Out-of-class work #2: (Week 2) - Percents & number scaling
SKQ-101: Sections DC & DD with E.C. Darsow (Version 0.9: 20 January 2022)

Question 1: Number format conversion: Life on Mars (1 pt per row, 1/2 pt per value)
A percent is a number that represents the composition of something, such as how much of the air is oxygen or how many days in the past month you rode on a bus. We can represent that percent value as a decimal or a fraction. Complete the following table by considering one row at a time. You'll be given one of the three possible ways to represent the same value. Undertake conversions to the missing two forms.
- Note: Reduce your fraction if possible (is there an integer that can be divided evenly (no remainder) into both the top and bottom value? If so, it's not reduced.)
- These facts come from The Wikipedia: https://en.wikipedia.org/wiki/Mars

#	Description	fraction	decimal (ratio)	percent
ex	Mars has two permanent polar ice caps. During a pole's winter, it lies in continuous darkness, chilling the surface and causing the deposition of 25–30% of the atmosphere into slabs of CO2 ice (dry ice).	$\frac{25}{100} = \frac{1}{4}$	0.25	25%
1	Amount of carbon dioxide in the atmosphere of Mars			95%
2	Amount of argon in Mars's atmosphere		0.028	
3	Volume of mars compared to earth		0.107	
4	Surface gravity on Mars with respect to Earth			38%
5	Ratio of the surface of Mars covered in the Borealis basin (hemispheric dichotomy)		.40	
6	Experiments performed by the lander showed that the Martian soil has a basic pH of 7.7, and contains 0.6% of the salt perchlorate,[69][70] concentrations that are toxic to humans.			0.6%
7	Liquid water cannot exist on the surface of Mars due to low atmospheric pressure, which is less than 1% that of Earth's,[28] except at the lowest elevations for short periods			1%
8	Analysis using the rover's DAN instrument provided evidence of subsurface water, amounting to as much as 4% water content, down to a depth of 60 centimetres (24 in),			4%

Question 2: Product price ratios (10 pts:5 pts for a legitimate answer; 5pts for work)

A ratio compares two values, such as the price offered for a product by seller X versus seller Y. (See section 3-A in your book). Ratios can be stated as two values separated by a colon like 1:4 or divided into a decimal value such as 1:4 = 0.25. We can think of the ratio as the multiplicative factor to transform the second value into the first.

2A: Choose a tool that you use often or expect to use in your future career, such as a laser-guided level (or a coffee machine). Use a catalog or The Interwebs to look up two sellers of this tool. Compare the prices offered for the same type of tool by your two sellers using a ratio, and interpret that ratio in a well-formed sentence. Document your work and sources.

Tool name and use:		
Retailer Name	Price for tool	Product details (brand, features, etc.)
X		
Y		

Compute the price ratio of retailer X to retailer Y (and don't forget to show units THROUGHOUT your calculations--be careful!)

2B: Is the price ratio 1:1? Close to 1:1? If not, why not? AND What would a price ratio of 1:1 mean? (5 pts)

Question 3: Be a stealthy people watcher (20 pts; 10 for complete documentation, 10 for calculations being accurate)

We can use a percent to describe the composition of something, or the frequency of some event occurring like a person walking by a building or window exhibiting a characteristic of interest, such as wearing a green hat. Choose a spot you can *safely* and *legally* and *ethically* observe passers by for a period of 5 continuous minutes. Example: A table by a vending machine or order counter. Or a window in your home looking onto a street and/or sidewalk.

Observation Location: _____

Decide on what you will be counting: (people or cars or something creative--birds?) _____

Now choose two characteristics that you can visually code--and do so so reliably and quickly--about this entity you are counting. (You are not being ask to talk to anybody!) For example: If you are counting pedestrians on a street, you might code: Is observed person 1) walking a dog 2) walking with a computer in their hand. If you are observing vehicles on a roadway, you could categorize them as 1) trucks or 2) busses
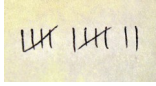
Characteristic 1: _____

Characteristic 2: _____

Do observation:

Get setup at your observation location. Set a timer for 5 minutes, and tally how many total people or cars pass by. As they pass, also tally if they meet either or both of your characteristics. Use a table like this to record your data:

Start date/ time _____ End time (start + 5 mins): _____

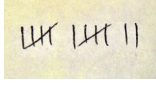| OBSERVATION PERIOD 1	Tick mark e.g. LHT |LHT ||	Counted total Counted total (convert ticks to a number)
Observed cars/persons		
Has characteristic 1 of		
Has characteristic 2 of		

Analysis: 3A: What percent of observed entities displayed characteristic 1? Show your computation and state your answer in a complete sentence:

Analysis 3B: What percent of observed entities displayed characteristic 1? Show your computation and state your answer in a complete sentence:

Question 4: Percent change (20 pts; 5 per sub-question)
Wait some amount of time, such as a few hours, or a day. Return to EXACTLY the same place of observation and conduct exactly the same 5 minute study you did for question 3

Start date/ time _____ End time (start + 5 mins): _____

OBSERVATION PERIOD 2	Tick mark e.g.	Counted total (convert ticks to a number)
	lHr lHr ll	
Observed cars/persons		
Has characteristic 1 of:		
Has characteristic 2 of:		

Compute: Using our general formula for absolute and relative (percent) change, respond to these questions:

4A) Comparing observation period 2 to observation period 1, how did the frequency of observing characteristic 1 change? State your answer as BOTH an absolute change and a relative percent change and explain those numbers in a complete sentence. *Example: "From observation 1 to observation 2, five more drivers of vehicles passing South Braddock Ave & Roslyn street could be seen holding a mobile computer in their hand while operating the vehicle, which is an increase of 12% from period 1 to period 2.*

4B) Comparing observation period 2 to observation period 1, how did the frequency of observing characteristic 2 change? State your answer as BOTH an absolute change and a relative percent change and explain those numbers in a complete sentence.

4C) Comparing period ONE to period TWO, how did the overall number of counted entities change? Note: Keep careful track of your reference or base value.

4D) Consider the magnitude of the change. If there is a difference in either observed characteristics, why might that difference have occurred? i.e. Is something else going on besides just random variation in the world? If there is no difference in the frequency of observed characteristics, how surprised were you?

Question 5: Big and small numbers (20 pts; 10 for legitimate answers, 10 for neat work)
Blood is very important in human bodies, and is composed of very tiny constituents. The Wikipedia on Blood contains this information (with citations linked to the bottom of the page): https://en.wikipedia.org/wiki/Blood. (Accessed 20-JAN'22@1137h)

Cells

Further information: Complete blood count

One microliter of blood contains:

- **4.7 to 6.1 million (male), 4.2 to 5.4 million (female) erythrocytes:**[7] Red blood cells contain the blood's hemoglobin and distribute oxygen. Mature red blood cells lack a nucleus and organelles in mammals. The red blood cells (together with endothelial vessel cells and other cells) are also marked by glycoproteins that define the different blood types. The proportion of blood occupied by red blood cells is referred to as the hematocrit, and is normally about 45%. The combined surface area of all red blood cells of the human body would be roughly 2,000 times as great as the body's exterior surface.[8]
- **4,000–11,000 leukocytes:**[9] White blood cells are part of the body's immune system; they destroy and remove old or aberrant cells and cellular debris, as well as attack infectious agents (pathogens) and foreign substances. The cancer of leukocytes is called leukemia.
- **200,000–500,000 thrombocytes:**[9] Also called platelets, they take part in blood clotting (coagulation). Fibrin from the coagulation cascade creates a mesh over the platelet plug.

A scanning electron microscope (SEM) image of a normal red blood cell (left), a platelet (middle), and a white blood cell (right)

5A) Use Nadler's Formula for computing blood volume of a human (could be yourself, or a made up human). State your <u>assumptions</u> and show your calculations. State your answer in Liters!!

Blood Volume (male) = $0.3669h^3 + 0.03219w + 0.6041$
Blood Volume (female) = $0.3561h^3 + 0.03308w + 0.1833$
Volume is computed in liters, height in meters, and weight in kilograms

5B) Recompute blood volume that you did for 5A, except assume the same height and weight but the other sex. What percent different is total blood volume using Nadler's formula between a human of the same weight and height but different sex? Be sure to describe your answer in a sentence that makes clear what sex you used as your base or reference value in your computations.

5C) Use your original blood volume from 5A and convert your answer to microliters, which is the unit The Wikipedia article uses to discuss counts of various cell constituents of blood. Show your work and box your final answer.

5D) How many Erythrocytes (red blood cells) do you expect would be found in your human used in 5A? State your answer in SCIENTIFIC NOTATION! Show your work.

5E) How many of the all-important and oh-so-politicized leukocytes are likely found in the blood of your human used in 5A? Show calculations and state your answer in SCIENTIFIC NOTATION.

5F) Using the interwebs and your searching prowess, how many strands of hair might be on the average adult (prior to starting to lose hair due to old age or pattern balding)? State your findings and any assumptions embedded in it (Eric saw different estimates based on the color of hair.)

5G) Compare the number of hairs on an adult's head with the number of Erythrocytes in their blood using the **notion of orders of magnitude.** See your book Section 3B (sub-section Giving Meaning to Numbers).