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Internal Assessment 1 – March 2019

Scheme and Solutions

Sub:	Object Oriented Concepts					Sub Code:	**17CS42**	Branch:	ISE
Date:	15-4-2019	Duration:	90 min's	Max Marks:	50	Sem / Sec:	4		OBE

Q. 1 a) Explain package and its type and import command in Java with example - 6M

A package as the name suggests is a pack(group) of classes, interfaces and other packages. In java we use packages to organize our classes and interfaces. We have two **types of packages in Java**: built-in packages and the packages we can create (also known as user defined package). In this guide we will learn what are packages, what are user-defined packages in java and how to use them.

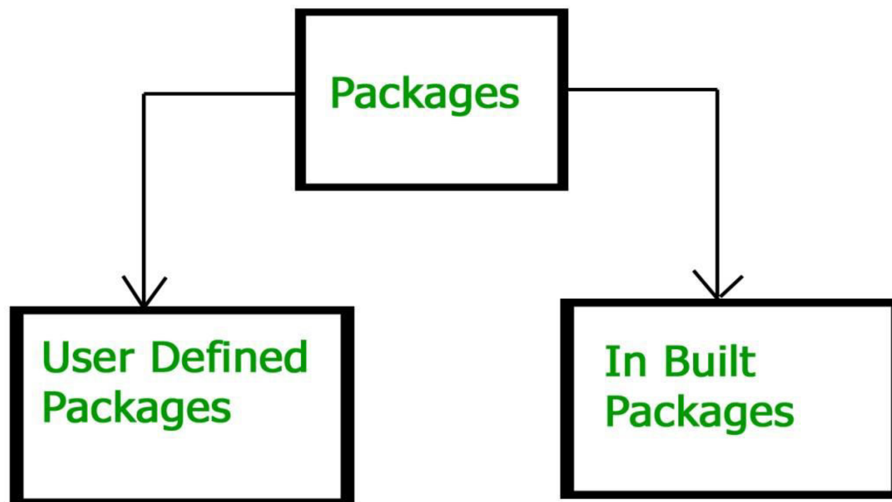
In java we have several built-in packages, for example when we need user input, we import a package like this:

import java.util.Scanner

Here:
→ **java** is a top level package
→ **util** is a sub package
→ and **Scanner** is a class which is present in the sub package **util**.

Types of packages in Java

Types of packages:



Built-in Packages

These packages consist of a large number of classes which are a part of Java **API**.Some of the commonly used built-in packages are:

1) **java.lang:** Contains language support classes(e.g classed which defines primitive data types, math operations). This package is automatically imported.

2) **java.io:** Contains classed for supporting input / output operations.

3) **java.util:** Contains utility classes which implement data structures like Linked List, Dictionary and support ; for Date / Time operations.

User-defined packages

These are the packages that are defined by the user. First we create a directory **myPackage** (name should be same as the name of the package). Then create the **MyClass** inside the directory with the first statement being the **package names**.

Q. 1b) Write a Java program for illustrating the exception handling when the number is divided by zero - 4M

```
class Exc2 {
  public static void main(String args[]) {
    int d, a;

    try { // monitor a block of code.
      d = 0;
      a = 42 / d;
      System.out.println("This will not be printed.");
    } catch (ArithmeticException e) { // catch divide-by-zero error
      System.out.println("Division by zero.");
    }
    System.out.println("After catch statement.");
  }
}
```

This program generates the following output:

```
Division by zero.
After catch statement.
```

Q. 2 a) Write a Java Program to define interface called Area which contains method called compute( ) and calculate the areas of rectangle (l * b) and triangle (1/2 * b * h) using classes rectangle and triangle -7M

```
interface area
{
double compute ( );
}
class Rectangle implements area
{
double l,b;
void getvalues( )
{
l = 10.5F
b = 7.3F
}
public double compute ( )
{
return (l*b);
}
}
class TRI extends Rectangle implements area
{
public double compute ( )
}
return (0.5*b*l);
}
}
class prog6b
{
public static void main( String [ ] args )
```

```
{
Rectangle R = new Rectangle ( );
R.getvalues( );
System.out.println("Area of rectangle =" +R.compute( ));
TRI T = new TRI( );
T.getvalues( );
System.out.println("Area of triangle=" + T.compute( ));
}
}
```

Q.2 b) What is the importance of finally block? -3M

finally

When exceptions are thrown, execution in a method takes a rather abrupt, nonlinear path that alters the normal flow through the method. Depending upon how the method is coded, it is even possible for an exception to cause the method to return prematurely. This could be a problem in some methods. For example, if a method opens a file upon entry and closes it upon exit, then you will not want the code that closes the file to be bypassed by the exception-handling mechanism. The **finally** keyword is designed to address this contingency.

finally creates a block of code that will be executed after a **try/catch** block has completed and before the code following the **try/catch** block. The **finally** block will execute whether or not an exception is thrown. If an exception is thrown, the **finally** block will execute even if no **catch** statement matches the exception. Any time a method is about to return to the caller from inside a **try/catch** block, via an uncaught exception or an explicit return statement, the **finally** clause is also executed just before the method returns. This can be useful for closing file handles and freeing up any other resources that might have been allocated at the beginning of a method with the intent of disposing of them before returning. The **finally** clause is optional. However, each **try** statement requires at least one **catch** or a **finally** clause.

Here is an example program that shows three methods that exit in various ways, none without executing their **finally** clauses:

Q. 3 a) Define the concept of multithreading in Java and explain the different phases in the life cycle of thread, with a neat sketch -6M

Multithreading in java is a process of executing multiple threads simultaneously.

A thread is a lightweight sub-process, the smallest unit of processing. Multiprocessing and multithreading, both are used to achieve multitasking.

However, we use multithreading than multiprocessing because threads use a shared memory area. They don't allocate separate memory area so saves memory, and context-switching between the threads takes less time than process.

Java Multithreading is mostly used in games, animation, etc

Multitasking

Multitasking is a process of executing multiple tasks simultaneously. We use multitasking to utilize the CPU. Multitasking can be achieved in two ways:

- Process-based Multitasking (Multiprocessing)
- Thread-based Multitasking (Multithreading)

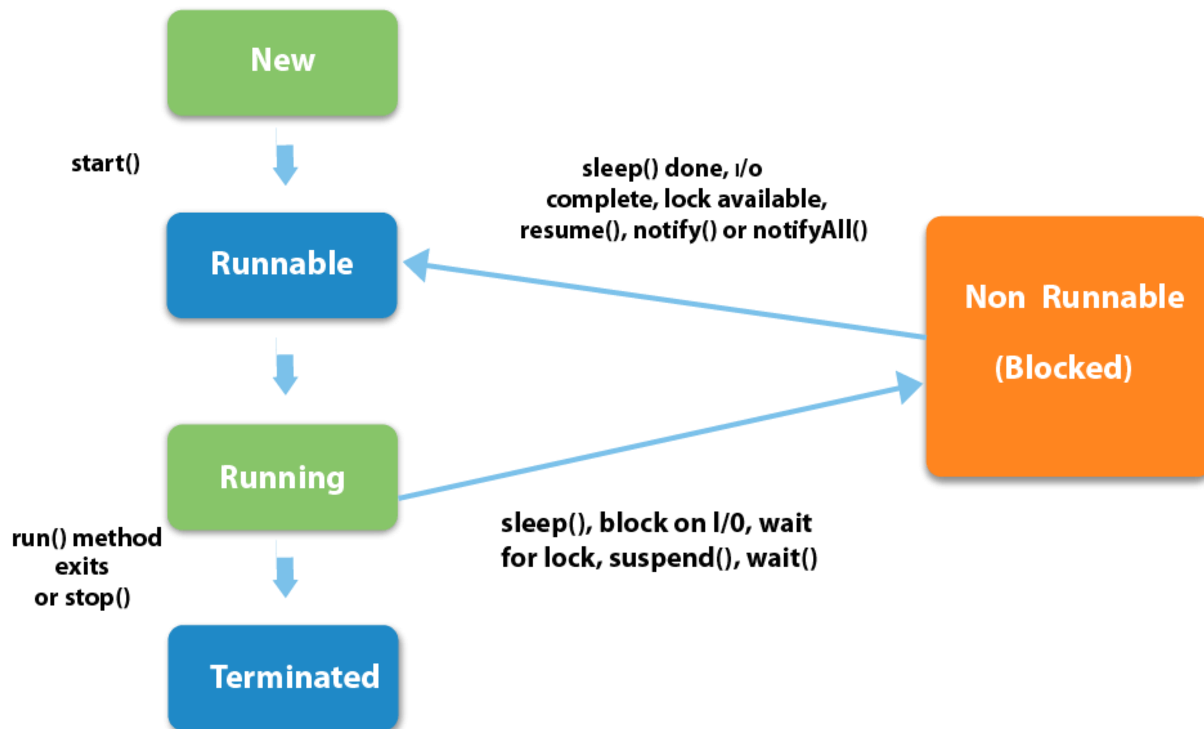
Life cycle of a Thread (Thread States)

A thread can be in one of the five states. According to sun, there is only 4 states in **thread life cycle in java** new, runnable, non-runnable and terminated. There is no running state.

But for better understanding the threads, we are explaining it in the 5 states.

The life cycle of the thread in java is controlled by JVM. The java thread states are as follows:

1. New
2. Runnable
3. Running
4. Non-Runnable (Blocked)
5. Terminated



Q. 3b) Explain keyEvent class with example -4M

The KeyEvent Class

A **KeyEvent** is generated when keyboard input occurs. There are three types of key events, which are identified by these integer constants: **KEY_PRESSED**, **KEY_RELEASED**, and **KEY_TYPED**. The first two events are generated when any key is pressed or released. The last event occurs only when a character is generated. Remember, not all keypresses result in characters. For example, pressing SHIFT does not generate a character.

There are many other integer constants that are defined by **KeyEvent**. For example, **VK_0** through **VK_9** and **VK_A** through **VK_Z** define the ASCII equivalents of the numbers and letters. Here are some others:

VK_ALT	VK_DOWN	VK_LEFT	VK_RIGHT
VK_CANCEL	VK_ENTER	VK_PAGE_DOWN	VK_SHIFT
VK_CONTROL	VK_ESCAPE	VK_PAGE_UP	VK_UP

The **VK** constants specify *virtual key codes* and are independent of any modifiers, such as control, shift, or alt.

KeyEvent is a subclass of **InputEvent**. Here is one of its constructors:

KeyEvent(Component *src*, int *type*, long *when*, int *modifiers*, int *code*, char *ch*)

Here, *src* is a reference to the component that generated the event. The type of the event is specified by *type*. The system time at which the key was pressed is passed in *when*. The *modifiers*

Q. 4 a) Elucidate the two ways of making a class threadable, with examples – 7M

How to create thread

There are two ways to create a thread:

1. By extending Thread class
2. By implementing Runnable interface.

1) Java Thread Example by extending Thread class

```
1. class Multi extends Thread{
2. public void run(){
3. System.out.println("thread is running...");
4. }
5. public static void main(String args[]){
6. Multi t1=new Multi();
7. t1.start();
8.  }
9. }
```

Output:thread is running...

2) Java Thread Example by implementing Runnable interface

```
1. class Multi3 implements Runnable{
2. public void run(){
3. System.out.println("thread is running...");
4. }
5.
6. public static void main(String args[]){
7. Multi3 m1=new Multi3();
8. Thread t1 =new Thread(m1);
9. t1.start();
10.  }
11. }
```

Output:thread is running...

Q. 4 b) What is synchronization? When do we use it? -3M

When we start two or more threads within a program, there may be a situation when multiple threads try to access the same resource and finally they can produce unforeseen result due to concurrency issues. For example, if multiple threads try to write within a same file then they may corrupt the data because one of the threads can override data or while one thread is opening the same file at the same time another thread might be closing the same file.

So there is a need to synchronize the action of multiple threads and make sure that only one thread can access the resource at a given point in time. This is implemented using a concept called **monitors**. Each object in Java is associated with a monitor, which a thread can lock or unlock. Only one thread at a time may hold a lock on a monitor.

Java programming language provides a very handy way of creating threads and synchronizing their task by using **synchronized** blocks. You keep shared resources within this block. Following is the general form of the synchronized statement −

Q. 5 a) Explain delegation event model used to handle events in Java – 6M

The event model is based on the Event Source and Event Listeners. Event Listener is an object that receives the messages / events. The Event Source is any object which creates the message / event. The Event Delegation model is based on – The Event Classes, The Event Listeners, Event Objects.

There are three participants in event delegation model in Java;

- Event Source

Event Sources

A *source* is an object that generates an event. This occurs when the internal state of that object changes in some way. Sources may generate more than one type of event.

A source must register listeners in order for the listeners to receive notifications about a specific type of event. Each type of event has its own registration method. Here is the general form:

```
public void addTypeListener(TypeListener el)
```

- Event Listeners – the classes which receive notifications of events

Event Listeners

A *listener* is an object that is notified when an event occurs. It has two major requirements. First, it must have been registered with one or more sources to receive notifications about specific types of events. Second, it must implement methods to receive and process these notifications.

The methods that receive and process events are defined in a set of interfaces found in **java.awt.event**. For example, the **MouseMotionListener** interface defines two methods to

- Event Classes – the class object which describes the event.

An event occurs (like mouse click, key press, etc) which is followed by the event is broadcasted by the event source by invoking an agreed method on all event listeners. The event object is passed as argument to the agreed-upon method. Later the event listeners respond as they fit, like submit a form, displaying a message / alert etc.

At the root of the Java event class hierarchy is **EventObject**, which is in **java.util**. It is the superclass for all events. Its one constructor is shown here:

EventObject(Object *src*)

Here, *src* is the object that generates this event.

EventObject contains two methods: **getSource( )** and **toString( )**. The **getSource( )** method returns the source of the event. Its general form is shown here:

Object getSource( )

Q.5 b) Explain inner class with example -4M

Java inner class or nested class is a class which is declared inside the class or interface.

We use inner classes to logically group classes and interfaces in one place so that it can be more readable and maintainable.

1. class Java_Outer_class{
2. //code
3. class Java_Inner_class{
4. //code
5. }
6. }

```
// Inner class demo.
import java.applet.*;
import java.awt.event.*;
/*
  <applet code="InnerClassDemo" width=200 height=100>
  </applet>
*/

public class InnerClassDemo extends Applet {
```

```
  public void init() {
    addMouseListener(new MyMouseAdapter());
  }
  class MyMouseAdapter extends MouseAdapter {
    public void mousePressed(MouseEvent me) {
      showStatus("Mouse Pressed");
    }
  }
}
```

Q. 6 a) What are two types of applets? Explain the skeleton of an applet -6M
Applet is a Java program that can be transported over the internet and executed by a Java enabled web-browser(if browser is supporting the applets) or an applet can be executed using **appletviewer** utility provided with JDK.

There are two types of applet -

- Applets based on the **AWT(Abstract Window Toolkit)** package by extending its **Applet** class.
- Applets based on the **Swing** package by extending its **JApplet** class

```
// An Applet skeleton.
import java.awt.*;
import java.applet.*;
/*
<applet code="AppletSkel" width=300 height=100>
</applet>
*/

public class AppletSkel extends Applet {
  // Called first.
  public void init() {
    // initialization
  }

  /* Called second, after init().  Also called whenever
     the applet is restarted. */
  public void start() {
    // start or resume execution
  }

  // Called when the applet is stopped.
  public void stop() {
    // suspends execution
  }

  /* Called when applet is terminated.  This is the last
     method executed. */
  public void destroy() {
    // perform shutdown activities
  }

  // Called when an applet's window must be restored.
  public void paint(Graphics g) {
    // redisplay contents of window
  }
}
```

Q. 6 b) Explain getDocumentBase and getCodebase in applet class

Often, you will create applets that will need to explicitly load media and text. Java will allow the applet to load data from the directory holding the HTML file that started the applet (the *document base*) and the directory from which the applet's class file was loaded (the *code base*). These directories are returned as **URL** objects (described in Chapter 20) by **getDocumentBase( )** and **getCodeBase( )**. They can be concatenated with a string that names the file you want to load. To actually load another file, you will use the **showDocument( )** method defined by the **AppletContext** interface, discussed in the next section.

The following applet illustrates these methods:

```
// Display code and document bases.
import java.awt.*;
import java.applet.*;
import java.net.*;
/*
<applet code="Bases" width=300 height=50>
</applet>
*/

public class Bases extends Applet{
  // Display code and document bases.
  public void paint(Graphics g) {
    String msg;

    URL url = getCodeBase(); // get code base
    msg = "Code base: " + url.toString();
    g.drawString(msg, 10, 20);

    url = getDocumentBase(); // get document base
    msg = "Document base: " + url.toString();
    g.drawString(msg, 10, 40);
  }
}
```

Q. 7 a) Explain the role of synchronization in producer consumer problem with example-10M

In computing, the producer–consumer problem (also known as the bounded-buffer problem) is a classic example of a multi-process synchronization problem. The problem describes two processes, the producer and the consumer, which share a common, fixed-size buffer used as a queue.

- The producer’s job is to generate data, put it into the buffer, and start again.
- At the same time, the consumer is consuming the data (i.e. removing it from the buffer), one piece at a time.

Problem
To make sure that the producer won’t try to add data into the buffer if it’s full and that the consumer won’t try to remove data from an empty buffer.

Solution
The producer is to either go to sleep or discard data if the buffer is full. The next time the consumer removes an item from the buffer, it notifies the producer, who starts to fill the buffer again. In the same way, the consumer can go to sleep if it finds the buffer to be empty. The next time the producer puts data into the buffer, it wakes up the sleeping consumer.

```
// A correct implementation of a producer and consumer.
class Q {
  int n;
  boolean valueSet = false;

  synchronized int get() {
    while(!valueSet)
      try {
        wait();

     } catch(InterruptedException e) {
        System.out.println("InterruptedException caught");
      }

      System.out.println("Got: " + n);
      valueSet = false;
      notify();
      return n;
  }

  synchronized void put(int n) {
    while(valueSet)
      try {
        wait();
      } catch(InterruptedException e) {
        System.out.println("InterruptedException caught");
      }

      this.n = n;
      valueSet = true;
      System.out.println("Put: " + n);
      notify();
  }
}

class Producer implements Runnable {
  Q q;
```

```
  Producer(Q q) {
    this.q = q;
    new Thread(this, "Producer").start();
  }

  public void run() {
    int i = 0;

    while(true) {
      q.put(i++);
    }
  }
}

class Consumer implements Runnable {
  Q q;

  Consumer(Q q) {
    this.q = q;
    new Thread(this, "Consumer").start();
  }

  public void run() {
    while(true) {
      q.get();
    }
  }
}

class PCFixed {
  public static void main(String args[]) {
    Q q = new Q();
    new Producer(q);
    new Consumer(q);

    System.out.println("Press Control-C to stop.");
  }
}
```

Output:

```
Put: 1
Got: 1
Put: 2
Got: 2
Put: 3
```