

INCORRECT ANSWERS WITH NO WORK = NO PARTIAL CREDIT!

1. Suppose you know for a fact that if Joe a CS major, then Alice is a math major.
 - (a) What can you conclude if Alice is an art major?

 - (b) What can you conclude if Alice is a math major?

2. For each of the statements below, give a domain of discourse for which the statement is true. Be sure that your domain of discourse is well-defined.
 - (a) $\forall x \exists y (x \cdot y \neq 0)$.

 - (b) $\forall x \forall y \forall z (x + y + z > 0)$.

3. Let $A = \{1, 2, 3, 4, 5\}$, $B = \{2, 4, 6, 8, 10\}$, and $C = \{4, 5, 6, 7\}$. Also, assume you are working with the universe $\mathcal{U} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$.
 - (a) Find \overline{B} .

 - (b) What is the cardinality of $B \times C$?

 - (c) Find $A \setminus B$.

 - (d) Find $A \cap (B \cup C)$.

4. Determine if each statement is true or false.

- (a) TRUE FALSE $f : \mathbb{N} \rightarrow \mathbb{N}$, $f(x) = 2x + 1$ is injective.
- (b) TRUE FALSE $f : \mathbb{N} \rightarrow \mathbb{Z}$, $f(x) = 2x + 1$ is injective.
- (c) TRUE FALSE $f : \mathbb{Z} \rightarrow \mathbb{Z}$, $f(x) = 2x + 1$ is surjective.
- (d) TRUE FALSE $f : \mathbb{R} \rightarrow \mathbb{R}$, $f(x) = 2x + 1$ is surjective.

5. At the Easy Street Pizza Parlor, you can make a pizza by choosing one of four types of meat, one of five different vegetables, and one of three different cheeses. How many different pizzas can you order?

6. Let $S = \{1, 2, 3, 4, 5, 6\}$.

(a) How many subsets are there in total?

(b) How many subsets have $\{2, 3, 5\}$ as a subset?

(c) How many subsets contain exactly one even number?

7. How many anagrams are there of the word “twitter” that start with the letter “e”?

8. How many ways are there to get a full house in poker?
9. Out of 12 students, I need to select 4 for a team to enter a combinatorics competition!
In addition, I need one student to be captain of the team.
- (a) How many ways can I do this if I first select the four students, and then select the captain from among them? (Do not just write an answer; write the appropriate combination/permutation you would use to make the calculation.)
- (b) How many ways can I do this if I first select the captain from among the students, and the three others on the team? (Do not just write an answer; write the appropriate combination/permutation you would use to make the calculation.)
- (c) Are your answers to the previous two questions the same or different? Explain.

10. You have ten identical Rubik's cubes, and you want to put them in three different boxes.

(a) How many ways can you do this if there are no restrictions?

(b) How many ways can you do this if each box must contain at least one cube?

(c) How many ways can you do this if no box can hold more than four cubes?

EXTRA CREDIT: You have 10 cookies which you want to give to four children named Ann, Bob, Cal, and Dee. However, you want to give Ann and Dee *at least* one cookie each, and you want to give Cal *more* cookies than Bob. In many ways can you do this?