Java A期末题解

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- 本题解对应《新东方烹饪学校**JAVA A**期末考试》
- 本题解为作者自制，非官方答案，如有错误，欢迎指出更正。
- 为便于大家阅读，将原试卷题目搬到了题解中。
- 题解包含试题解读，加入了一些图解，并且将涉及到的知识点都复述了一遍，便于大家理解和复习。
- 计算机系试卷原则上为保密资料，请使用该资料的同学私下传阅，勿公开张扬。

Part I. True or False

1、The architecture of stored-program computer was proposed by James Gosling.

F.

计算机存储结构是由冯诺依曼(John von Neumann)提出的

2、Compilers are system software that can translate source programs into machine code.

T.

编译器将代码转化为机器语言再通过计算机执行。

3、Java programs cannot be executed on a computer unless JDK is installed.

F.

编译java源文件需要JDK,运行java的可执行文件.class只需要JRE，JDK包含JRE，题目比较含糊，如果按executed字眼来看，应该是错的。

4、Java has only eight primitive data types(e.g.,int).

T.

Java中八大primitive type为byte, short, int, long, float, double, boolean, char

5、The operator + can only be used as a binary arithmetic operator in java.

F.

+除了可以用于算术计算外，还可以用于字符串的拼接

6、Whether arrys are objects depends on the data type of the arrays elements.

F.

数组变量是reference type的变量，其指向的为数组对象，与其存储什么类型的元素无关。

7、Enum types cannot have constructors.

F.

enum类可以且必须有构造器，但必须是private的，因为enum类内部实现会用到构造器，并且不允许外部调用。

8、Calls to overloaded methods are resolved(i.e.,determine the called method) at compile time.

T.

此题考察static binding和dynamic binding.对于子类重写父类的方法，即overrided methods, 采用的是dynamic binding，在运行时根据变量实际指向的对象决定使用的方法版本。其余的方法以及实例变量均采用static binding,在编译时确定，直接采用定义变量的类中的方法版本。此题故意写成overloaded methods来混淆。

9、When defining an abstract class named Foo, one can also define a field of the type Foo.

T.

类的定义中可以有本类的实例变量，例如enum类内部就是这么实现的。

10、All exception that could be thrown at runtime should be handled with the try-cathch statement.

F.

Exception分为checked exception和unchecked exception，继承自Exception但不继承自RuntimeException的Exception为checked exception，需要人为使用throw抛出异常或者用try-catch语句块解决。对于unchecked exception，系统在出现异常时会自动抛出异常。题中描述的是在运行时会抛出异常的unchecked exception

Part II. Multiple-Choice Questions

1.Which one of the following identifiers is valid in Java?

A.123name B.$_$123 C.void D.#foo

答案：B

变量命名要求只能使用数字、英文字母、下划线_以及美刀$，并且不能以数字开头，不能使用保留字（保留字在代码中会变色）。A以数字开头，C为保留字，D中#不是允许用于变量名的字符

2.What is the output of the following code?

```
int i=0;
int j=0;
while(i+++1< 5){
    ++j;
}
System.out.println(j);
```

A.3 B.4 C.5 D.The code cannot be compiled

答案：B

此题考察自增操作。自增操作不参与其他运算或比较单独出现时，与直接+1没有区别，此题中++j可以直接写成j = j + 1。i + + + 1中前两个+表示自增，第三个+表示加法操作。在参与其他运算时，i + +是先参与运算或比较再+1，因此循环可以等价成如下代码，手动模拟后可得最终i = 5, j = 4

```
while(i+1<5){
    i=i+1;
    j=j+1;
}
i=i+1;//这里再+1是因为即使while不符合循环条件，进行了表达式的运算也会导致i+1
```

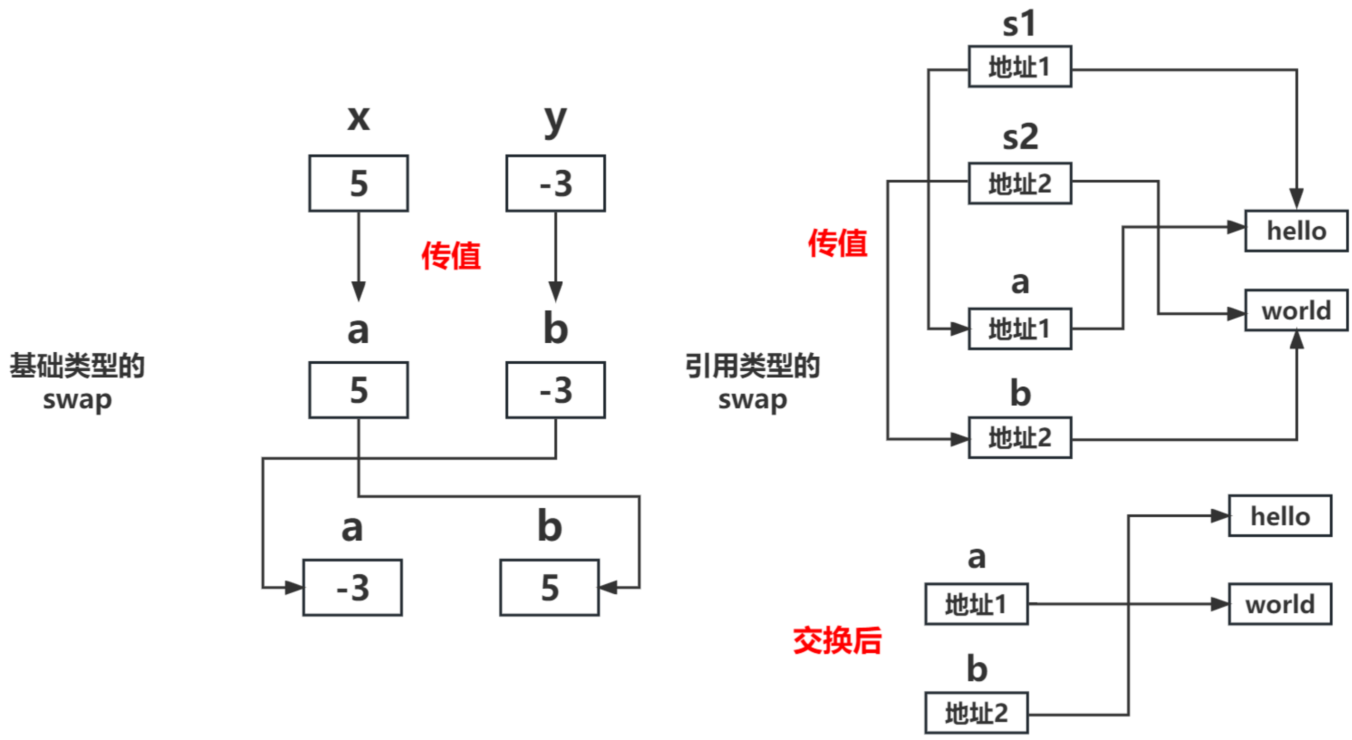
3.What is the output of the main method below?

```
public static void main(String[] args){
    int x=5,y=-3;
    String s1="hello";
    String s2="world";
    swap(x,y);
    swap(s1,s2);
    System.out.println(x+s1);
}
public static void swap(int a,int b){
    int temp=a;
    a=b;
    b=temp;
}
public static void swap(String a,String b){
    String temp=a;
    a=b;
    b=temp;
}
```

A.5hello　B.−3hello　C.5world　D.−3world

答案：A

此题考察了方法参数传递中传值的知识点。Java方法中出现的参数是一个独立的变量，它可以与传入的变量同名，但它们是两个不同的变量，拥有相同的值。这个指根据变量类型而不同，primitive type传的是具体的值，reference type传的就是指向对象的地址。java方法的参数都是传值的。对于这类题，我们画图来理解便可以发现，两个方法本质上都是在对swap方法内的变量进行交换，对main方法中的变量没有任何影响，因此最终答案是5hello



4.Which one of the following is the valid range of an array a's index?

A.$[0,a.\text{length}]$ B.$(a,a.\text{length}-1)$ C.$[0,a.\text{length}-1]$ D.$(0,a.\text{length})$

答案：C

本题考察数组。大小为n的数组的下标是从$[0,n-1]$的，或者写成$[0,n)$

5.How many times will the following loop body be executed?

```
int product=1;
do{
    product=product*3;
} while(product<=100);
```

A.0 B.1 C.4 D.5 E.Infinite

答案：D

Do-while循环会先做一次循环体内的操作再进行判断。模拟即可，最终为5次

6.What is the output of the following code?

```
int a=0;
if(a!=1){
    int a=3;
}
System.out.println(a);
```

A.0   B.1   C.3   D.The code cannot be compiled

答案：D

一个方法的作用域内（花括号内）不能定义两个同名的变量。此处a被重复定义，因此编译错误。

7.Which of the following binary arithmetic operators has the lowest precedence?

A.+   B.∗   C.%   D./

答案：A

+最低，∗,%,/同级。

8.Which of the following statements is true about constructor?

A.Every concrete class must have at least one constructor, whether it is explicitly created by the programmer or the compiler.

B.Enum types cannot have constructors.

C.Since abstract classed cannot be instantiated, they cannot have constructors.

D.Constructors can be called at any place where a normal method can be called.

答案：A

A每个类都需要有至少一个构造器，可以由写代码的人自己定义，或者编译器默认加上无参数的空构造器

B枚举类必须有private的构造器用于其内部实现

C抽象类必须有构造器，因为继承其的子类的构造器中首行需要调用父类的构造器

D构造器根据其modifier决定能在哪里被调用，例如enum的构造器就不能在外部调用

9.What it the output of the following main method(← means "new line")?

```
public class SuperClass{
    public static void foo() {
        System.out.println("super foo");
    }
    public void bar() {
        System.out.println("super bar");
    }
    public static void main(String[] args){
        SuperClass obj = new SubClass();
        obj.foo();
        obj.bar();
    }
}

class SubClass extends SuperClass{
    public static void foo(){
        System.out.println("sub foo");
    }
    public void bar(){
        System.out.println("sub bar");
    }
}
```

A.super foo←super bar   B.super foo←sub bar   C.sub foo←super bar   D.sub foo←sub bar

答案：B

本题考察static binding 和dynamic binding。对于子类重写父类的非静态方法采用dynamic binding，在运行时根据变量实际指向的对象选择使用方法的版本，题中bar()方法为dynamic binding，根据指向的SubClass对象采用其版本的方法；其余的方法包括实例变量均采用static binding，编译时采用定义变量的类中的方法版本，题中foo()方法采用static binding，根据变量定义时使用SuperClass中的方法。

10.Which one of the following statements is wrong about abstract classed?

A.Abstract classes usually contain abstract methods that are intended to be overriden by subclasses.

B.Abstract classes can be used to declare variables to store the references of its subclasses' instances.

C.Abstract classed cannot have instance variables because they are never intended to be instantiated.

D.Abstract class names can be used to invoke static methods declared in the abstract classes.

答案：C

A.抽象类一般用于要求继承其的子类重写其抽象方法

B.抽象类可以表现多态，即抽象类可以用来定义变量，并指向子类对象

C.抽象类本质是一个类，可以拥有实例变量，继承抽象类并实现了所有抽象方法的concrete class生成的实例可以调用到抽象类中定义的实例变量

D.静态方法是描述类的而不是描述实例的，抽象类只是不能生成实例，抽象类并不影响静态方法的调用。

11.Which one of the following statements is true about Java interfaces?

A.Interface can have constructors.

B.Interface can used to declare variables.

C.Interface cannot extend multiple interfaces(i.e.,single inheritance is enforced on interfaces)

D.When a class implements an interface, it has an HAS-A relationship with the interface data type.

答案：B

Java当中的class和interface是两类不同的东西。class是可以拥有实例的，其侧重于描述这个实例的特征和属性。而interface是不能拥有实例的，其侧重于描述某些性质，因此interface多数情况下都命名为形容词。

A.接口不拥有实例，因此不能有构造器

B.接口虽然不能生成实例，但可以用于定义变量，并指向具有其性质（实现了接口的类）的实例，来表现多态

C.类只能单继承，接口可以多继承，一个接口可以继承多个接口，一个类也可以实现多个接口，但接口不能继承类

D.当一个类中有其它类作为实例变量，我们称为has-a关系；当一个类实现一个接口，我们称其为like-a关系

12.Which of the following statements is true about the Java.lang.Object class?

A.It is the common ancestor class of all other Java classes, including all exception classes.

B.Since the Object class it too generic, it does not have concrete methods.

C.Interface types inherit from the Object class.

D.Object class does not have any constructor

答案：A

A.Object在Java继承关系中是所有类的祖宗

B.Object类可以通过构造器生成实例，说明其不是抽象类或接口，不是接口就可以有concrete methods，即使是抽象类也可以有concrete methods

C.interface不能继承自class.

D.Object有构造器且可以生成实例。注意有构造器和能生成实例是两件事情，抽象类不能生成实例但有构造器,接口不能生成实例也没有构造器。

13.What is the range of whole-number values that can be stored in a variable of short type?

A.-2^8 to 2^8-1 B.-2^{16} to $2^{16}-1$ C.-2^{32} to $2^{32}-1$ D.-2^{64} to $2^{64}-1$

答案：B

short占16bit，即16个二进制位，最多能表示$2^{16}-1$个数，范围为$[-2^{15}, 2^{15}-1]$，此题应该是出题失误，没有正确答案，但按原意应该是选B

14.How do you create a variable that stores the floating-point number 3.14?

A.int x = 3.14f;

B.float x = 3.14f

C.double x = 3.l4L

D.byte x = 3.14

答案：B

一个不注明类型的小数默认是double类型。此处floating-point number指浮点数，包括float

和double类型，因此排除AD。对于C，3.14L表示将3.14强转为long类型，则变成了整数3。因此选B，3.14f表示float类型的3.14

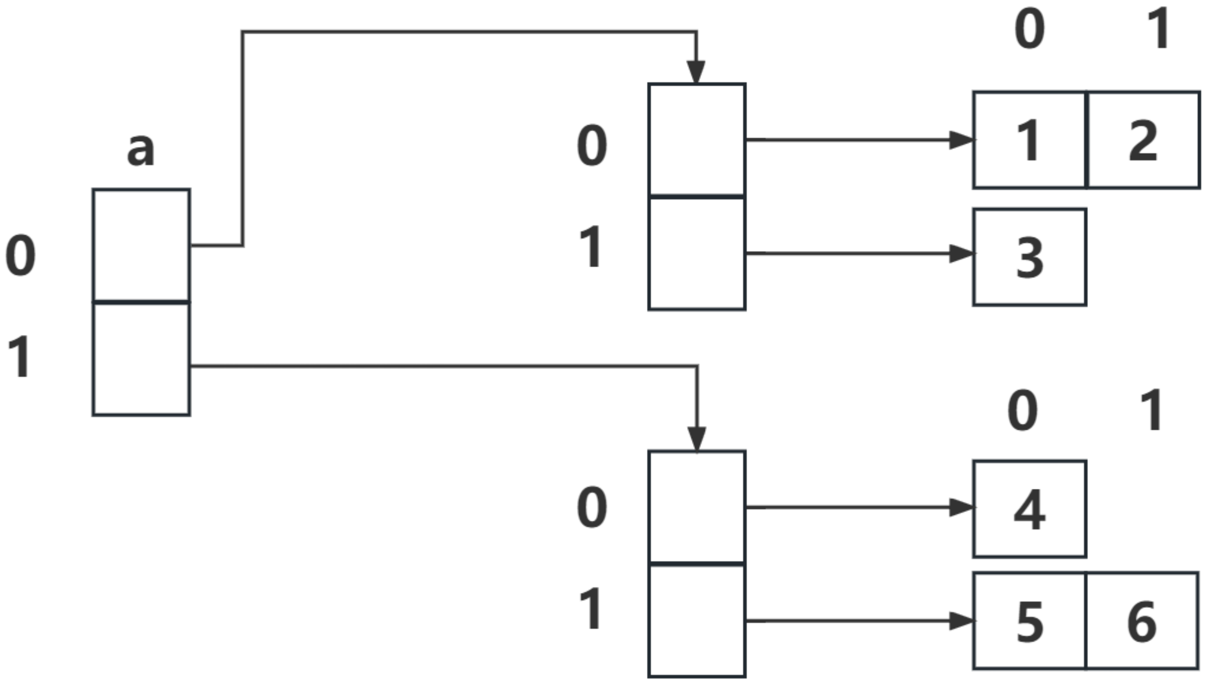
15.For the following 3D array a, what is the value of the expression a[0][1]. length?

```
int[][][] a= {{{1,2},{3}},{{4},{5,6}}};
```

A.0　B.1　C.2　D.3　E.Array index out of bound exception

答案：B

n维数组本质为存储元素为n－1维数组的数组（套娃），根据题目将数组的画出来再注意下标从0开始即可



Part III. Completion by Matching

```
Abstract, Break, Byte, Concrete, Const, Continue, Dynamic, Enum, For, Final,
Generic, Heap, If, Import, Instance, Interface, Local, Overloading, Overriding,
Polymorphism, Package, Package-Private, Private, Public, Repetition, Recursion,
Refactoring(重构), Short, Stack, Static, Super, Switch, This
```

1.According to the Bohm-Jacopini Theorem, only three forms of control are needed to implement any algorithm. They are sequence, selection, and Repetition.

2.Static methods can be called without the need for an object of the class to exist.

静态方法用于描述类，不需要实例对象即可调用。

3.Method Overriding, in object-oriented programming, is a language feature that allows a subclass or child class to provide a specific implementation of a method that is already provided by one of its superclasses or parent classes.

4.Objects and arrays are stored in the Heap area of the runtime memory.

栈(stack)存放基本数据类型和对象的引用，即primitive type和reference type变量中实际存的值。堆(heap)存放对象和数组的实体，即reference type 中的地址指向的位置。堆中有一部分称为常量池(constant pool)，其中String类型的对象实体存在于常量池中。

5.Polymorphism is a language feature that allows an object to take on many forms and it occurs when there are many classes that are related to each other by inheritance.

一个父类变量可以指向子类对象，即被当做父类对象看待的这个对象可以表现出不同的形式

6.Variable defined inside methods, constructors or blocks are called local variables.

在类的花括号中，方法、构造器花括号外定义的变量为instance variable,方法、构造器花括号内定义的变量为local variable

7.Dynamic binding is a process of linking a method call to a sepcific sequence of code.

此题的描述笔者个人认为题目更倾向于在描述binding这个事情，但由于static用过了，所以填dynamic合适一点。

8.Package-Private fields of superclass are inherited by a subclass only if the subclass resides in the same package as the superclass.

No modifier的field的访问级别为Pacakge-Private，即同一个Pacakge内的类都可以访问到

9.The package keyword is used to create a pacakge in Java.

10.The final keyword is used to define a constant variable in Java.

11.Enum is a special data type that represents a group of predefined constants.

12.In a class's constructor, the keyword this can be used to call other overloaded constructors of the same class.

this用于在类内指代当前实例，也可以用来调用overloading的构造器

13.Switch statement is a multi-selection statement that chooses one of many code blocks to be executed.

14.The break statement is often used to jump out of a loop and continue with the next statement after the loop.

注意与continue区分，break是直接结束循环，continue是结束当次循环，还会进行下一次循环。

15.Java generics is/are a language feature that allows for definition and use of generic types and methods.

Part IV. Short Answer Questions

1.Java has around 50 keywords(reserved words). Please list twelve of them.

最简单的就是八大基本类型，然后再从选填题中找出是关键字的就可以。注意：关键字指在代码中会变色的单词，且均为小写。

2.What is the value of the following expression?

```
1/2*3-4%5>1?2:3;
```

答案:3

本题考察运算符号和优先级。乘除取模同优先级且优先级最高，加减法其次，最后是三目运算符? :，三目运算符本质是一个简写的if，若?前面的表示为true则执行:前面的操作，否则执行:后面的操作。则以上表达式可以转化为如下代码

```
if( (1/2*3-4%5) > 1)//-4 > 1  false
    res=2;
else res=3;
```

3.Java objects have a set of common methods(i.e.,these methods can be called on any object), can you give two of them(providing method name is sufficient)?

此题其实就是在问Object类有哪些方法，因为Object是所有类的祖宗。Obeject类中的方法中最常见的有equals, toString, hashCode等

4.What is the output of the following code?

```
int x=5, y=-3;
if((y>0) & (x-=5) >=0) { System.out.println("hello");}
if((x>0) && (y+1) >=0) { System.out.println("world");}
System.out.println(x+y);
```

答案：-3

此题考察短路运算。对逻辑表达式进行运算时，使用逻辑运算符&&或位运算符&的计算

结果无异,但逻辑运算符会发生短路运算，即一旦表达式确定为真时，会忽略后续的逻辑表达式。而位运算符不会有短路操作，所有表达式都会运行一遍。

- 对于第一个if, $y > 0$为false，但由于不会短路运算，会运行后面的表达式。$x- = 5$先进行运算得到$x = 0$后再判断$x >= 0$为true。而整个表达式值为false，因此不执行if内的语句
- 对于第二个if，$x > 0$为false（此时$x = 0$），此时发生短路运算，不执行$(y + 1) >= 0$的判断，整个表达式的值为false，不执行if内的内容。
- 最后$x = 0, y = -3, x + y = -3$

5.The following program aims to find the largest number in an array but has a bug(only a single statement is buggy). Please find the bug, briefly explain why it is a bug, and propose a fix. Here, we assume that all input arrays have at least one element.

```
public int findMax(int[] nums){
        int max=0;
        for(int i=0;i<nums.length;i++){
            if(nums[i]>max) max=nums[i];
        }
        return max;
}
```

答案:输入的数可能是负数

修改：int max=Integer.MIN_VALUE; 或者表达一下max取比所有可能输入的数都小

考察点：实际操作中，要求最大值时，应初始化为比任何可能出现的数都小的值；要求最小值时，应初始化为比任何可能出现的数都大的值。

Part V. Programming

1.**[String Matching]** Given two non-empty strings **s** and **p**, where the length of **p** is smaller than that of **s**, your task is to implement a method to find all occurrences of **p** in **s**. We give the skeleton of the program. The program returns an array list of the indices of all substrings of **s** that matches **p** (case sensitive). Please complete the program. Each empty lien contains no more than one statement or one expression. Please note that your algorithm should be efficient: the body of the **do..while** loop cannot iterate more than **s.length()** times.

Some input/output examples:

```
(1)
s: "hhh", p: "hh"
result: {0,1}
(2)
s: "hhh", p: "w"
result: {}
```

```
public static ArrayList<Integer> match(String s, String p){
    ArrayList<Integer> indices= new ArrayList<>();
    int i=0;
    do{
        boolean match = ___①___;
        for(int j=0;j<p.length();j++){
            if(p.charAt(j) != s.charAt(i+j)) {
                _____②_____
                _____③_____
            }
        }
        if(match) _____④_____;
        i++;
    }while(_____⑤_____);
    return indices;
}
```

参考答案:

```
①  true
②  match=false;
③  break;
④  indices.add(i)
⑤  i+p.length()<=s.length()
```

分析:

该算法采用一个boolean类型的match来判断s以i为起点的子串是否和p匹配。如果循环中遇到不匹配的则直接令match = false并break退出；如果循环顺利结束，即匹配成功，则

match应为true，所以①中将match初始值设为true。对于循环的出口，由于算法是先做一遍比较，再i++,那么在do..while判断时，当次的i是还未进行比较的位置，因此当 i + p.length() == s.length()时，最后一个位置还没有比较，还需要比较一次，要加上这个等号

2.**[Matrix Transpose]** Write a Java program to find the transpose of a matrix(we use a 2D array to represent matrix). Let $A = [a_{ij}]$ be an $m \times n$ matrix. The transpose of A, denoted by A^t, is the $n \times m$ matrix obtained by interchanging the rows and columns of A. In other words, if $A^t = [b_{ij}]$, then $b_{ij} = a_{ji}$ for $i = 1, 2, \ldots, m$. We give an example below.

Original matrix:

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$$

the transpose of the matrix:

$$\begin{bmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{bmatrix}$$

The skeleton of the program is given(we assume that the size of the input matrix a is at least 1×1). Please complete the program. Each empty line shoud contain no more than one statement or one expression.

```java
public static int[][] transpose(int[][] a){
    int row=__①__;
    int column=__②__;
    int temp[][]=new int[row][column];
    for(int i=0;__③__;i++){
        for(int j=0;__④__;j++){
            ____⑤____
        }
    }
    return temp;
}
```

参考答案:

```
①  a[0].length
②  a.length;
③  i<row
④  j<column
⑤  temp[i][j]=a[j][i]
或
①②同上
③  i<column
④  j<row
⑤  temp[j][i]=a[i][j]
```

分析:

注意temp是转置后的数组，因此其第一、二维的长度应分别对应原数组第二、一维的长度。因为输入至少为1 × 1矩阵，因此①空要调用a[0]. length。

3.**[3D Object]** Suppose we are asked to implement a system that can polymorphically process various types of 3D objects. In this system, we first design an abstract class Object3D that contains an abstract method volume, which has no parameters and returns a floating-point(double) number representing the volume(体积) of the object. We further design two concrete classes Cylinder(圆柱体) adn Cube（正方体） that extend the Object3D class and override the volume method.Cylinder has (1) two private fields:radius(底面半径) of double type, height(高) of double type and (2) a two-arguments constructor for initializing the two fields, respectively. Cube has (1) one private field:edgeLen(边长) of double type and(2) an one-argument constructor for initializing the field. For simplicity, we do not define setter/getter methods in the two concrete classes(the fields are acessed directly in the correspoinding class) and we assume that the system user never allows invalid inputs to enter the system(there is no need to do input validation in your program). Please put down the code of the three classes. If your code is correct the following main method will output "3.14, 1.00". Note:Please use Math. PI to get the value of Pi.

```java
public static void main(String[] args){
    Object3D obj1=new Cylinder(1.0, 1.0);
    Object3D obj2=new Cube(1.0);
    System.out.printf("%.2f, %.2f",obj1.volume(),obj2.volume());
}
```

参考答案:

```java
public abstract class Object3D
{
    public abstract double volume();
}

class Cylinder extends Object3D
{
    double radius;
    double height;
    public Cylinder(double radius,double height)
    {
        this.radius=radius;
        this.height=height;
    }
    @Override
    public double volume()
    {
        return Math.PI*radius*radius*height;
    }
}

class Cube extends Object3D
{
    double edgeLen;
    public Cube(double edgeLen)
    {
        this.edgeLen=edgeLen;
    }
    @Override
    public double volume()
    {
        return edgeLen*edgeLen*edgeLen;
    }
}
```