

2015 APRIL 18

**QUESTION:**

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Find the overall weighted average of the following sets:

- SET A={1, 1, 1, 3}
- SET B={1.5, 1.5, 3}
- SET C={1, 1, 1, 3}
- SET D={1, 1, 1}
- SET E={1, 1, 1}

A total of 17 classes. Units in hours/class.

**SOLUTION:**

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The overall weighted average can be calculated two different ways. Both ways give the same answer.

METHOD #1:

First find the weighted average of each individual set. To find the overall weighted average of all the sets find the weighted average of the individual weighted averages.

In general, for a set  $\{t_1, t_2, t_3, \dots, t_n\}$  the formula for calculated a weighted average is

$\frac{[t_1 \times (\text{number of occurrences of } t_1)] + [t_2 \times (\text{number of occurrences of } t_2)] + \dots + [t_n \times (\text{number of occurrences of } t_n)]}{(\text{total \# of occurrences})}$
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Thus,

$$\begin{aligned}\text{weighted average of set A} &= \frac{(1 \text{ h/class} \times 3 \text{ classes}) + (3 \text{ h/class} \times 1 \text{ class})}{(3 + 1) \text{ classes}} \\ &= 1.5 \text{ h/class}\end{aligned}$$

Similarly,

weighted average of Set B = 2 h/class

weighted average of Set C = 1.5 h/class

weighted average of Set D = 1 h/class

weighted average of Set E = 1 h/class

Thus, a new set is formed: {1.5, 2, 1.5, 1, 1}.

However, this set is incomplete. We must keep track of the number of occurrences of each value.

(For example: The total number classes taken at Dalhousie during the week is 17. Although the weighted average for Set B is 2, of the 17 classes taken at Dalhousie during the week, a weighted average of 2 h/class occurs three times out of 17. In other words, 3 out of 17 classes will have a weighted average of 2 h/class. )

Therefore, the correct set is {1.5, 1.5, 1.5, 1.5, 2, 2, 2, 1.5, 1.5, 1.5, 1.5, 1, 1, 1, 1, 1, 1}.

Therefore, to find the overall weighted average that applies to all classes:

$$\begin{aligned} \text{overall weighted average of the weighted averages of sets \#1 to \#5} &= \frac{(1.5 \text{ h/class} \times 4 \text{ occurrences}) + (2 \text{ h/class} \times 3 \text{ occurrences}) + (1.5 \text{ h/class} \times 4 \text{ occurrences}) \\ &\quad + (1 \text{ h/class} \times 3 \text{ occurrences}) + (1 \text{ h/class} \times 3 \text{ occurrences})}{(4 + 3 + 4 + 3 + 3) \text{ occurrences}} \\ &= \frac{24 \text{ h}}{17 \text{ class}} \\ &= 1.4117 \dots \text{h/class} \end{aligned}$$

## METHOD #2:

Calculate the overall weighted average directly from the raw data.

$$\begin{aligned} \text{weighted average sets \#1 to \#5} &= \frac{(1 \text{ h/class} \times 12 \text{ classes}) + (3 \text{ h/class} \times 3 \text{ classes}) + (1.5 \text{ h/class} \times 2 \text{ classes}) + (1 \text{ h/class} \times 3 \text{ occurrences})}{(12 + 2 + 3) \text{ classes}} \\ &= \frac{24 \text{ h}}{17 \text{ class}} \\ &= 1.4117 \dots \text{h/class} \end{aligned}$$

## **FINAL NOTES:**

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My explanation is not the most elegantly written one but it seems to explain why I was getting a discrepancy before. If anyone would like to add or clarify anything, input is always welcome. :3