Name: Solutions

Directions: Show all work. No credit for answers without work. Unless otherwise specified, you may leave your answers in terms of factorials and binomial/multinomial coefficients.

1. **[5 parts, 2 points each]** Let $A = \{1, 2, 3\}$, $B = \{\{1, 2, 3\}\}$, $C = \{\{1, 2\}, 3\}$, and $D = \{\varnothing\}$.

   (a) Determine the sizes of A, B, C, and D.

   $|A| = 3$ (3 integers) $\quad |C| = 2$ (1 set, 1 integer)

   $|B| = 1$ (1 set) $\quad |D| = 1$ (1 set)

   (b) Find $A \cap B$.

   Since the elements in A are integers and the elt in B is a set,

   $$A \cap B = \boxed{\varnothing}$$

   (c) Find $C - A$.

   $$C - A = \boxed{\{\{1,2\}\}}$$

   (d) Find $\mathcal{P}(C)$.

   $C = \{\underbrace{\{1,2\}}_{a}, \underbrace{3}_{b}\} = \{a, b\}$

   $$\mathcal{P}(C) = \{\varnothing, \{a\}, \{b\}, \{a,b\}\} = \boxed{\{\varnothing, \{\{1,2\}\}, \{3\}, \{\{1,2\}, 3\}\}}$$

   (e) Find $\mathcal{P}(B) \triangle D$.

   $B = \{\underbrace{\{1,2,3\}}_{a}\} = \{a\}$

   $\mathcal{P}(B) = \{\varnothing, \{a\}\} = \{\varnothing, \boxed{\{\{1,2,3\}\}}\}$ ($\varnothing$: in both; $\{\{1,2,3\}\}$: in one)

   $D = \{\varnothing\}$

   $$\mathcal{P}(B) \triangle D = \boxed{\{\{\{1,2,3\}\}\}}$$

   Recall: symmetric difference is the elts in exactly one of the sets