

CSE 20

DISCRETE MATH

Fall 2020

<http://cseweb.ucsd.edu/classes/fa20/cse20-a/>

Today's learning goals

- Define data types: set, string (over specific alphabet)
- Define sets and functions in multiple ways



Women In Computing

"We're coders and engineers - of all genders - who support the female presence in computing."

Bloomberg
x
RESUME REVIEW

Tuesday, October 6 at 10:00 P.M.
Come join our Resume Review Workshop & Networking event with Bloomberg! Have your resume reviewed and learn more about Bloomberg and their 2021 Software Engineering roles.

Register to learn how you can speak with a Bloomberg Software Engineer at the event as well!

UCSD CSE

Tuesday, October 8

FALL GBM #1

Wednesday, October 7 at 4:30 P.M. - 6:00 P.M.
Come meet Women in Computing @ UCSD at our first General Body Meeting of the year!

We will go over what WIC does as an org, how you can get involved and play some games to get to know each other!

UCSD CSE

Wednesday, October 9

**BUILD YOUR OWN
PIN MIXER**

Thursday, October 8 at 6:30 P.M.
Meet with members and bond by designing pins together! We will also have some ice breaker games we'll be playing as well!

UCSD CSE

Thursday, October 10

wic.ucsd.edu/links

wic.ucsd.edu/discord

Types

- set: unordered, repetition doesn't matter
- n-tuple: ordered, repetition matters, fixed length
- string: ordered, repetition matters, arbitrary finite length

Term	Examples:
set unordered collection of elements <i>Equal means agree on membership of all elements</i>	(add additional examples from class) $7 \in \{43, 7, 9\}$ $2 \notin \{43, 7, 9\}$
n-tuple ordered sequence of elements with n "slots" <i>Equal means corresponding components equal</i>	
string ordered finite sequence of elements each from specified set <i>Equal means same length and corresponding characters equal</i>	

Numbers, sets of numbers, tuples of numbers

Find an example of a set that has 0 as an element.

- A. $\{-1, 1\}$
- B. $\{0, 0\}$
- C. $\{-1, 0, 1\}$
- D. \mathbb{Z}
- E. \mathbb{N}

Numbers, sets of numbers, tuples of numbers

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Bonus: \emptyset

$$\{x \in \mathbb{Z} \mid x > 0\}$$

Which of the sets above are defined using the roster method? Which are defined using set builder notation?

Numbers, sets of numbers, tuples of numbers

How many **different** 2-tuples are there whose elements may be -1, 0, or 1?

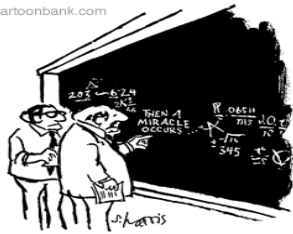
“different” or “distinct” or “unequal”

- A. 2
- B. 3
- C. 6
- D. 8
- E. 9

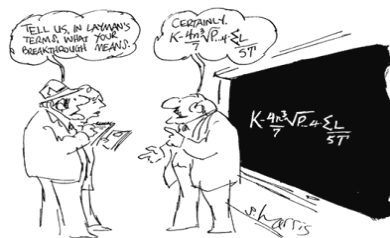
Recurring examples in CSE 20

- Netflix ratings and machine learning
 - Bonus: <https://research.netflix.com/research-area/recommendations>
- RNA and DNA: genomics and bioinformatics
- Codes: secret messages and error correction
- “Under the hood” of computers (e.g. circuits, color representation, data structures)

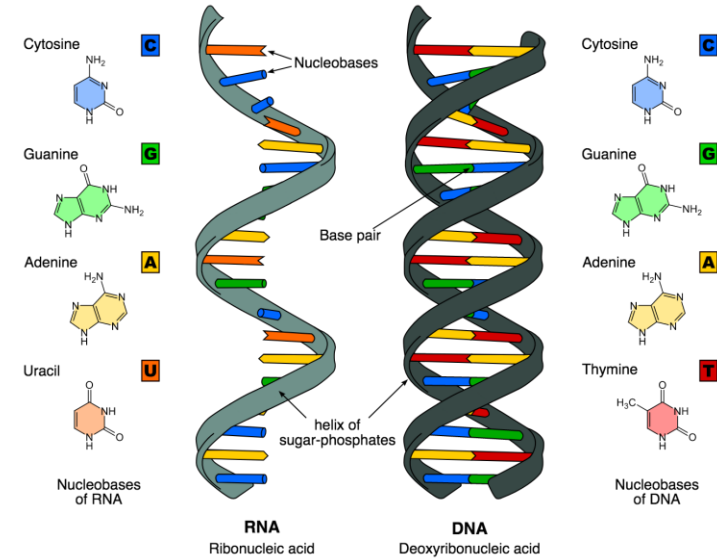
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"I think you should be more explicit here in step two."



RNA strands as strings



Each RNA strand is a **string** whose symbols are elements of the set $B = \{A, C, G, U\}$.

Definition by recursion

New! Recursive Definitions of Sets: The set S (pick a name) is defined by:

Basis Step: Specify finitely many elements of S

Recursive Step: Give a rule for creating a new element of S from known values existing in S , and potentially other values.

Definition The set of RNA strands S is defined (recursively) by:

$$B = \{A, C, G, U\}$$

Basis Step: $A \in S, C \in S, U \in S, G \in S$

Recursive Step: If $s \in S$ and $b \in B$, then $sb \in S$

Two different RNA strands:

Defining sets

- Roster method
- Set builder notation
- Definition by recursion
- **New** Applying operations to other sets
 - Cartesian product, set-wise concatenation

$$B = \{A, C, G, U\}$$

Set

Example elements in this set:

Fill in possible set

(A, C) (U, U)

$$B \times \{-1, 0, 1\}$$

Fill in example elements

$$\{-1, 0, 1\} \times B$$

Fill in example elements

(0, 0, 0)

Fill in possible set

$$\{A, C, G, U\} \circ \{A, C, G, U\}$$

Fill in example elements

Fill in possible set

GGGG

Defining functions

A function is defined by

- (1) domain Nonempty set
- (2) codomain Nonempty set
- (3) rule assigning each element in the domain exactly one element in the codomain Table, formula, etc.

Notation:

Defining functions recursively when domain is recursively defined

Definition (Of a function, recursively) A function $rnalen$ that computes the length of RNA strands in S is defined by:

$$\begin{array}{ll} \text{Basis Step:} & \text{If } b \in B \text{ then} & rnalen : S & \rightarrow \mathbb{Z}^+ \\ & & rnalen(b) & = 1 \\ \text{Recursive Step:} & \text{If } s \in S \text{ and } b \in B, \text{ then} & rnalen(sb) & = 1 + rnalen(s) \end{array}$$

The domain of $rnalen$ is _____ . The codomain of $rnalen$ is _____ .

$$rnalen(\text{ACU}) = \underline{\hspace{15em}}$$

For next time

- Read website carefully

<http://cseweb.ucsd.edu/classes/fa20/cse20-a/>

- Make sure you can access course tools: Canvas, Piazza, Gradescope
- Next pre-class reading
 - Section 4.2, Examples 1 and 2 pp. 246-247