

A few thoughts and a look ahead

Posted on: Friday, March 20, 2020 4:33:37 PM EDT

Dear Students,

I hope you and your loved ones are well. We are now facing a time where maintaining our mental health will be as important as taking measures to protect physical health. My hope is that a return to our coursework will be a welcome distraction from our quarantine.

Importantly, we need to practice good communication, on all levels. This means listening to and heeding public service announcements, staying connected with friends and family, and talking to neighbors from across the fence or across the hallway.

It also means that if you need help in these times then please, without reservation, reach out. This includes needing to talk for the sake of talking because you feel down, needing to develop a plan for doing school work, or figuring out how to take care of yourself or a sick friend or relative. I am completely willing to talk with you about any of these matters should you deem that to be helpful.

We are beginning our transition to online teaching next week. For us faculty, we are taking this time to design and implement radical new changes and there is a lot to do! Further updates will come next week. If you have particular thoughts or concerns about the course, then feel free to share those with me.

Regardless of what happens at school, our first commitment should be to ourselves, or families, and our communities. One way in which we can be most helpful in these times is by ensuring that we take steps to maintain our health and well-being. We can fight depression and fear by keeping active, by creating work for ourselves, by making lists of activities to do for set periods of time to fill up our days. I hope that your coursework will become a helpful part of your daily rituals as we move forward.

We are all members of an extended community through the College, so know that I am here for you. Please be conscious of your actions and make good choices for yourself and your families.

Be well,
Eric

Request: please respond to distance learning survey

Posted on: Monday, March 23, 2020 9:54:47 AM EDT

Dear Students,

I have set up a short 6 question survey to help with planning for distance learning. Since this is all new to me, and likely to you as well, I would like to start by soliciting your feedback on what you think would work well. The last question is an open response where you can provide me with any additional thoughts about what you think would work well or not well.

Given that I need to do the majority of planning this week, I am asking for your feedback by Wednesday night.

Thank you,

Eric

Question about averages in the lab

Posted on: Wednesday, April 8, 2020, 10:05:47 PM EDT

Jared asked a great question over on the Teams forum tonight:

For lab 5 I'm having trouble understanding why the excel average under the Vxi w/ time is different than the division of the time and distance averages. If I understand correctly, shouldn't the average of Vxi just be the average of the distance divided by the average of the time? Shouldn't it be all the same numbers? Maybe a rounding error in excel?

Jared noticed something really important - these two ways of calculating the average in Excel are not equal. It seems like they should, so is this a problem with the average command in Excel? While it is very much within the realm of possibility that Microsoft made some terrible blunder, but let's explore this in detail before jumping to a conclusion.

We are looking at the equation $v = \frac{x}{t}$ and want to find the average value of v for many measurements. Let's use a set of < > brackets to indicate taking the average over our measurements. The definition of the average is

$$\langle z \rangle = \frac{1}{N} \sum_{i=1}^N z_i$$

which just means that we sum up all the measurements and then divide by the number of measurements of some quantity we are calling z (whatever that is). If we had only two measurements, we get the well-known formula $\langle z \rangle = (z_1 + z_2)/2$ and if we had four measurements it would be $\langle z \rangle = (z_1 + z_2 + z_3 + z_4)/4$.

Now, back to v . Let's just apply the average. We can first take each of our x measurements and then divide each measurement by its corresponding time to get

$$\langle v \rangle = \frac{1}{N} \sum_{i=1}^N \frac{x_i}{t_i}$$

But, rather than summing the ratio of x to t , we could have also calculated an average velocity by using the averaged x value divided by the averaged t value, which is

$$\langle v \rangle = \frac{\langle x \rangle}{\langle t \rangle} = \frac{\frac{1}{N} \sum_{i=1}^N x_i}{\frac{1}{N} \sum_{i=1}^N t_i}$$

To see how they are different, consider that we only took two measurements (so $N=2$). In the first definition of the average we would have

$$\langle v \rangle = \frac{1}{2} \left(\frac{x_1}{t_1} + \frac{x_2}{t_2} \right)$$

and in the second case we would have

$$\langle v \rangle = \frac{\frac{1}{2}(x_1 + x_2)}{\frac{1}{2}(t_1 + t_2)} = \frac{x_1 + x_2}{t_1 + t_2}$$

These equations look similar, but closer inspection shows that they are simply not the same thing. You can easily test this with a few numbers, like $x_1 = 2$, $t_1=1$, and $x_2=4.5$, $t_2=1.5$. In the first average you get a value of $0.5*(2 + 3) = 2.5$, and in the second average you get a $(2+4.5)/(1 + 1.5) = 6.5/2.5 = 2.6$, which is close, but clearly different.

Yup, Microsoft got this one right. So, which average should one use? Like most things in life, the answer is not simple and can best be stated as: it depends. Specifically, it depends on whether your measurements of x and t are correlated. Roughly that means did you measure x and t in the same experiment, or did you first just measure a bunch of x 's in one set of experiments, and then measure a bunch of t 's in a second set of experiments. We did the first type of measurement (for each trial you measured an x and a t). So, in this case we should use the first form of the average described here.

Thanks for the great question Jared!