

## Quiz Questions: Sets and Functions

---

- Let  $S = \emptyset$ . Which of the following is not a subset of  $\mathcal{P}(\mathcal{P}(S))$  (The power set of the power set of  $S$ )?
  - $\emptyset$
  - $\{\emptyset\}$
  - $\{\{\emptyset\}\}$
  - $\{\emptyset, \{\{\emptyset\}\}\}$
- If you need to prove that  $S$  is a proper subset of  $T$ , it is sufficient to show which of the following?
  - $|T - S| > 0$
  - $|S| < |T|$
  - There is an element of  $T$  that is not an element of  $S$
  - None of these
- According to De Morgan's laws  $\overline{A \cup (B \cap C)} =$ 
  - $\overline{A} \cap (B \cap C)$
  - $\overline{A} \cup (\overline{B} \cap \overline{C})$
  - $\overline{A} \cap (\overline{B} \cup \overline{C})$
  - $\overline{A} \cup (B \cap C)$
- Which of these rules defines a function  $f$  from the set of all letter strings of length 6 to the set  $\{1,2,3,4,5,6\}$ ?
  - The number of vowels in the string. For example,  $f(TAZNAV) = 2$ .
  - The reverse of the string. For example,  $f(BAQKDU) = UDKQAB$ .
  - The number of distinct letters in the string. For example,  $f(TNVRRN) = 4$ .
  - The position in which the first  $Z$  occurs. For example,  $f(PPABZY) = 5$ .
- Suppose  $f: A \rightarrow B$  is a function. Which one of these statements is true?
  - If  $a_1$  and  $a_2$  are distinct elements of  $A$ , then  $f(a_1) \neq f(a_2)$ .
  - If  $b \in B$ , then there is at least one element  $a \in A$  such that  $f(a) = b$ .
  - If  $b \in B$ , then there is exactly one  $a \in A$  such that  $f(a) = b$ .
  - For each element  $a \in A$ , there is exactly one element  $b \in B$  such that  $f(a) = b$ .
- Let  $f: A \rightarrow B$  where  $B = \{0,1,4,9\}$  and  $f$  is defined by the rule  $f(x) = x^2$ . For which set  $A$  is " $f$ " a correctly defined function from  $A$  to  $B$  and one-to-one
  - $\{1,2,3\}$
  - $\{-3,-1,0,2,3\}$
  - $\{0,1,4,9\}$

D.  $\{-1,0,1,2\}$

7. Let  $S$  be the set of all bit strings of length at least 2. Which of the following functions  $f: S \rightarrow S$  is NOT one-to-one?
- A. The string  $s$  with a 1 bit appended at the end
  - B. The string obtained by moving all 0's (if any) in  $s$  to the end of the string.
  - C. The reversal of  $s$ . (For example,  $f(110) = 011$ .)
  - D. The string obtained from interchanging 0's and 1's.
8. Suppose  $f: \mathbf{R} \rightarrow \mathbf{R}$  has the following property for all real numbers  $x$  and  $y$ : if  $x < y$  then  $f(x) < f(y)$ . Which is true?
- A.  $f$  must be 1-1 but is not necessarily onto  $\mathbf{R}$ .
  - B.  $f$  is onto  $\mathbf{R}$ , but is not necessarily 1-1.
  - C.  $f$  must be both 1-1 and onto  $\mathbf{R}$ .
  - D.  $f$  is not necessarily 1-1 and not necessarily onto  $\mathbf{R}$ .