Weighted Means

As was said previously, the common word for the **arithmetic mean** is the average. Most people think of marks when they think of average, but most teachers do not use the arithmetic mean to find a student's "average". They use a **weighted mean**. This refers to a series of values where some have more of an impact, more weight, on the mean than other numbers. This is like having homework worth 10% of your mark, quizzes worth 30%, tests worth 40% and a final exam worth 20%. (**Note** that the sum of all the percents must be 100. In this case, 10 + 30 + 40 + 20 = 100.)

With weighted means, the values in each category are added together then multiplied by their weight. Then all the weights are added together to find the weighted mean.

Here is a simple example:

Example 1: Frieda earned grades of 85%, 72%, 65%, and 90% on four tests in one term in her math class.

a) If each test were worth the same percentage of her final grade, what would be her final grade? Since each is worth the same percentage, we use the arithmetic mean.

$$\frac{85 + 72 + 65 + 90}{4} = 78$$

b) What was her term grade if the first test was worth 10% of her final grade, the second and third were each worth 20%, and the fourth test was worth 50%? In this case, we have to multiply each grade by the percent it is worth, then add all those answers.

Mark	**×**	**Worth**	**=**	**Grade**
85	×	10/100	=	8.8
72	×	20/100	=	14.4
65	×	20/100	=	13
90	×	50/100	=	45

Final Grade = 81.2

Warning: the words "mark" and "grade" are sometimes used interchangeably, so in one problem a mark is a grade, or the other way around, and sometimes both are used for the same thing. I will be consistent in these problems.

Example 2: Carina is calculating her final grade in her Spanish class. In the course, assignments are worth 15% all together, each quiz is worth 5%, the presentation is worth 25%, and the final exam is worth 45%.

Carina earned:

- 8/10, 6.5/10, and 16/20 on her assignments
- 10/10, 7/10, and 7/10 on her quizzes
- 85/100 on her presentation
- 86% on her final exam

What is Carina's final grade?

This is different than the previous example, because we are given **raw scores**, what the actual marks are, not turned into percents like the previous problem. In this case, the raw scores are **the fraction of the percent** for each category (assignments, quizzes, presentation and exam).

So, to calculate the assignments, all together, we add all the numerators (tops) together and all the denominators (bottoms) together, then multiply that by what the assignments are worth. (Note that this is NOT the same as adding fractions!)

Assignments: $\frac{8}{10}+\frac{6.5}{10}+\frac{16}{20}=\frac{8+6.5+16}{10+10+20}=\frac{30.5}{40}\times 15=11.4$

Each quiz we calculate separately.

Quizzes: Quiz 1 = $\frac{10}{10}\times 5=5$

Quiz 2 = $\frac{7}{10}\times 5=3.5$

Quiz 3 = = $\frac{7}{10}\times 5=3.5$

Presentation: = $\frac{85}{100}\times 25=21.25$

Exam: = $\frac{86}{100}\times 45=38.7$

We add all the category grades together to get the final grade.

11.4 + 5 + 3.5 + 3.5 + 21.25 + 38.7 = 83.35 or **83%**

Instructions: Do the following three practices following the two examples above and referring to the instructions above on how to solve **weighted mean** problems when you have difficulties. The last problem is your test problem. Send me you answer and I will confirm if it is correct.

Workplace 10
Statistics and Probability 3

1. Truman earned 86% in term 1, 75% in term 2 and 65% on the final exam. Term 1 is worth 40% of the final mark, term 2 is worth 40% and the exam is worth 20%. What was his final grade? (Which example do you use when marks are percents rather than raw scores?) [1]

2. Pat's Math teacher makes quizzes worth 20%, chapter tests worth 50% and the final exam worth 30%.

   On the quizzes, Pat earned 7/10, 12/15, 6/12 and 8/10.

   On the two tests, Pat earned 18/25 and 24/30

   On the exam, Pat earned 52/75.

   What was Pat's final mark? (Which example do you use when marks are raw scores rather than percents?)[2]

[1] 77.4%
[2] 73%

3. Bethany loves writing but her spelling and grammar need some work. Her English teacher has partitioned her mark into categories. Spelling is worth 10%, grammar is worth 20%, writing is worth 30% and literary analysis is worth 40%.

   In spelling she wrote five quizzes and earned 7/10, 2/5, 8/12, 5/10 and 6/10.

   Her grammar marks were 12/20, 8/15 and 15/20.

   Her two writing assignments earned her 28/30 and 38/40.

   She earned 32/40 in the literary analysis project. What was her final grade?[3]

[3] 80.6%

Workplace 10
Statistics and Probability 3

Test Question: Email your answers to this problem at larry.green@sd71.bc.ca and I will confirm your answer. If you do not get this correct, I will email you a second set of weighted mean questions to help you complete your understanding of the second statistics lessons.

Kris loves Socials Studies. But he struggles with tests. Luckily, the Socials department at his school gives greater weighting to projects than tests. Quizzes are worth 10%. Tests are worth 20%. Projects are worth 40%. And an open-notebook exam is worth 30%. Kris's marks are as follows:

Quizzes: 6/10, 5/10, 9/15 and 10/15

Tests: 21/30 and 18/25

Projects: 18/20 and 24/25

Exam: 48/60

What was Kris's final score?