

## CS 1173: Review of percentages

Percentage problems are in the form:  $x\% \text{ of } y = z$

This problem statement is equivalent to the equation:

$$\frac{x}{100} \times y = z$$

In the statement: "15% of 200 is 30", the variables are  $x = 15$ ,  $y = 200$  and  $z = 30$ . Usually, you are given two of the three quantities ( $x$ ,  $y$ ,  $z$ ) and are asked to find the missing one.

**Example 1:** A total of 1,305,300 cases of childhood contagious diseases were reported in New York City during the years 1931-1971. Of these, 697,948 were measles. What percentage of the cases were measles?

**Answer:** This problem translates into:

$$x\% \text{ of } 1,305,300 = 697,948 \text{ or:}$$

$$\frac{x}{100} \times 1,305,300 = 697,948$$

Solving for  $x$  gives:

$$x = \frac{697,948}{1,305,300} \times 100 = 53 \%$$

See EXAMPLE 3 of LESSON 3 and the first example in the pie chart gallery:

<http://www.cs.utsa.edu/~cs1173/gallery/pieCharts.html#ContagiousDiseases>

**Example 2:** In EXAMPLE 2 of LESSON3 we calculated the total number of cases of measles, mumps and chicken pox respectively:

```
totalMeasles = sum(measles(:));  
totalMumps = sum(mumps(:));  
totalCP = sum(chickenPox(:));
```

We can calculate the total number of cases of all three diseases as:

```
totalDisease = totalMeasles + totalMumps + totalCP;
```

We can calculate the percentage of measles as:

```
percentMeasles = 100 .* totalMeasles ./ totalDisease;
```

**Example 3:** In Week 13 of the 2008-2009 flu season, the CDC had 800 positive tests. In that week 12% of the submitted specimens were positive. How many specimens were submitted in Week 13?

**Answer:** This problem translates into 12% of  $y = 800$  or  $0.12 \times y = 800$ . Solving for  $y$  gives:

$$y = \frac{800}{0.12} = 6,667 \text{ cases}$$

See the multiple graph gallery for an example showing positive tests for flu during the 2008-2009 flu season:

<http://www.cs.utsa.edu/~cs1173/gallery/multipleGraphs.html#PositiveFluTests>

**Example 4:** This is an extension of Example 3. Suppose that `positiveTests` is a MATLAB variable containing the number of positive tests in the first 31 weeks of the 2008-2009 flu season, and `percentPositive` is a MATLAB variable containing the percentage of positive tests in the first 31 weeks of the 2008-2009 flu season. Both variables have 31 rows and 1 column. Write a MATLAB statement to calculate the total number of tests submitted in each of the 31 weeks.

```
totalTests = positiveTests .* 100 ./ percentPositive;
```

**Example 5:** The United States used 101,605 quadrillion BTUs of energy in 2007, 23% of which came from natural gas. How many BTUs of natural gas did the US use in 2007?

**Answer:** This problem translates into: 23% of 101,605 =  $z$  or:

$$\frac{23}{100} \times 101,605 = z = 23,369 \text{ quadrillion BTUs}$$

See the pie chart gallery for the sources of US energy:

<http://www.cs.utsa.edu/~cs1173/gallery/pieCharts.html#EnergySource1>

**Example 6:** This is an extension of Example 5. From the pie chart we know that the breakdown of US energy sources in 2007 was: 40% petroleum, 23% natural gas, 22% coal, 8% nuclear energy and 7% renewal energy. If the US used 101,605 quadrillion BTUs of energy, define a MATLAB variable containing the number of BTUs from each source.

```
BTUs = [0.4, 0.23, 0.22, 0.08, 0.07] .* 101605 * 1e+15;
```