

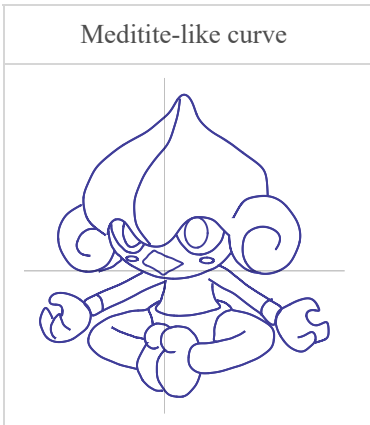
MATH:1260 Pokémath

The Mathematics of Pokémon Go[®]

Week 3 Monday, Spring 24

Popular curve:

Meditite-like curve



Plan for Today

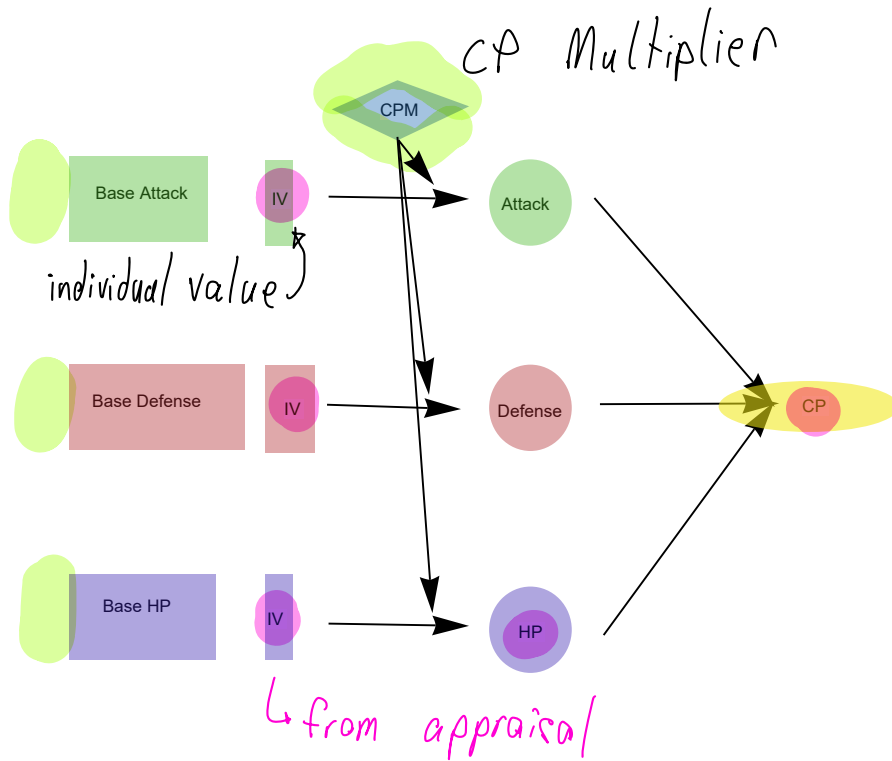
- Intro to Pokemon stats
 - Attack, Defense, HP
 - CP "Combat Power"
- Definition of a function

Class Reminders

- HW2 due Wednesday at midnight.
- GW3 in discussion Thursday.

- My office hour is right after class on Mondays

Stats in the code? What can you see? What can you look up?

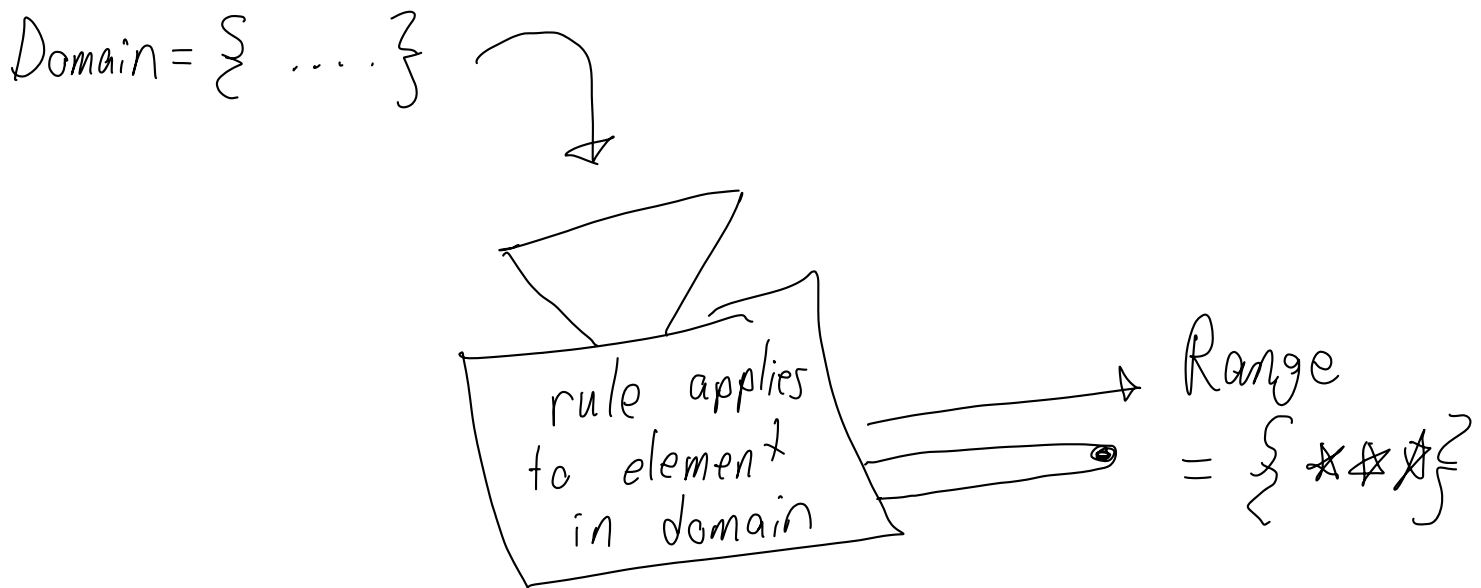


Functions

The arrows in the diagram above represent functions. What are functions?

Definition

A **function** consist of a **set** of inputs called the **domain**, a **set** of outputs called the **range** and a rule by which each input determines exactly one output.



Notation: Ways functions can be defined

Tables and charts

Example: [https://bulbapedia.bulbagarden.net/wiki/List_of_Pokémon_by_base_stats_\(GO\)](https://bulbapedia.bulbagarden.net/wiki/List_of_Pokémon_by_base_stats_(GO))

Formulas or calculation instructions

name of function (input) = directions of what to do to the input

$$f(x) = 2(x - 4)$$

$$g(x) = x^2$$

$$h(x) = 7$$

Descriptions

Domain = {Pokemon Types} Range = {Pokemon}

If you input a type, the function outputs the most recent Pokemon you caught with that type.

→ $D = \{\text{Pokemon in your bag}\}$ → $R = \{\text{CP | Pokemon}\}$

If you input a Pokemon from your bag, the function outputs the CP of that Pokemon.

The following is a description that looks like a function, but isn't. Can you spot what's wrong?


If you input a Pokemon from your bag, the function outputs the Type of that Pokemon.

→ If a Pokemon has 2 types, the function will give 2 outputs at once.

Let's try it on Top Hat.

Find Pokemon's Base Attack: a function example

Example: [https://bulbapedia.bulbagarden.net/wiki/List_of_Pokémon_by_base_stats_\(GO\)](https://bulbapedia.bulbagarden.net/wiki/List_of_Pokémon_by_base_stats_(GO))

Input			HP	Atk	Def
142		Aerodactyl	190	221	159
			Output		

Domain for the function?

$\{\text{Pokemon}\}$

Range for the function?




$\{\text{Number}\}$

new domain: {Pokemon / use community names}


Key Point!

Each input gives a single output. Does that change how you defined your domain?

same input different output

006		Charizard	186	223	173
006MX		Charizard (Mega Charizard X)	186	273	213
006MY		Charizard (Mega Charizard Y)	186	319	212

But it is still a function if different inputs give the same output!

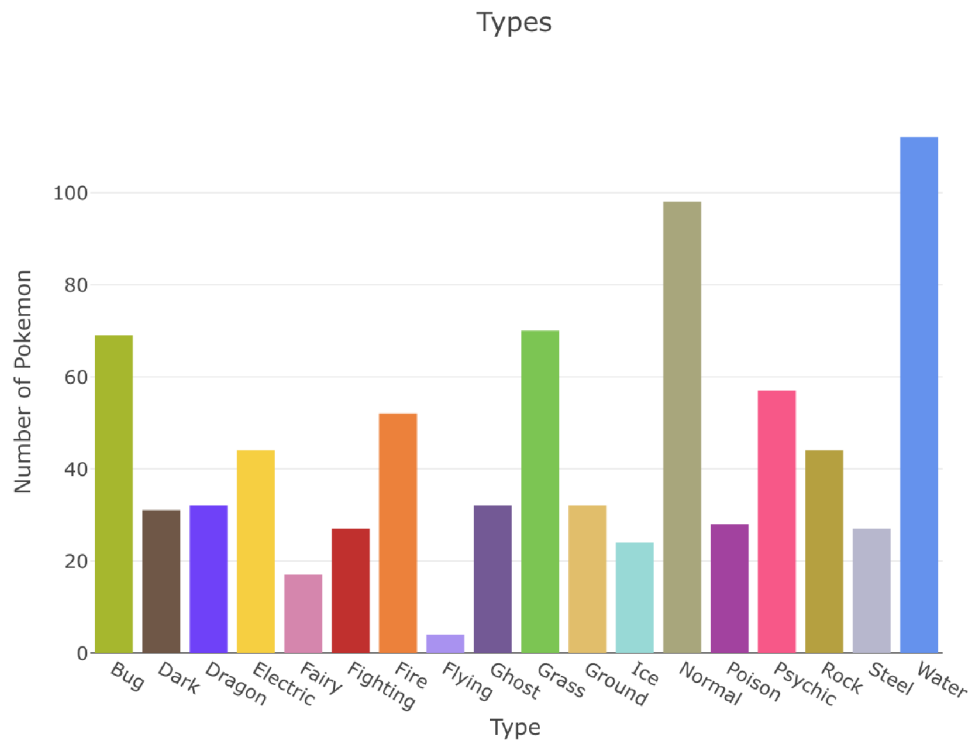
129		Magikarp	85	29	85
349		Feebas	85	29	85

Visualization?

<https://www.kaggle.com/lakshyaag/data-visualization-pokemon-data>

This is a bar graph of the number of pokémon® in the pokédex (generation 1-6) of each type.

It is a visualization of the function where you input a Pokemon type and it outputs the number of Pokemon in Generation 1-6 with that type.



Formulas or calculation instructions (these are what you see in algebra or calculus)

name of function (input) = directions of what to do to the input

$$f(x) = 2(x - 4)$$

Domain for the function?

$\{\text{Numbers}\} = \mathbb{R} \rightarrow \text{the real numbers}$

Range for the function?

\mathbb{R}

For formulas, unless otherwise stated, **the domain is** assumed to be **the largest set of real numbers** that **produces a real output**. The book calls this “the agreement on domains”. This is almost always all the real numbers, but there is an important exception.

What might cause our output to be a non-real number?

divide by zero!

Example: $g(m) = \frac{3}{m-1}$

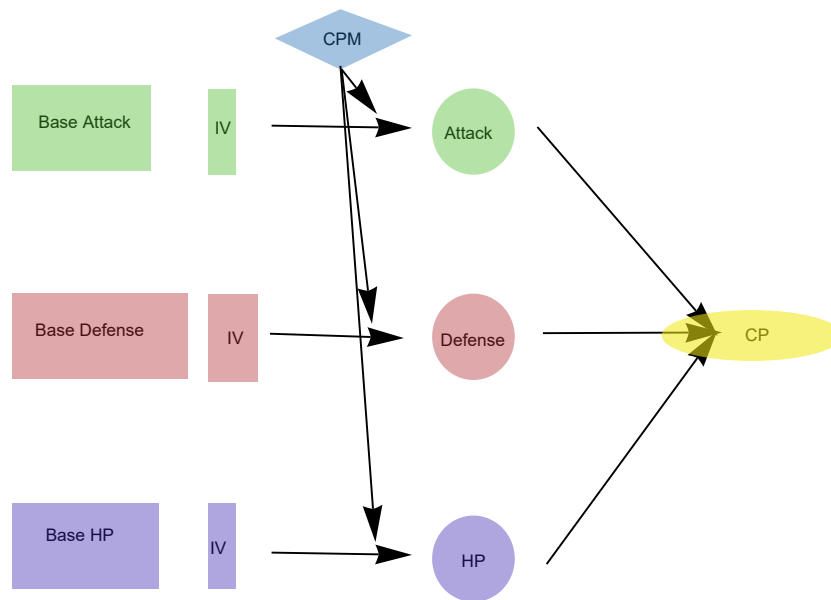
Using the agreement on domains: What is the domain for this function? What might cause our output to be a non-real number?

domain = \mathbb{R} without 1

we exclude 1 to avoid divide by 0.

Let's do one on Top Hat.

What calculations does the game do? Addition?
Multiplication?



Meditite

[https://bulbapedia.bulbagarden.net/wiki/List_of_Pokémon_by_base_stats_\(GO\)](https://bulbapedia.bulbagarden.net/wiki/List_of_Pokémon_by_base_stats_(GO))

307		Meditite	102	78	107
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Compute Attack stat

The Base Attack for Meditite is 78. We got this from our bulbapedia chart.

This Meditite has an Attack IV of 11. We'll talk about how to get this from appraisal.

This Meditite is level 20. So he has a CPM of 0.5974. This is more tricky, stay tuned.

Description of the Function

The Attack stat is computed by adding the Base Attack to the Attack IV and then multiplying by the CPM. This result is then rounded up to 10 if it is less than 10.