

Select all and only the sets below that have 0 as an element.

$\{-1, 1\}$  0 is not an element

$\mathbb{Z}$   $\{\dots, -2, -1, 0, 1, 2, \dots\}$  Set:

$\{0, 0\}$

$\mathbb{Z}^+$   $\{1, 2, 3, \dots\}$

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

$\mathbb{N}$   $\{0, 1, 2, 3, \dots\}$

- unordered collections  
- there can be repeated elements  
 $\{ \leftarrow, \rightarrow, \rightarrow \}$

Select all and only the sets below that have the ordered pair (2, 0) as an element.

$\{x \mid x \in \mathbb{N}\}$  is an element in  $\{0, 1, 2, 3, \dots\}$

$\{(x, x) \mid x \in \mathbb{N}\}$

$x=0$   $(0, 0)$     $x=1$   $(1, 1)$     $x=3472$   $(3472, 3472)$

$\{(x, x-2) \mid x \in \mathbb{N}\}$

$x=0$   $(0, -2)$     $x=1$   $(1, -1)$     $x=2$   $(2, 0)$

$\{(x, y) \mid x \in \mathbb{Z}, y \in \mathbb{Z}\}$

$\{(x, y) \mid x \in \mathbb{Z}, y \in \mathbb{Z}^+\}$

$x=2$   $y=0$   $(2, 0)$

$y$  could never be 0

Week 1 Notes  
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Term	Notation	Example(s)	We say in English ...
all reals	$\mathbb{R}$		The (set of all) real numbers (numbers on the number line)
all integers	$\mathbb{Z}$		The (set of all) integers (whole numbers including <u>negatives</u> , zero, and <u>positives</u> )
all positive integers	$\mathbb{Z}^+$		The (set of all) <u>strictly positive integers</u>
all natural numbers	$\mathbb{N}$		The (set of all) natural numbers. <u>Note</u> : we use the convention that <u>0 is a natural number</u> .



RNA is made up of strands of four different bases that encode genomic information in specific ways. The bases are elements of the set

$B \ni \{A, C, G, U\}$ . The set of RNA strands  $S$  is defined (recursively) by:

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  $sb \in S$

$A$   $\underbrace{AC}_s \underbrace{A \in S, U \in S}_{b \in B}$   $\underbrace{ACG}_s \underbrace{A \in S, U \in S}_{b \in B}$   
 $C \in B, U \in B$   $G \in B, U \in B$

A function  $rnaLen$  that computes the length of RNA strands in  $S$  is defined recursively in the class notes.

How many distinct elements are in the set described using set builder notation as  $\{x \in S \mid rnaLen(x) = 1\}$ ? *set contains elements in S where the length is 1*

4

A U C G

How many distinct elements are in the set described using set builder notation as  $\{x \in S \mid rnaLen(x) = 2\}$ ?

16

AA CA  
AC CC  
AU  
AG

How many distinct elements are in the set described using set builder notation as  $\{rnaLen(x) \mid x \in S \text{ and } rnaLen(x) \neq 2\}$ ?

1

{2}

How many distinct elements are in the set obtained as the result of the set-wise concatenation  $\{AA, AC\} \circ \{U, AA\}$ ?

4

{AAU, AAAA, ACU, ACA}

How many distinct elements are in the set obtained as the result of the Cartesian product  $\{AA, AC\} \times \{U, AA\}$ ?

4

{(AA, U), (AA, AA), (AC, U), (AC, AA)}

True or False: There is an example of an RNA strand that is both in the set obtained as the result of the set-wise concatenation  $\{AA, AC\} \circ \{U, AA\}$  and in the set obtained as the result of the Cartesian product  $\{AA, AC\} \times \{U, AA\}$ ?

ordered pairs string

When running the algorithm *logb* for calculating the integer part of base *b* logarithm with inputs  $b = 4$  and  $n = 25$ , which of the following calculations are helpful? Select all and only the calculations that are both relevant to the algorithm trace **and** are correct.

~~25 div 4 = 5~~

25 div 4 = 6

~~25 div 4 = 1~~

4 div 25 = 0

4 div 25 = 5

4 div 25 = 1

6 div 4 = 1

5 div 4 = 1

4 div 4 = 1

$$\log_b(4, 25) = \boxed{2}$$

$$i \quad \boxed{\cancel{2} \times \cancel{2}} \quad \text{with } 2 \text{ circled}$$

$$n \quad \boxed{\cancel{25} \times \cancel{1}} > b \quad \boxed{4}$$

$$25 \text{ div } 4 = \textcircled{6}$$

$$6 \text{ div } 4 = 1$$

Week 2 Notes  
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$\log_b(b, n) =$  greatest integer  $y$  so that  $b^y$  is less than or equal to  $n$

Calculating integer part of base  $b$  logarithm

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1  procedure logb(b,n: positive integers with b > 1)
2  i := 0
3  while n > b-1
4      i := i+1
5      n := n div b
6  return i {i holds the integer part of the base b logarithm of n}

```

*Handwritten note: 1 > 3 X*