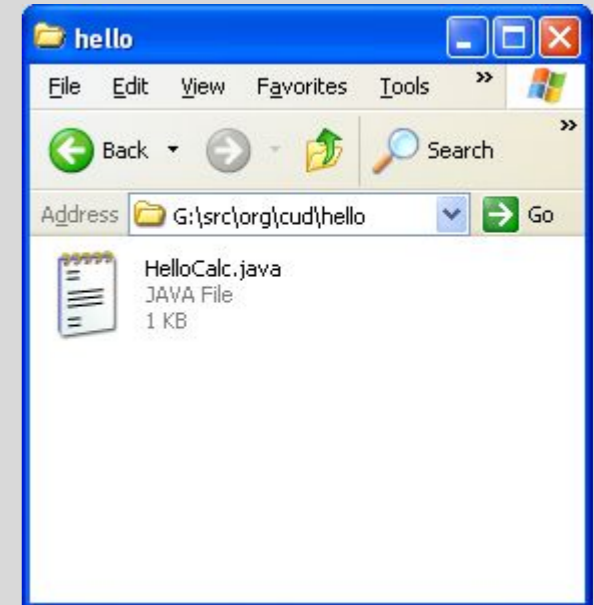
G:\>javac -d bin src\org\cud\hello\HelloCalc.java

G:\>dir bin\org\cud\hello
Volume in drive G has no label.
Volume Serial Number is 3400-744D

Directory of G:\bin\org\cud\hello

11/13/2012  05:18 PM    <DIR>          .
11/13/2012  05:18 PM    <DIR>          ..
11/13/2012  05:20 PM                369 Calculator.class
11/13/2012  05:20 PM                760 HelloCalc.class
                2 File(s)          1,129 bytes
                2 Dir(s)  42,080,108,544 bytes free

G:\>
```



Создадим манифест

Main-Class: org.cud.hello.HelloCalc



Создание JAR архива приложения и запуск

```
G:\>dir
Volume in drive G has no label.
Volume Serial Number is 3400-744D

Directory of G:\

11/14/2012  12:50 PM    <DIR>          bin
11/14/2012  01:11 PM                39 manifest.mf
11/14/2012  12:48 PM    <DIR>          src
               1 File(s)                39 bytes
               2 Dir(s)  42,079,703,040 bytes free

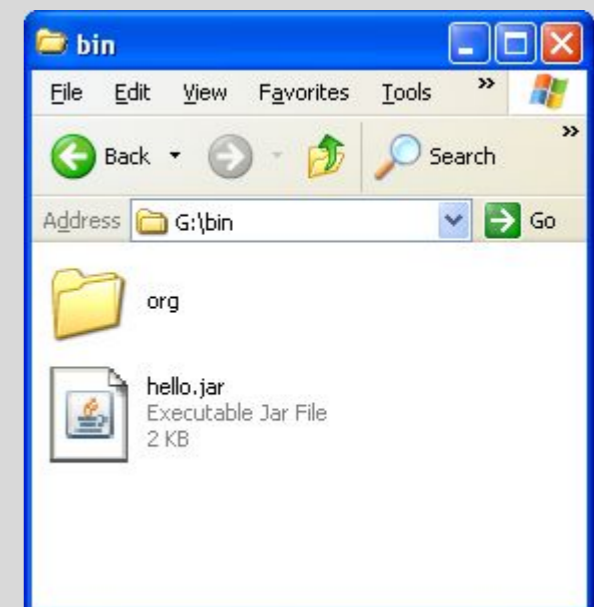
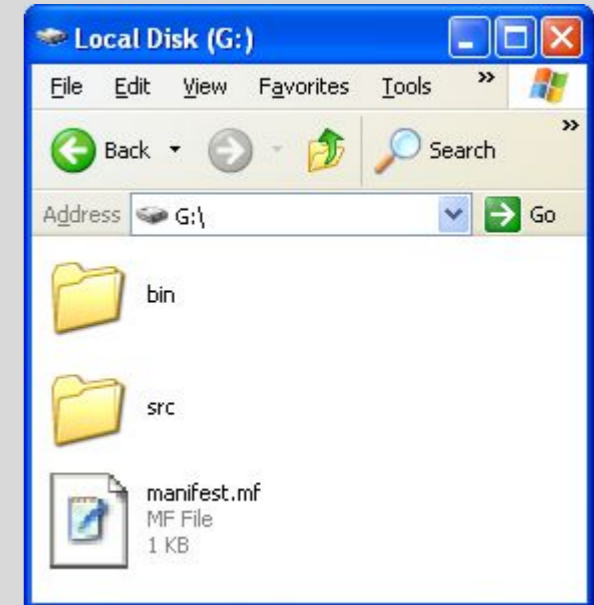
G:\>jar cvmf manifest.mf bin/hello.jar -C bin org
added manifest
adding: org/(in = 0) (out= 0) (stored 0%)
adding: org/cud/(in = 0) (out= 0) (stored 0%)
adding: org/cud/hello/(in = 0) (out= 0) (stored 0%)
adding: org/cud/hello/Calculator.class(in = 369) (out= 301) (deflated 18%)
adding: org/cud/hello/HelloCalc.class(in = 760) (out= 460) (deflated 39%)

G:\>dir bin
Volume in drive G has no label.
Volume Serial Number is 3400-744D

Directory of G:\bin

11/14/2012  12:50 PM    <DIR>          .
11/14/2012  12:50 PM    <DIR>          ..
11/14/2012  01:30 PM                1,722 hello.jar
11/14/2012  12:48 PM    <DIR>          org
               1 File(s)                1,722 bytes
               3 Dir(s)  42,079,703,040 bytes free

G:\>java -jar bin/hello.jar
Hello Calculator
2+3+4 = 9
```



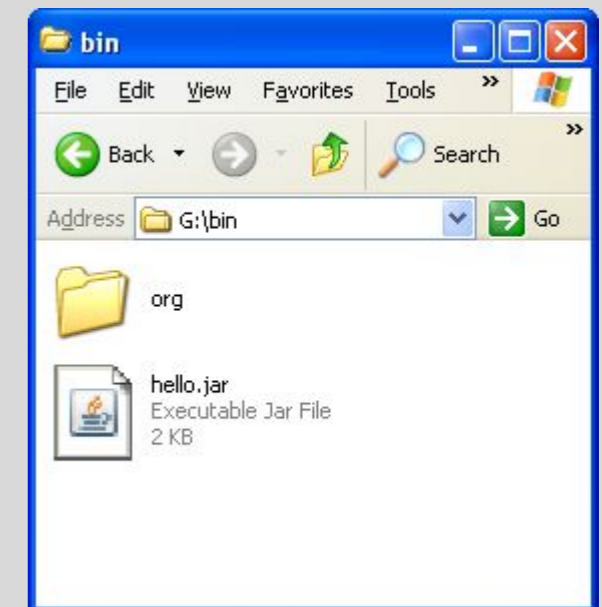
Более простой способ задания точки входа

```
G:\>javac -d bin src\org\cud\hello\HelloCalc.java

G:\>jar cfev bin/hello.jar org.cud.hello.HelloCalc -C bin org
added manifest
adding: org/(in = 0) (out= 0) (stored 0%)
adding: org/cud/(in = 0) (out= 0) (stored 0%)
adding: org/cud/hello/(in = 0) (out= 0) (stored 0%)
adding: org/cud/hello/Calculator.class(in = 369) (out= 301) (deflated 18%)
adding: org/cud/hello/HelloCalc.class(in = 760) (out= 460) (deflated 39%)

G:\>java -jar bin/hello.jar
Hello Calculator
2+3+4 = 9

G:\>
```



Автоматически добавленное поле Main-Class

```
Manifest-Version: 1.0  
Created-By: 1.6.0_35 (Sun Microsystems Inc.)  
Main-Class: org.cud.hello.HelloCalc
```

Работа с classpath

Манифест



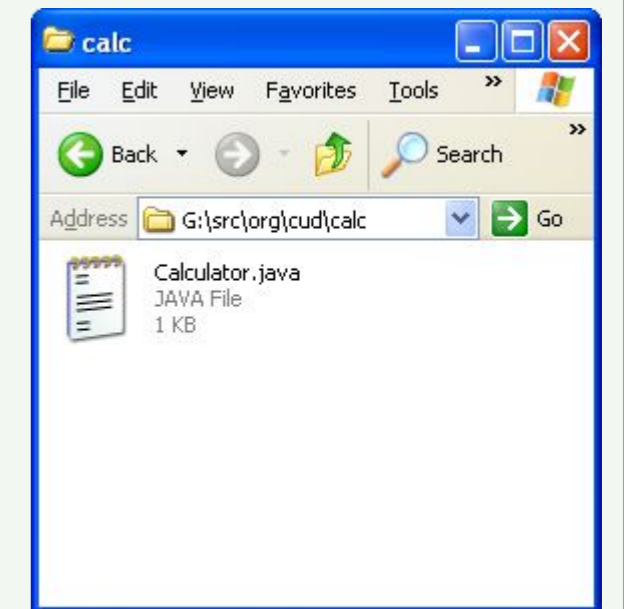
По умолчанию `classpath` включает текущую директорию. Дополнительные директории можно указать используя запись `Classpath:` в манифесте.



При использовании исполняемых JAR файлов опция `-cp` или `-classpath` утилиты `java` игнорируется.

Библиотека “Калькулятор!”

```
package org.cud.calc;  
  
public class Calculator {  
  
    public int sum(int... numbers) {  
  
        int total = 0;  
  
        for (int i : numbers) {  
            total += i;  
        }  
        return total;  
    }  
}
```



Компиляция и создание JAR архива

```
G:\>javac -d bin src\org\cud\calc\Calculator.java

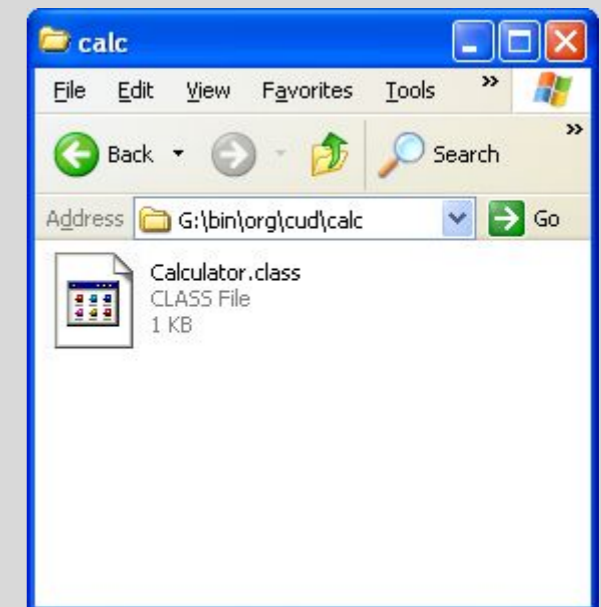
G:\>dir bin\org\cud\calc
Volume in drive G has no label.
Volume Serial Number is 3400-744D

Directory of G:\bin\org\cud\calc

11/14/2012  11:54 AM    <DIR>          .
11/14/2012  11:54 AM    <DIR>          ..
11/14/2012  11:58 AM                369 Calculator.class
               1 File(s)                369 bytes
               2 Dir(s)  42,079,776,768 bytes free

G:\>jar -cfv bin/calculator.jar -C bin org
added manifest
adding: calculator.jar(in = 111) (out= 64) (deflated 42%)
adding: org/(in = 0) (out= 0) (stored 0%)
adding: org/cud/(in = 0) (out= 0) (stored 0%)
adding: org/cud/calc/(in = 0) (out= 0) (stored 0%)
adding: org/cud/calc/Calculator.class(in = 369) (out= 300) (deflated 18%)
adding: org/cud/hello/(in = 0) (out= 0) (stored 0%)
adding: org/cud/hello/HelloCalc.class(in = 759) (out= 461) (deflated 39%)

G:\>
```



Простое приложение “Привет калькулятор!”

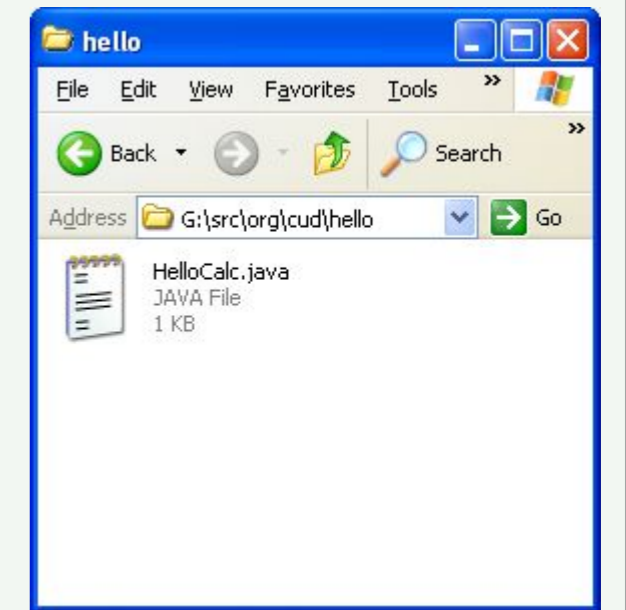
```
package org.cud.hello;

import org.cud.calc.Calculator;

public class HelloCalc {

    public static void main(String[] args) {

        System.out.println("Hello Calculator");
        Calculator calculator = new Calculator();
        System.out.println("2+3+4 = " + calculator.sum(2, 3, 4));
    }
}
```



Компиляция и запуск

```
G:\>javac -d bin -cp bin\calculator.jar src\org\cud\hello\HelloCalc.java
```

```
G:\>dir bin\org\cud\hello
```

```
Volume in drive G has no label.  
Volume Serial Number is 3400-744D
```

```
Directory of G:\bin\org\cud\hello
```

```
11/14/2012  11:54 AM    <DIR>          .  
11/14/2012  11:54 AM    <DIR>          ..  
11/14/2012  12:08 PM                759 HelloCalc.class  
            1 File(s)                759 bytes  
            2 Dir(s)  42,079,776,768 bytes free
```

```
G:\>dir bin
```

```
Volume in drive G has no label.  
Volume Serial Number is 3400-744D
```

```
Directory of G:\bin
```

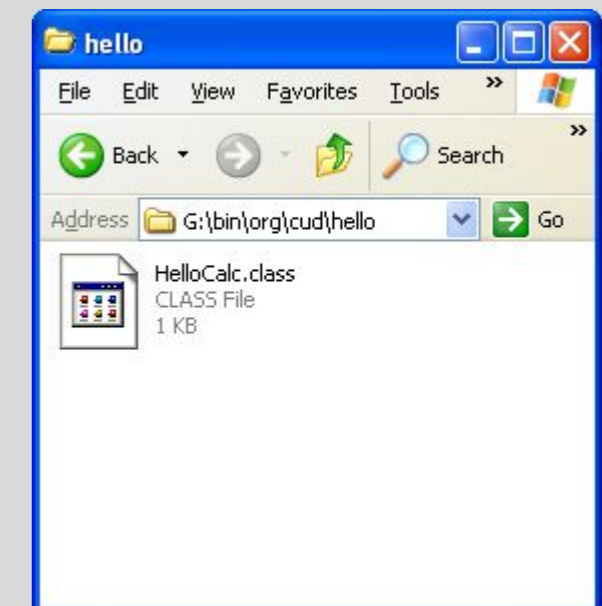
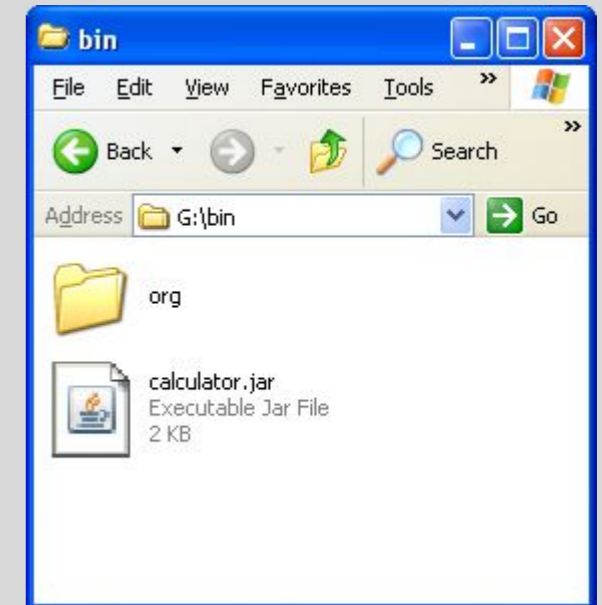
```
11/14/2012  11:58 AM    <DIR>          .  
11/14/2012  11:58 AM    <DIR>          ..  
11/14/2012  11:59 AM                1,972 calculator.jar  
11/14/2012  11:54 AM    <DIR>          org  
            1 File(s)                1,972 bytes  
            3 Dir(s)  42,079,776,768 bytes free
```

```
G:\>java -cp bin;bin\calculator.jar org.cud.hello.HelloCalc
```

```
Hello Calculator
```

```
2+3+4 = 9
```

```
G:\>
```



Создадим манифест

```
Main-Class: org.cud.hello.HelloCalc  
Class-Path: calculator.jar
```



Создание JAR архива приложения и запуск

```
G:\>dir
Volume in drive G has no label.
Volume Serial Number is 3400-744D

Directory of G:\

11/14/2012  01:58 PM    <DIR>          bin
11/14/2012  01:53 PM                69 manifest.mf
11/14/2012  01:44 PM    <DIR>          src
                1 File(s)        69 bytes
                2 Dir(s)  42,079,608,832 bytes free

G:\>jar cvmf manifest.mf bin/hello.jar -C bin org/cud/hello/HelloCalc.class
added manifest
adding: org/cud/hello/HelloCalc.class(in = 759) (out= 461) (deflated 39%)

G:\>dir bin
Volume in drive G has no label.
Volume Serial Number is 3400-744D

Directory of G:\bin

11/14/2012  01:58 PM    <DIR>          .
11/14/2012  01:58 PM    <DIR>          ..
11/14/2012  01:58 PM                897 calculator.jar
11/14/2012  02:04 PM                1,009 hello.jar
11/14/2012  01:44 PM    <DIR>          org
                2 File(s)        1,906 bytes
                3 Dir(s)  42,079,608,832 bytes free

G:\>java -jar bin/hello.jar
Hello Calculator
2+3+4 = 9
```

