Activity for the Weighted Mean Calculation

This is an activity for the weighted mean calculation.

Weighted Mean

When we calculate a mean, we may be making a serious mistake if we overlook the fact that the quantities we are averaging are not all of equal importance with reference to the situation being described. Consider, for example, a cruise line that advertises the following fares for single-occupancy cabins on an 11-day Caribbean cruise:

Cabin category	**Fare**
Ultra deluxe outside	$7,870
Deluxe outside	$7,080
Outside	$5,470
Outside shower only	$4,250
Inside shower only	$3,460

The arithmetic mean of these five fares is

$$\begin{aligned}\overline{X} &= \frac{7,870 + 7,080 + 5,470 + 4,250 + 3,460}{5} \\ &= \$5,626\end{aligned}$$

But we cannot very well say that the average fare for one of these single-occupancy cabins is $5,626. To get the fare, we would also have to know how many cabins there are in each of the categories. Referring to the ship's deck plan where the cabins are color-coded by category, we find that there are, respectively, 6, 4, 8, 13 and 22 cabins available in these five categories. If it can be assumed that these 53 cabins will all be occupied, the cruise line can expect to receive a total of

$$6(7,870) + 4(7,080) + 8(5,470) + 13(4,250) + 22(3,460) = \$250,670$$

Learning outcomes: Understand the weighted mean. Determine the weighted mean of a given data set.

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for the 53 cabins and hence, on the average $\frac{250,670}{53} \approx \$4,729.62$ per cabin.

To give quantities being averaged their proper degree of importance, it is necessary to assign them (relative importance) **weights** and then calculate a **weighted mean**. In general, the weighted mean $\overline{x}_w$ of a set of numbers x_1, x_2, x_3, ..., x_n whose relative importance is expressed numerically by a corresponding set of numbers $w_1, w_2, w_3, \ldots, w_n$ is given by

$$\overline{x}_w = \frac{w_1x_1 + w_2x_2 + w_3x_3 + \ldots + w_nx_n}{w_1 + w_2 + w_3 + \ldots + w_n} = \frac{\sum w \cdot x}{\sum w}$$

Here $\sum w \cdot x$ is the sum of the products obtained by multiplying each x by the corresponding weight and $\sum w$ is simply the sum of the weights. Note that when the weights are all equal, the formula for the weighted mean reduces to that for the ordinary (arithmetic) mean.

Question 1

Question 2

Question 3

Question 4