MATH230 Week 2 Worksheet - Basics of Sets

The following problems are on notation and single-set properties. For 1-3, convert to set-builder notation. For 4-6, roster notation. For 7-8, determine true or false; A is an arbitrary set.

1: The set of football teams in the NFL

2: $\{3,4,5,6,7\}$

3: $\{1,3,5,7,...,99\}$

4: $\{x \mid x$ is a digit in the number $352646\}$

5: $\{x \mid x$ is a letter in HIPPOPOTAMUS$\}$

6: $\{x \mid 2-x = 4$ and x is an integer$\}$

7a: $\{a, b, c\} = \{b, c, a\}$, **7b:** $A \in A$, **7c:** $0 \in \emptyset$, **7d:** $\emptyset \in \emptyset$, **7e:** $0 = \emptyset$, **7f:** $\{\emptyset\} = \emptyset$

8a: $\{a,b\} \in \{a,b,c\}$, **8b:** $\{a,b\} \subseteq \{a,b,c\}$, **8c:** $\emptyset \subseteq A$, **8d:** $\{a,b\} \subseteq \{a, \{b,a\}\}$

9: List all subsets of $\{1,2,3,4\}$. How many are there? How many are proper?

10: Determine all pairs of sets among $\emptyset$, $\{1\}$, $\{1,2\}$, $\{1, a\}$, $\{a, b, 2\}$ which are disjoint.

The following problems cover interactions between multiple sets.

11: Simplify the following: $(A^c)^c$ n A, $((A^c$ n $B^c)^c$ u $B)^c$, $(A$ u B^c u $C)^c$ u $(C^c$ u $C)^c$

12: Let $U = \{1, 2, 3, 4, 5, 6, 7\}$, $A = \{1, 2, 3\}$, $B = \{3, 4, 5, 6\}$, and $C = \{2, 3, 4\}$. Find the following sets: A^c, A u B, B n C, $(A$ u $B)$ n C, $(A$ n $B)$ u C, A^c n $(B$ u $C)^c$.

13: If $|A| = 4$, $|B| = 5$, and $|A$ u $B| = 9$, find $|A$ n $B|$.

14: Let A, B be subsets of a universal set U and suppose $|U| = 100$, $|A| = 60$, $|B| = 40$, and $|A$ n $B| = 20$. Compute $|A$ u $B|$, $|A$ n $B^c|$, $|A^c$ n $B|$.

If you want extra practice, here are some harder problems

15: How many subsets does $\{a, b, c, \ldots, x, y, z\}$ have?

16: Prove $|A$ u B u $C| = |A|+|B|+|C|-|A$ n $B|-|A$ n $C|-|B$ n $C|+|A$ n B n $C|$

17: Find exactly when $|A$ u B u $C| = |A| + |B| + |C|$ is true

18: Expand out, then simplify $(x-a)(x-b)(x-c)...(x-z)$

Even more problems. If you have nothing better to do, try 20.

19: If $|A| = |B| = 12$, $|A$ n $B| = |A$ n $C| = 5$, $|B$ n $C| = 4$, $|A$ n B n $C| = 2$, $|A$ u B u $C| = 25$, find $|C|$.

20: $A_1, \ldots, A_n \subseteq \{1, 2, \ldots, 420\}$ are n subsets with $|A_i|$ odd and $|A_i$ n $A_j|$ even for any $i \neq j$. What's the largest value of n that's possible?