Directions

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

2. Start early! Getting help is much easier five days before the due date/time than it will be five hours before.

3. These questions cover material from Appendix A of “Kneel Before Zodd,” available from D2L and the class web page. Access info is available on Piazza.

4. Write complete answers to each of the following questions, in accordance with the given directions. Create your solutions as a PDF document such that each question is on a separate page; all parts of a multi-part question may be on the same page. Show your work, when appropriate, for possible partial credit.

5. If you have questions about any aspect of this assignment, help is available from the class staff via piazza.com and our Zoom office hours.

6. When your answers are ready to be turned in, do so on gradescope.com. The entry code is 74DKZK, should you need it. Be sure to assign pages to problems after you upload your PDF. Need help? Visit https://help.gradescope.com and search for “Submitting an Assignment.”

7. Solutions submitted after the first five minutes of class on the due date will not be accepted.

Fractions

1. (4 points) Simplify (including reducing the result, if appropriate) each of these expressions.

   (a) \[
   \frac{3x}{4y} - \frac{6y}{24x}
   \]

   (b) \[
   \frac{\frac{3}{5} + \frac{2}{3}}{3} + \frac{1}{20}
   \]

Rational Numbers

2. (5 points) Express each of these values as a rational number.

   (a) 27.38

   (b) 5.5

   (c) 71.717

(Continued …)
Sets

3. (2 points) List the elements of this set: \{x \mid x \text{ is an odd number between 100 and 108}\}

4. (1 point) True or False: 49 \in \{y \mid y \text{ is a square number and is less than 60}\}

5. (3 points) Describe the set \{0, 3, 6, 9, 12, 15, 18\} using set builder notation.

6. (5 points) Evaluate each of these set expressions:
   (a) \mid \{y \mid y \text{ is a square number and is less than 60}\} \mid \quad \text{(Note the leading and trailing vertical lines!)}
   (b) \{0, 1, 3, 6, 10\} \cup \{0, 3, 6, 9, 12, 15, 18\}
   (c) \{0, 1, 3, 6, 10\} \cap \{0, 3, 6, 9, 12, 15, 18\}
   (d) \{0, 1, 3, 6, 10\} - \{0, 3, 6, 9, 12, 15, 18\}

7. (1 point) Assume that \mathcal{U} = \{1, 5, 9, 13, 17, 21\}. What is the evaluation of \{1, 9, 17\}?

8. (3 points) Provide a single set expression in terms of \(A, B, C, \text{ and } D\) that describes exactly the shaded areas of this Venn diagram:

9. (2 points) Why do we avoid using the symbol \(\mathbb{N}\) in this class?

Assocativity, etc.

10. (2 points) Division is not associative over the real numbers. Create an example the demonstrates this.

11. (1 point) True or False: Union is commutative.

12. (2 points) Create an example that explains why the concept of one person looking at another person (as in, “Ahmed is looking at Irina”) is not transitive.

Inequalities

13. (3 points) If \(a < j\) and \(j \leq m\), is it more accurate to say that \(a < m\) or that \(a \leq m\)? Why?

14. (2 points) Given \(h \leq q, 3b < 4g, \text{ and } 2g < h\), what is the relationship between \(b\) and \(q\)?

Summation and Product Notation

15. (7 points) Evaluate each of these expressions to integer results.
   (a) \sum_{a=1}^{6} a + 1
   (b) \prod_{b=0}^{4} (b + 1)
   (c) \prod_{c=2}^{3} \sum_{d=1}^{3} (c + d)

(Continued . . .)
Integer Division

16. (7 points) Evaluate each of these expressions:
   (a) $36 / 8$ (Yes, this one is real division!)
   (b) $36 \div 8$
   (c) $36 \% 8$
   (d) $36 \% 8$
   (e) $8 \div 36$
   (f) $8 \% 36$
   (g) $8 \% 36$

17. (3 points) Are 48 and 26 congruent modulo 11? Explain how you arrived at your answer.

18. (2 points) What do we know to be true about $x$ when $x \equiv 1 \pmod{2}$ is true?

Logarithms and Exponents

19. (7 points) Evaluate the following expressions:
   (a) $\log_5 625$
   (b) $\log_2 (4 \cdot 2^5)$
   (c) $\log_9 \left( \frac{3^{x+2}}{3^{x-2}} \right)$

Quadratics

20. (4 points) Consider this quadratic expression: $10n^2 - 7n - 12$.
   (a) Factor this expression.
   (b) What are the roots of this expression?

Number Systems

21. (2 points) Convert $156_{10}$ to binary.

22. (2 points) Convert $11010110_2$ to both decimal and to octal.

23. (2 points) Convert $A4B_{16}$ to decimal.

24. (3 points) Consider the Base 5 number system.
   (a) What are the available digits in Base 5?
   (b) Convert $231_{10}$ to Base 5.