**IPO PROGRAMMING EXAMPLES**

Convert Liters to U.S. Gallons
Write a Java application to convert liters to U.S. gallons. A quick Google search shows 1L = 0.264 gallons. Here’s an IPO diagram of the program:

The coded Java program is shown below.

```java
import java.util.Scanner;

public class LitersToGallons {
    public static void main( String[] args ) {
        // declare data
        double liters;  // amount in liters
        double gallons; // amount in U.S. gallons
        // input data
        Scanner in = new Scanner( System.in );
        System.out.print( "How many liters? " );
        liters = in.nextDouble( );
        // 1L = 0.264 U.S. gal.
        gallons = 0.264 * liters;
        // output results
        System.out.print( liters + " L = " );
        System.out.println( gallons + " U.S. gal." );
    }
}
```
Convert U.S. Gallons to Liters
This is the inverse conversion of the previous example. Taking the conversion formula from that example and dividing both sides of the equation by the conversion factor gives this formula:

\[ x \text{ liters} = y \text{ gallons} \times \frac{1 \text{ liters}}{0.264 \text{ gallon}} \]

```
import java.util.Scanner;
public class GallonsToLiters {
    public static void main( String[] args ) {
        // declare data
        double liters;  // amount in liters
        double gallons; // amount in U.S. gallons
        // input data
        Scanner in = new Scanner( System.in );
        System.out.print( "How many U.S. gallons? " );
        gallons = in.nextDouble( );
        // 1L = 0.264 U.S. gal.
        liters = gallons / 0.264;
        // output results
        System.out.print( liters + " L = " );
        System.out.println( gallons + " U.S. gal." );
    }
}
```
**Height versus Time**

Pretend you’re in a hot-air balloon. Write a Java application that calculates how far up you are in feet based on the number of seconds it takes for a dropped ball to reach the ground.

A Google search of *calculate height by timing falling object* discovers this formula:

\[ \text{height (meters)} = \frac{1}{2} gt^2 \]

\( t \) is the time (in seconds) it takes the ball to reach the ground. \( g \) is the force of gravity (9.81 meters per sec\(^2\)).

The program is to calculate the height in feet, so the height in meters given by the above formula must be converted using the formula:

\[ \text{height (feet)} = 3.281 \times \text{height (meters)} \]

Here’s the program’s input, processing and output:

<table>
<thead>
<tr>
<th>INPUT</th>
<th>PROCESSING</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>time ( t ) (sec)</td>
<td>( \text{height (meters)} = \frac{1}{2} gt^2 ) ( \text{height (feet)} = 3.281 \times \text{height (meters)} )</td>
<td>( \text{height (m)} )</td>
</tr>
</tbody>
</table>

The coded Java program is shown on the next page. It uses the \(*=` operator, which is covered in the subsequent topic *Assignment Operators*. 
```java
import java.util.Scanner;

public class Height {
    public static void main( String [] args ) {
        // declare data
        double t;  // number of seconds for fall
        double h;  // height
        // input data
        Scanner in = new Scanner( System.in );
        System.out.print( "Enter time for ball to drop: " );
        t = in.nextDouble();
        // calculate height
        h = (9.81 * t * t) / 2.0; // height in meters
        h *= 3.281; // in feet, 1 m = 3.281 ft.
        // print result
        System.out.print( "Height = " + h + " ft." );
    }
}
```
**Worker’s Gross Pay**

Write a Java application that reads a worker’s hourly wage and the number of hours he or she worked and prints his or her pay. The worker’s pay is the number of hours worked times the hourly wage.

\[
\text{gross pay} = \text{hourly wage} \times \text{hours worked}
\]

The coded Java program is shown below. Notice that you need only create one `Scanner` object from which to read all the data.

```java
import java.util.Scanner;

public class Pay {
    public static void main(String[] args) {
        // declare data
        double wage;  // worker's hourly wage
        double hours; // worker's hours worked
        double pay;   // calculated pay

        // build a Scanner object to obtain input
        Scanner in = new Scanner(System.in);

        // prompt for and read worker's data
        System.out.println("Wage and hours?");
        wage = in.nextDouble();
        hours = in.nextDouble();

        // calculate pay
        pay = hours * wage;

        // print result
        System.out.println("Pay = "+pay);
    }
}
```