Worksheet 5

CS 2210 Discrete Structures

Due 2/26 9pm. Late submissions get grade 0.

* Teams of 3-4 students (must work in group). Follow directions given during discussion.
** This page is double sided. Make sure to do both sides.

Name1: Cobin Bliss Name 2: Colin Cano

Name3: Hongwei Zhou Name 4:

Question 1: Let sequence $\{a_n\}$ be -8, -3, 2, 7, … ($a_1 = -8$)

a. Find a_8

$a_n = \{-8, -3, 2, 7, 12, 17, 22, 27\}$

$a_8 = 27$

b. Find $\sum_{i=3}^{8} a_n$

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c. Find recursive formula for a_n.

$a_n = a_{n-1} + 5$

d. Find explicit (iterative) formula for a_n.

$a_n = 5n - 13$

Question 2: Find $\sum_{i=0}^{100} 6 \cdot 2^i$. Hint: Use formula from section 2.4.

$$\frac{6 \cdot 2^{101} - 6}{2 - 1} = 6 \cdot 2^{100} - 6$$

Question 3: Determine whether each of these sets is countable or uncountable. For those that are countably infinite, exhibit a one-to-one correspondence between the set of positive integers and that set. Explain/proof when can why it is 1-1 correspondence.

(a) All bit strings not containing the bit 0. $\{1, 11, 111, 1111 \dots\}$

Countable ✓ yes because it can be put in a list.

One-to-one ✓ yes $f(a) = f(b)$, $a = b$. $a, b \in S$, $f(a)^n = f(b)^n$

$a = b$

Onto X no because it cannot represent all numbers.

(b) All positive rational numbers that cannot be written with denominators less than 4.

Countable ✓ yes because it can be represented like this → $\frac{1}{4}\ \frac{2}{4}\ \frac{3}{4} \dots$

$\frac{1}{5}\ \frac{2}{5}\ \frac{3}{5} \dots$

one-to-one ✓ each positive integer can be represented by only one value of the set.

onto ✓ yes because every positive $\mathbb{Z}$ can be represented.

(c) The real numbers not containing 0 in their decimal representation

Countable X real numbers are not countable

$\{4.1,\ 4.111,\ 4.123,\ 5.2512\}$

(d) The real numbers containing only a finite number of 1s in their decimal representation

countable ✓ can be mapped to a one-to-one corespondence set with set of finite length seq-ences

one-to-one ✓ yes because each element $\in N$ can be represent by exactly one number in the set.

onto ✓ yes because all positive integers can be represented.

$\{0.239,\ 1.1235,\ 1.231567\}$