Homework #1
(50 points)

Due Date: September 13th, 2024, <u>at the beginning of class</u>

Directions
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1. **This is an INDIVIDUAL assignment; do your own work! Submitting answers created by computers or by other people is NOT doing your own work.**

2. <u>Start early!</u> Getting help is much easier n days before the due date/time than it will be n hours before. Help is available from the class staff via `piazza.com` and our office hours.

3. Write complete answers to each of the following questions, in accordance with the given directions. <u>Create your solutions as a PDF document such that each answer is clearly separated from neighboring answers, to help the TAs easily read them.</u> Show your work, when appropriate, for possible partial credit.

4. When your PDF is ready to be turned in, do so on `gradescope.com`. Be sure to assign pages to problems after you upload your PDF. Need help? See "Submitting an Assignment" on `https://help.gradescope.com/`.

5. **Solutions submitted more than five minutes late will cost you a late day. Submissions more than 24 hours late are worth no points.**

<u>Topic: Math Review</u>

1. (2 points) For each of the following expressions, what is the most precise relationship that exists between a and e? Assume that a through e are all integers. If no clear relationship exists, explain why not.

   (a) $a = b \geq c = d \geq e$ 　　　　　　　(b) $e \leq d \neq c = b < a$

2. (6 points) For each of the following decimal representations, determine the reduced fraction that represents the same value.

   (a) $10.\overline{2}$ 　　　　　　　　　　　(b) $0.3\overline{8}$

3. (4 points) If $\mathcal{U} = \{q, r, s, t, u, v, w, x, y, z\}, F = \{q, s, t, u, x, y\}, G = \{r, s, v, y, z\}$, and $H = \{q, r, s, v, x, z\}$, what is the result of the evaluation of each of the following set expressions? (Recall: $\mathcal{U}$ is the universe.)

   (a) $F \cap (G \cup H)$ 　　　　　　　　(b) $(F \cap G) - (G \cap H)$

4. (6 points) Evaluate each of the following expressions, producing a single integer result.

   (a) $\displaystyle\sum_{a=-1}^{5} a(a-1)$ 　　　　　　(b) $\displaystyle\sum_{x=1}^{3} \prod_{y=2}^{4} \frac{x}{y-1}$

5. (4 points) Evaluate each of the following expressions, producing a single result value for each.

   (a) $89 \,/\, 16$ 　　　(b) $89 \setminus 16$ 　　　(c) $89 \,\%\, 16$ 　　　(d) $89 \mid 16$

6. (3 points) Assume that $e \equiv f \pmod 3$. Is $(e - 3) \equiv (f - 3) \pmod 3$ also true? Briefly explain how you determined your answer.

7. (5 points) Evaluate each of the following expressions, producing as reduced a result as possible.

(a) $\dfrac{6-\frac{3x}{2z}}{\frac{z}{y}-\frac{x}{4y}}$

(b) $\dfrac{\log_5 1}{\log_5 7}$

Propositional Logic:

8. (2 points) For each of the following English sentences, is it a proposition?

   (a) Where are you going?
   (b) My brother Denton wears a nose ring.

9. (2 points) Express, as conversational English sentences, the negations of each of the following sentences. (Starting an answer with the phrase "It is not the case that" is an example of an answer that is NOT conversational.)

   (a) Ernest and Francis are brothers.
   (b) a is greater than b

10. (4 points) Aemila's laptop computer has 8 GB of primary storage, a 512 GB SSD for secondary storage, and a screen resolution of 1920 by 1080 pixels. Burrah's laptop's characteristics are 16 GB, 1,024 GB, and 1600 by 1200, respectively, and Cilcen's laptop's characteristics are 6 GB, 512 GB, and 1366 by 768. Based on this information, are each of the following English statements true or false? Briefly explain your answers.

    (a) Aemila's SSD has less capacity than does Burrah's but has more capacity than does Cilcen's.
    (b) Burrah's computer has less primary storage or more pixels than does Cilcen's.

11. (4 points) Let p label the proposition "I bought a bag of cherries," and let q label the proposition "The cherries weighed one pound." Express each of these logical expressions as an equivalent conversational English sentence.

    (a) $q \oplus p$
    (b) $\neg p \wedge \neg q$

12. (4 points) Consider the propositions $r :$ "Your ankle is healthy", $s :$ "You ran the marathon", and $t :$ "You won the race". Rewrite each of the following English sentences in the form of an equivalent logical expression, using those propositions and appropriate logical operators.

    (a) You ran the marathon but you didn't win the race.
    (b) Your ankle is painful or you ran the marathon, but not both.

13. (4 points) Each of the following statements use "or." For each, determine whether the intended meaning is inclusive–OR or exclusive–OR. Briefly explain your answers.

    (a) A passing grade in Calculus I or in Linear Algebra is required.
    (b) The broken writing implement is a pen or a pencil.