Name: Shivani Patel GSI: Madeline Brandt DISC #: 103

Math 55, Handout 5.

SETS.

1.1. A **set** is an unordered collection of objects and can be specified/used as a roster method

Q1. List five most commonly used sets in mathematics and explain where our notation in class will differ from the notation in the book.

$\mathbb{N}$:= the set of all natural numbers
$\mathbb{Z}_+$:= the set of all non-neg ints.
$\mathbb{Z}$:= $\{\ldots -2, -1, 0, 1, 2 \ldots\}$ the set of all ints
$\mathbb{Q}$:= $\{p/q \mid p \in \mathbb{Z}, q \in \mathbb{Z}, \text{and } q \neq 0\}$ the set of all rational #s
$\mathbb{R}$:= the set of all real numbers
Differences - we will include 0 in $\mathbb{Z}_+$, we will not include 0 in the $\mathbb{N}$

1.2. Two sets are **equal** if and only if they have the same elements. A and B are sets, then A and B are equal if and only if $\forall x\, (x \in A \leftrightarrow x \in B)$. We write $A = B$ if A and B are equal sets.

1.3. A is a **subset** of B means every element of A is also in B (denoted as $A \subseteq B$)

1.4. A is a **proper subset** of B means A is a subset of B but $A \neq B$ (denoted as $A \subset B$)

THE SIZE OF A SET.

2.1. All sets are either finite or infinite.

The **cardinality** of a finite set is the number of its distinct n elements in the set (denoted as $|S|$)

2.2. The **power set** $\mathcal{P}(S)$ of a set S is the set of all subsets of the set S

Q2. If $|S| = n$, what is $|\mathcal{P}(s)|$? Why?

n because n represents the cardinality of s therefore the power set of S is 2^. This is true because every element is a subset and cardinality counts the subsets

2.3. The **Cartesian product** of sets $S_1, \ldots, S_k$ is the set of ordered n-tuples $(a_1, a_2, a_3 \ldots a_n)$ where a_i belongs to A_i for $i = 1, 2, \ldots n$ In other words: $A_1 \times A_2 \times \cdots \times A_n = \{(a_1, a_2, \ldots a_n) \mid a_i \in A_i \text{ for } i = 1, 2, \ldots n\}$

Q3. How does $|S_1 \times S_2 \times \cdots \times S_k|$ depend on $|S_1|, |S_2|, \ldots, |S_k|$? Why?

$|S_1 \times S_2 \times \cdots \times S_k| = |S_1||S_2| \cdots |S_k|$ product bc this exhausts all possible combos of elements in $S_1, S_2 \cdots S_k$

TRUTH SETS.

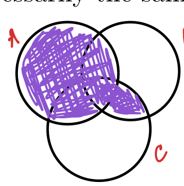
Q4. Let $P(x)$ be "$|x| < |x - 1|$". What is the truth set $\{x \in \mathbb{R} \mid P(x)\}$?

the set of real #s such that $P(x) = |x| < |x-1|$ is true. the truth set of $\{x \in \mathbb{R} \mid P(x)\}$ is all $x < 0.5$.

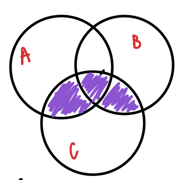
3.1. The **union** of two sets is the set that contains those elements that are either in A or in B or in both

3.2. The **intersection** of two sets is the set containing those elements in both A and B

Q5. Draw a Venn diagram for $A \cup (B \cap C)$ and for $(A \cup B) \cap C$. Are these necessarily the same sets?



$A \cup (B \cap C)$



$(A \cup B) \cap C$

These are not the same according to the venn Diagrams to the left. the

3.3. The **difference of two sets** is the set containing those elements that are in A but not in B.

3.4. The **complement** of a set is the complement of A with respect to U. (Denoted by A) Therefore, the complement of the set A is U-A