

# Worksheet 1 Review

Hyungmo Gu

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## Question 1

- a.  $A^c = \{1, 3, 4, 6\}$
- b.  $A = U \setminus A$
- c.  $A^c \cap B^c = \{x \mid x \in U, x \leq 0 \text{ and } x \geq 4\}$   
 $A^c \cup B^c = \{x \mid x \in U, x < 1 \text{ and } x > 2\}$   
 $(A \cap B)^c = \{x \mid x \in U, x < 1 \text{ and } x > 2\}$   
 $(A \cup B)^c = \{x \mid x \in U, x \leq 0 \text{ and } x \geq 4\}$

### Correct Solution:

$$A^c \cap B^c = \{x \mid x \in U, x \leq 0 \text{ or } x \geq 4\}$$

$$A^c \cup B^c = \{x \mid x \in U, x < 1 \text{ or } x > 2\}$$

$$(A \cap B)^c = \{x \mid x \in U, x < 1 \text{ or } x > 2\}$$

$$(A \cup B)^c = \{x \mid x \in U, x \leq 0 \text{ or } x \geq 4\}$$

It follows from above that  $A^c \cap B^c = (A \cup B)^c$  and  $A^c \cup B^c = (A \cap B)^c$

## Question 2

- a.  $T_0 = \{3, 6, 9, \dots\}$   
 $T_1 = \{1, 4, 7, \dots\}$   
 $T_2 = \{2, 5, 8, \dots\}$   
 $T_3 = \{6, 12, 18, \dots\}$
- b. A partition of  $\mathbb{Z}$  is  $\{T_0, T_1, T_2\}$ .

All four sets can't be used because elements in  $T_3$  overlaps with  $T_0$ . A partition cannot have any elements in common.

**Notes:**

- **Definition of Partition:** Let  $A$  be a set. A (finite or infinite) collection of nonempty sets  $\{A_1, A_2, A_3\}$  is called a **partition** of  $A$  when (1)  $A$  is the union of all of the  $A_i$ , and (2) the sets  $A_1, A_2, A_3, \dots$  do not have any element in common.

### Question 3

- a. All strings over the alphabet  $\{0, 1\}$  of length three are

000, 100, 010, 001, 110, 101, 011, 111

- b.  $S_1 = \{aa, ab, ac, ba, bb, bc, ca, cb, cc\}$

$$S_2 = \{a, b, c, aa, bb, cc, \dots\}$$

$$S_1 \cap S_2 = \{aa, bb, cc\}$$

$$S_1 \setminus S_2 = \{ab, ac, ba, bc, ca, cb\}$$

- c.  $S_1 = (S_1 \cap S_2) \cup (S_1 \setminus S_2)$

d.

	$\lfloor x \rfloor$	$\lceil x \rceil$
$\frac{25}{4}$	6	7
0.99	0	1
-2.01	-3.0	-2.0

**Notes:**

- floor of a negative number: ceiling but with negative sign
- ceiling of a negative number: floor but with negative sign

### Question 4