Problem 1. (2 points)
Let \( A = \{ x : x \in \mathbb{Z} \text{ and } x \leq 0 \} \). Circle all that you think are correct:
   (b) \( 0 \in A \)
   (d) \( -1118 \in A \)

Problem 2. (2 points)
Which other way(s) can we write the set \( B = \{1, 2, 3, 4, 5\} \)? Circle all that you think are correct:
   (b) \( B = \{ x : x \in \mathbb{N} \text{ and } x \leq 5 \} \)
   (d) \( B = \{ x : x \in \mathbb{N} \text{ and } x < 6 \} \)

Problem 3. (2 points)
Suppose that \( A = \{1, 2, 3\}, B = \{3, 2, 1, 14\}, \) and \( C = \{0, 1, 14, 2\} \). Circle all that you think are correct:
   (c) \( \emptyset \subseteq A \)
   (d) \( A \subseteq B \)

Problem 4. (2 + 2 = 4 points)
Let \( D = \{4, -13\} \). What is \( |D| \)? Write down the power set of \( D \).
   \( |D| = 2 \). Power set of \( D \) is \( \{ \emptyset, \{4\}, \{-13\}, \{4, -13\} \} \).

Problem 5. (2 + 2 = 4 points)
Let universal set \( U = \{\text{apple, orange, grape, plum, chocolate}\} \).
Let \( X = \{\text{apple, orange}\} \), and \( Y = \{\text{chocolate}\} \). Write down \( X' \) and \( Y' \).

   \( X' = \{\text{grape, plum, chocolate}\} \). \( Y' = \{\text{apple, orange, grape, plum}\} \).
Problem 6. (2 points)
Represent the elements floyd, doors, doors, beatles, carpenters, doors, beatles as a multi-set.

\[ \{ (floyd, 1), (doors, 3), (beatles, 2), (carpenters, 1) \} \].

Problem 7. (Boolean Algebra) (5 points)
If Boolean variable \( A = F \), \( B = T \), and the value of \( C \) is unknown,

(a) What is the value of \( \sim (\sim A) \)? \( F \)

(b) What is the value of \( A.T \)? \( F \)

(c) What is the value of \( C.F \)? \( F \)

(d) What is the value of \( B + B \)? \( T \)

(e) What is the value of \( C + \sim C \)? \( T \)

Problem 8. (Boolean Algebra) (2 + 2 = 4 points)
Suppose Google comes to the PSU campus for internship interviews. Let us say, that for any PSU student, a Boolean variable \( A \) implies “GPA > 3.0”, \( B \) implies “Major is IST”, and \( C \) implies “Eats, drinks, and thinks Google”.

Example: \( A + B \) implies “Either has a GPA > 3.0 or is an IST Major”.

(a) What does the expression \( A.\sim C \) imply ?

Has GPA > 3.0 and does not eat, drink, think Google
(Variations that essentially mean the same thing are acceptable)

(b) If Google wishes to interview all students who either have a GPA of less than or equal to 3.0 or those IST majors who eat, drink, and think Google, what Boolean expression is appropriate ?

\( \sim A + (B.C) \) OR \( \sim A + B.C \) (both acceptable)