

Midterm #1, 10/5
Math 181 (Discrete Structures), Fall 2022

Each problem is worth 10 points, for a total of 50 points. You have 50 minutes to do the exam. Remember to *show your work* and *explain your answers* on all problems!

1. In this problem, let the universal set be $U = \{1, 2, 3, 4, 5\}$ and let $A = \{1, 3, 4\}$, $B = \{2, 4\}$. Write the following sets:

- (a) $(A \cap B)^c$ (this is also written $\overline{A \cap B}$ in the book)
(b) $B \setminus A$ (this is also written $B - A$ in the book)
(c) $(A \setminus B) \cup (B \setminus A)$

2. Write truth tables for $p \rightarrow q$ and $q \vee \neg p$. What does this tell you about the two propositions?

3. Convert this argument to a symbolic form, and determine (with explanation) if it is valid:

Hypotheses: If I woke up early, then I'll go for a run. I do not go for a run.

Conclusion: I did not wake up early.

4. Let $P(x)$ be the propositional formula " $x^2 \geq 1$," where the domain of discourse is the set \mathbb{R} of all real numbers. Write the proposition " $\neg(\forall x P(x))$ " in English words, and determine (with explanation) if it is true or false.
5. Give a direct proof of the following theorem: "The product of an even integer and any integer is an even integer."