Exercise 1

Math Bootcamp

Instructions

- Please show your work! You may lose points by simply writing in the answer. If the problem requires you to execute commands in `R`, please include the code you used to get your answers. Please also include the `.R` file that contains your code. If you are not sure if work needs to be shown for a particular problem, please ask.

Question 1

Indicate the level of measurement and which measure(s) of central tendency can be used for the following:

1. college education: none, BA/BS, MA, Ph.D.
2. letter grades
3. income given as 0–10K, 10–20K, 30–50K, 50–80K, 100K+
4. distance of commute from home to work
5. marital status: single, married, widowed, divorced
6. working status: employed, unemployed, retired, student
7. governmental level: local, state, federal, international
8. party: Conservative, Labour, Liberal Democrats, Brexit Party

Question 2

Simplify and solve the following expressions:

1. $(-x^4y^2)^2$
2. $\frac{x4}{x3}$
3. $y^7y^6y^5y^4$
4. $(2a^2)(4a^4)$

5. $\left(\frac{1}{27b^3}\right)^{1/3}$
6. $(z^2)^4$
7. $9(3^0)$
8. $(-2)^{7-4}$
9. $\frac{2a/7b}{11b/5a}$
10. $(a+b)^2+(a-b)^2+2(a+b)(a-b)-3a^2$
11. $\sqrt[3]{2^3}$
12. $\sqrt[3]{27}$
13. $\sqrt[4]{625}$

Question 3

1. de Morgan's Laws are a series of rules governing the combination of multiple logical operators. Prove de Morgan's Laws for two sets A and B. Formally, the rules are written as:

   $\neg(P \cup Q) \iff (\neg P) \cap (\neg Q), \neg(P \cup Q) \iff (\neg P) \cap (\neg Q),$

   and

   $\neg(P \cap Q) \iff (\neg P) \cup (\neg Q), \neg(P \cap Q) \iff (\neg P) \cup (\neg Q)$

   where P and Q are propositions:

   $\neg$ is the negation logic operator (NOT),

   $\cap$ is the conjunction logic operator (AND),

   $\cup$ is the disjunction logic operator (OR),

   $\iff$ is a metalogical symbol meaning "can be replaced in a logical proof with"

   Using a Venn diagram can help wrap your head around this problem while also building a visual intuition for sets.

2. For some set A, explain $A \cup A$ and $A \cap A$: what elements are in each of these sets?