

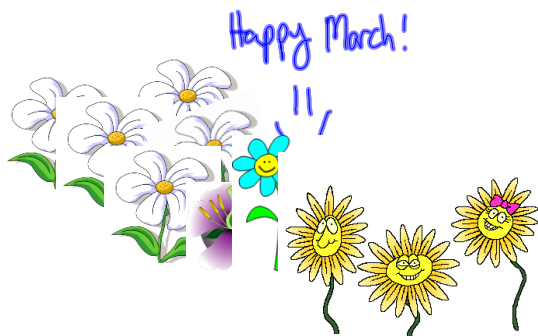
Present Tuesday: #30, 57, and (**)

9:55 Alexis Blo., Ashley, Mae, Aspyn, Abby, Kelly Buc.
11:00 Lauren Eng., Katie, Courtney, Sarah, Tyler, Melissa Hla.

Homework: Handout on Weighted Averages

Present Wednesday: #2, 3a, and 5

9:55 Timothy Chr., Cory, Kaitlin, Amber, Alyssa, Molly Gio.
11:00 Sam Hod., Courtney, Jennifer, Taylor, Elizabeth, Kamry Lon.



After reviewing the correct solution (below), write your score on the back of your quiz.

- 0 = no progress at all; just rewrote problem
- 0.5 = false start, not based on relevant principles
- 1 = false start, but sustained effort with some relevant principles
- 1.5 = significant mistake(s), or significant misunderstanding(s)
- 2 = mistake near the end or could not finish; also excessive reliance on calculator or 'brute force' methods
- 2.5 = trivial mistake (e.g. arithmetic error), but work is mostly correct
- 3 = correct answer and work

Oops, Mr. Pitts accidentally deleted all five of Mary's test scores for the semester. He knows the scores were all whole numbers from 0 to 100. A summary of the scores shows the mean was 88, the median was 87, and the mode was 92. What is the lowest possible number among the missing scores?

$$\begin{array}{ccccccc} \boxed{a} & \boxed{b} & 87 & 92 & 92 & & \\ & & \uparrow & \underbrace{} & \underbrace{} & & \\ & & \text{med.} & & \text{mode} & & \end{array}$$
$$\frac{a+b+87+92+92}{5} = 88 \Rightarrow a+b = 440 - 87 - 92 - 92$$
$$\Rightarrow a+b = 169,$$

If $b = 86$, a has to be 83. ← 83 is the lowest possible missing score.
If $b = 85$, a has to be 84.

Motivating Example: Nothing but Nets

Fact: About 3,000 people die each day from malaria. A mosquito net that costs \$10 installed can reduce infection rates by as much as 90% in high transmission areas. <http://www.nothingbutnets.net> has sold over 4.2 million nets to date (03/01/11).

A small high school held a fundraiser to raise money to buy mosquito nets to help prevent the spread of malaria in Africa.

The high school has:

- The freshmen raised an average of \$80 / person. $\leftarrow \dots \rightarrow$ 20% Freshmen
- The sophomores raised an average of \$84 / person. $\leftarrow \dots \rightarrow$ 23% Sophomores
- The juniors raised an average of \$113 / person. $\leftarrow \dots \rightarrow$ 30% Juniors
- The seniors raised an average of \$98 / person. $\leftarrow \dots \rightarrow$ 27% Seniors
- The teachers raised an average of \$95 / person.

Who raised more money on average? The students, or the teachers?

Weighted Averages

A **weighted average** is used whenever we need to assign different weights to the items in our data set, usually because some items are considered more important or more valuable (in some sense) than others. (In an **unweighted average**, all data points are treated equally.)

Expected value is an example we've seen already; the **weights** in this case are the probabilities associated with each of the different values.

$$\text{In general, wtd avg} = \frac{\sum (w_i \cdot x_i)}{\sum (w_i)}$$

With expected value:

$$\sum (P_i \cdot x_i)$$

$\leftarrow \dots \rightarrow$ (P_i)

\downarrow
 $= 100\%$

Unequal groups: Calculating a weighted average.

Because these groups are not all the same size, we need to use a weighted average to calculate the correct average amount raised.

The high school has:

- The freshmen raised an average of \$80 / person. \leftarrow 20% Freshmen
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 - The juniors raised an average of \$113 / person. \leftarrow 30% Juniors
 - The seniors raised an average of \$98 / person. \leftarrow 27% Seniors
- The teachers raised an average of \$95 / person.

$$\frac{\sum(w_i \cdot x_i)}{\sum(w_i)}$$

$$= \frac{(20\%)(80) + (23\%)(84) + (30\%)(113) + 27\%)(98)}{20\% + 23\% + 30\% + 27\%}$$

$$= \$95.68 \text{ (students win!)}$$

Weighted Averages and Teaching

Weighted averages are used by teachers in calculating student grades:

- Weighted grade categories
- Grade point averages
- Finding the missing grade

Class A has scores: 55, 70, 73, 75, 80, 80, 85, 85, 87, 90 \leftarrow 10 scores

Class B has scores: 50, 60, 72, 80, 88 \rightarrow 5 scores

Verify: Class A's mean is 78.

Verify: Class B's mean is 70.

What is the overall average score? (and why isn't it just 74?)

$$\frac{(78)(10) + 70(5)}{10 + 5} = \frac{780 + 350}{15}$$

$$\approx 75.3$$

Weighted Averages and Teaching

Grading Scale. In Mrs. Jones' Math class:

- * Homework counts for 20% of the grade
- * Tests count for 50% of the grade
- * Group work counts for 30% of the grade.

Timmy has an 86% average on his homework, 76% average on his tests, and 90% average on his group work. What grade should Tim receive in Math?

$$\frac{\sum(w_i x_i)}{\sum(w_i)} = \frac{(20\%)(86\%) + (50\%)(76\%) + (30\%)(90\%)}{20\% + 50\% + 30\%}$$

$$= 82.2\%$$

Weighted Averages and Teaching

What Score Do I Need?

Before the final exam, a student has earned 67% of the 500 points possible in the class. All that remains is a 100 point final exam. She needs a C (70%) in the class to meet her program requirements. What does she need to score on the final exam to pass the class with a C?

$$\frac{\sum(w_i x_i)}{\sum(w_i)} = \frac{500(67\%) + 100(x)}{500 + 100}$$

$$\times 600 \quad 70\% = \frac{500(67\%) + 100(x)}{600} \quad \times 600$$

$$420 = 335 + 100x$$

$$x = .85 = 85\%$$

1.) Answer is $\$5.50 + 5.00 = \10.50
(verify!)

(If you get ~ 88.7 you
forget the 93.8% chance of
recurring 0).

$$(5\%)(50) + 1\%(200) + 0.2\%(500) + 93.8\%(0)$$

$$(5\% + 1\% + 0.2\% + \underline{93.8\%}) \rightarrow 100\%$$