Sets & Stuff

In groups, open your own Sage Notebook and work on the following. You are free to work with a copy of "Sage Examples" (posted on the class webpage).

1. Enter the sets A, Z, and B defined in class into sage. Also create the set $C = \{x^2 | x \in \mathbb{Z} \wedge 0 \leq x^2 \leq 10000\}$ in sage.

   Definition 1. *The* cardinality *of a finite set X is equal to the number of elements in the set X and is denoted as $|X|$.*

   Sage 1. *If X is a Set, then $|X|$ can be found with "X.cardinality()". If Y is a list, then the length can be returned with "len(Y)".*

2. Find each of the following:

   (a) the number of elements in the set A.

   (b) $|Z|$

   (c) the cardinality of the set C.

   Definition 2. *Let X and Y be sets. The* Cartesian product *of X and Y, denoted by $X \times Y$, is the set of all ordered pairs $[x, y]$ where $x \in X$ and $y \in Y$.*

   Sage 2. *If X and Y are sets then $X \times Y$ can be found with "CartesianProduct(X,Y)".*

3. Write out 10 elements from $C \times B$ and 2 elements from $B \times C$.

4. Find $|C \times B|$.

   Definition 3. *Given a set X, the* power set *of X is the set of all subsets of the set X and is denoted by $\mathcal{P}(X)$*

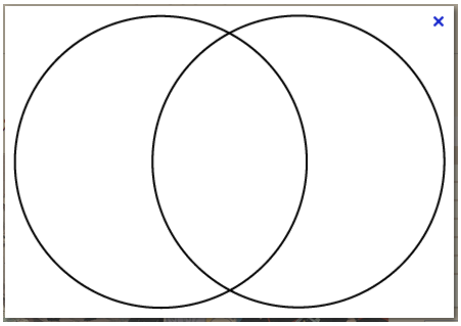
   Sage 3. *If X is a set then Sage needs to uses a hash to create $\mathcal{P}(X)$. The command "list(powerset(X))" returns a* list *instead of a* Set.

5. Write down $\mathcal{P}(\{2, 3, -4, 5, 6.3, 1/2, 42\})$.

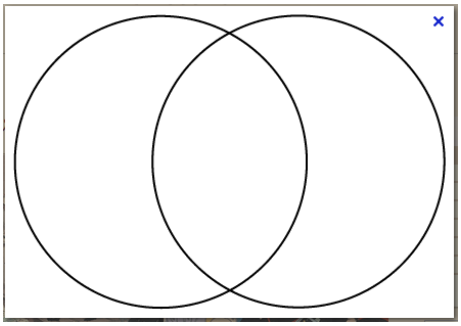
6. Find $|\mathcal{P}(\{2, 3, -4, 5, 6.3, 1/2, 42\})|$ and $|\mathcal{P}(B)|$. Be Careful!!

7. Consider the sets S and T within the Universal set U. For each of the following, identify the regions on the Venn diagram and determine if any of them are describing the same set.

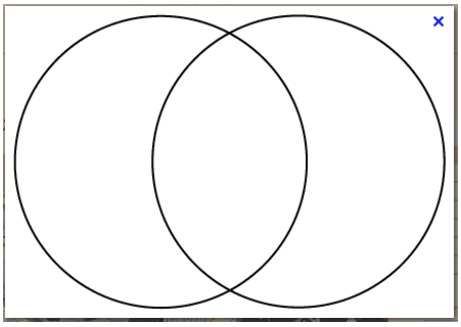
(a) S



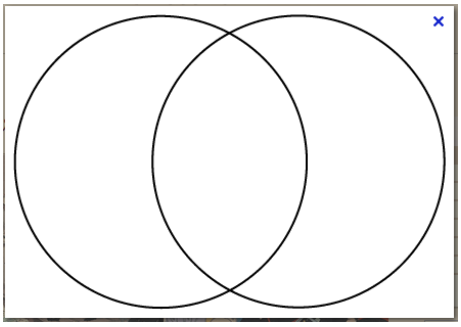
(b) $\overline{(\overline{S})}$



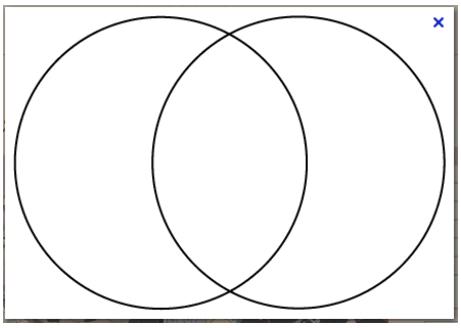
(c) $\overline{S \cap T}$



(d) $\overline{S \cup T}$



(e) $\overline{S} \cap \overline{T}$



(f) $\overline{S} \cup \overline{T}$