Kennesaw State University

College of Computing and Software Engineering

Department of Computer Science

Mathematical Structures for Computer Science

CS5070 Assignment 2

1. Find the truth value of the logical expression:

$$\mathcal{P}(A \cup B) = \mathcal{P}(A) \cup \mathcal{P}(B)$$

2. With sets $A = \{3, 4\}$, $B = \{x, y, z\}$, $C = \{a, b\}$, write the Cartesian product $A \times B \times C$.

3. With set $B = \{1, 2, 2, 4, 5, 6, 7\}$, write the power set of B.

4. (a) Write the set expression for all even integer numbers greater than 26 and less than 50.

   (b) Determine the cardinality of the set

5. With set $A = \{1, 2, 3, 4, 5, 6, 7\}$, Find all sets $B \in \mathcal{P}(A)$ that have the property $\{2, 3, 5\} \subseteq B$.

6. Given A_2 the set of all multiples of 2 except for 2 and A_3 the set of all multiples of 3 except for 3, and so on, so that A_n is the set of all multiples of n except for n, for any $n \geq 2$. Describe (in words) the set $\overline{A_2 \cup A_3 \cup A_4 \cup \cdots}$

   Hint: It might help to think about what the union $A_2 \cup A_3$ is first. Then think about what numbers are *not* in that union. What will happen when you also include A_5 ?

7. The following functions all have domain $\{1, 2, 3, 4, 5\}$ and codomain $\{1, 2, 3\}$. For each, determine whether it is (only) injective, (only) surjective, bijective, or neither injective or surjective.

(a)

$$f = \begin{array}{|c|c|c|c|c|} \hline 1 & 2 & 3 & 4 & 5 \\ \hline 1 & 2 & 1 & 2 & 1 \\ \hline \end{array}$$

(b)

$$f = \begin{array}{|c|c|c|c|c|} \hline 1 & 2 & 3 & 4 & 5 \\ \hline 1 & 2 & 3 & 1 & 2 \\ \hline \end{array}$$

(c)

$$f(x) = \begin{cases} x, & \text{if} x \leq 3 \\ x - 3, & \text{if} x > 3 \end{cases}$$

8. Suppose $f: \mathbb{N} \mapsto \mathbb{N}$ satisfies the recurrence $f(n+1) = f(n) + 3$. For each of the initial conditions below, find the value of $f(5)$.

   (a) $f(0) = 0$
   (b) $f(0) = 1$
   (c) $f(0) = 2$
   (d) $f(0) = 100$