Computational Thinking - 2

Honor 4471
Spring 2021


logistics

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Teams

Your teams

- Paralab ...
- Honor 4471 ...
  - General
  - Concepts
  - How do I
  - Project ideas
  - Python

General

Posts | Files | +

Team | Meet

Let's get the conversation started

Try @mentioning a student or teacher to begin sharing ideas.

HS

Hari Sundar Tuesday 9:40 AM

Like this message once you have logged on to teams

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Reply

HS

Hari Sundar Tuesday 10:11 AM Edited

Link for Lectures

https://utah.zoom.us/j/98541169450

Meeting ID: 985 4116 9450

See more

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Zoom is the leader in modern enterprise video communications, with an easy, reliable cloud platform for video and audio conferencing, chat, and webinars across mobile, desktop, and room systems. Zo...

Poll (on Teams)

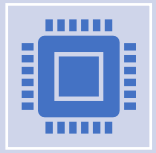
What is your major ?

Social work, Linguistics, Psychology, Film, Marketing, Economics, International Studies, Special Education, English, Spanish, Environmental & Sustainability, Political Science, Business, Statistics, Biology, Finance, Criminology, Sociology, …

What is your academic standing ?

Freshman, sophomore, …

Freshman – **40%**, Sophomore – **50%**, Junior – 10%



Have you programmed before ?

45% - Yes, **55%** - No

Module 1: NYPD Stop & Frisk Data

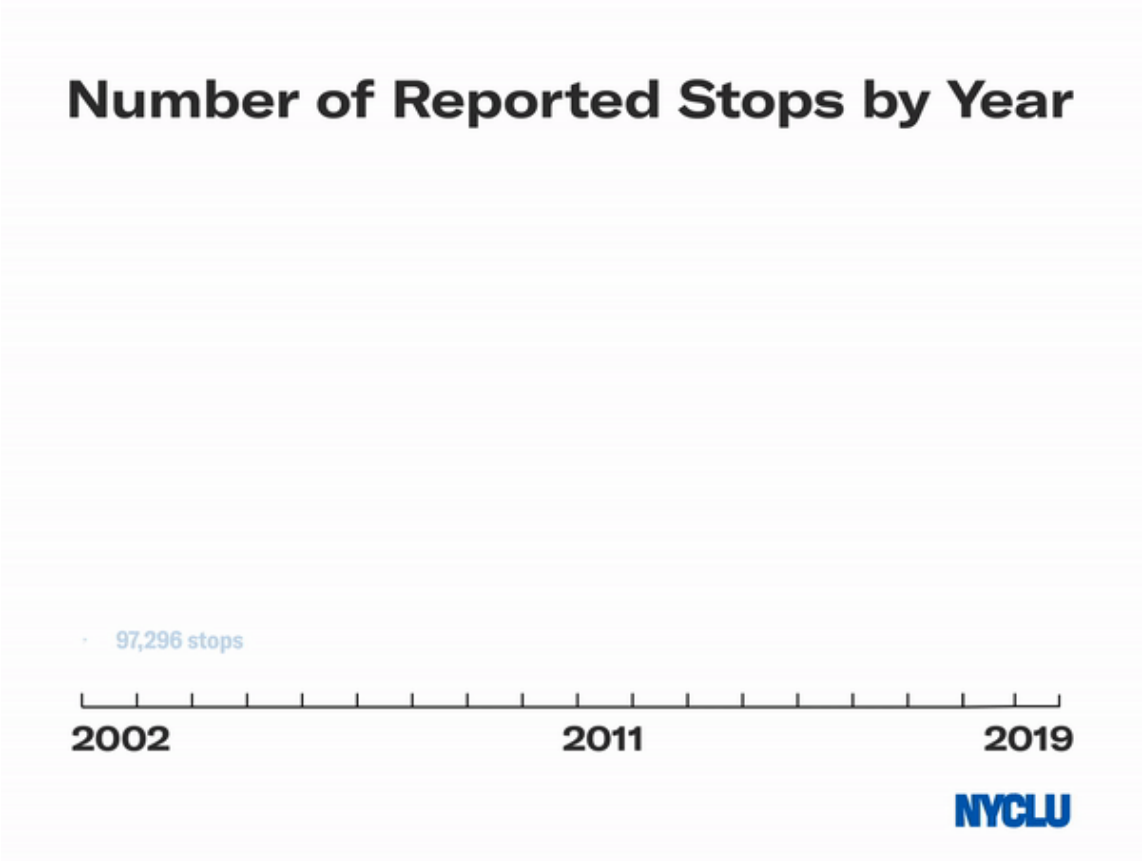
https://www.nyclu.org/en/stop-and-frisk-data

About the Data:

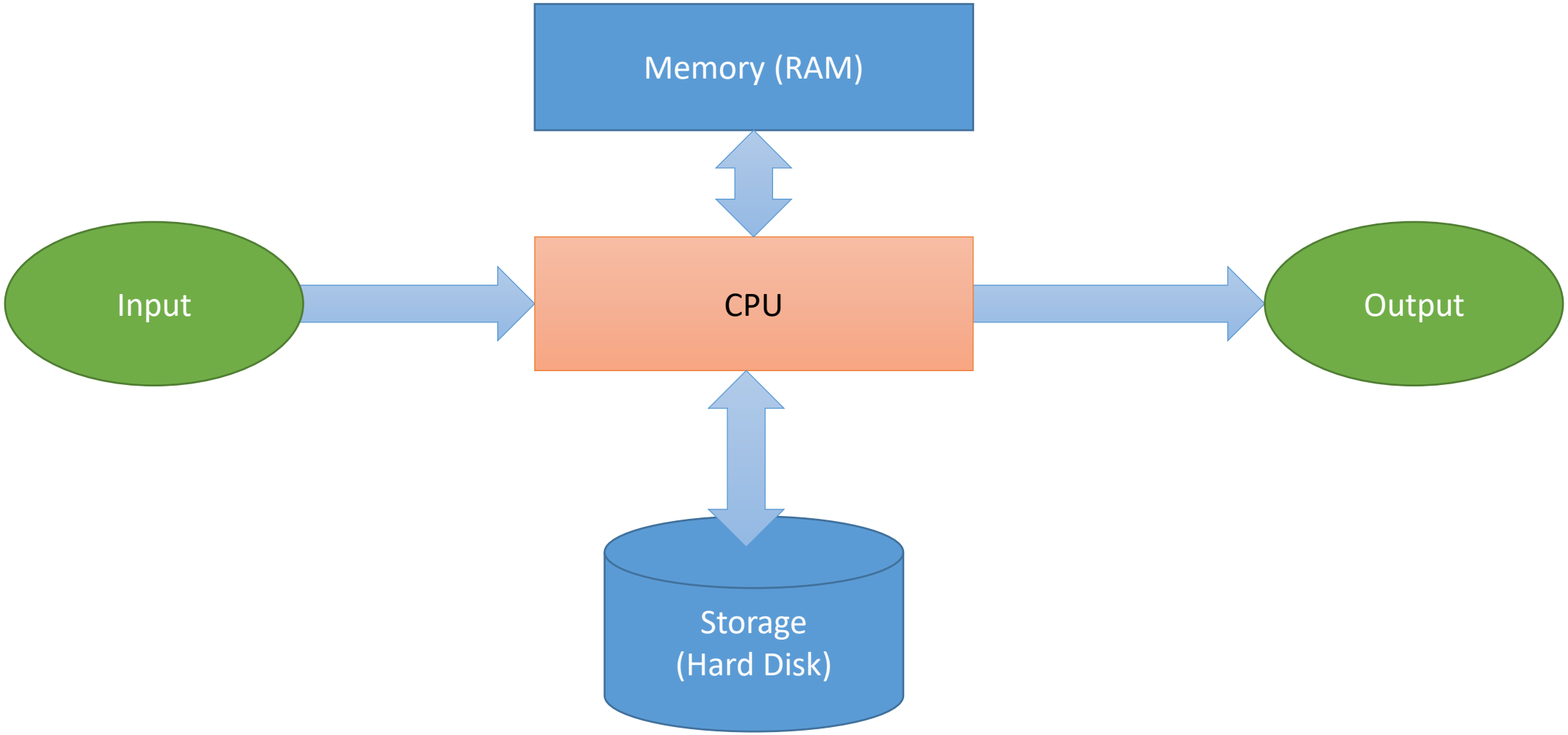
Every time a police officer stops a person in NYC, the officer *is supposed to* fill out a form recording the details of the stop. The forms were filled out by hand and manually entered into an NYPD database until 2017, when the forms became electronic. The NYPD reports stop-and-frisk data in two ways: a summary report released quarterly and a complete database released annually to the public.

The quarterly reports are released by the NYCLU every three months (available here) include data on stops, arrests, and summonses. The data are broken down by precinct of the stop and race and gender of the person stopped.

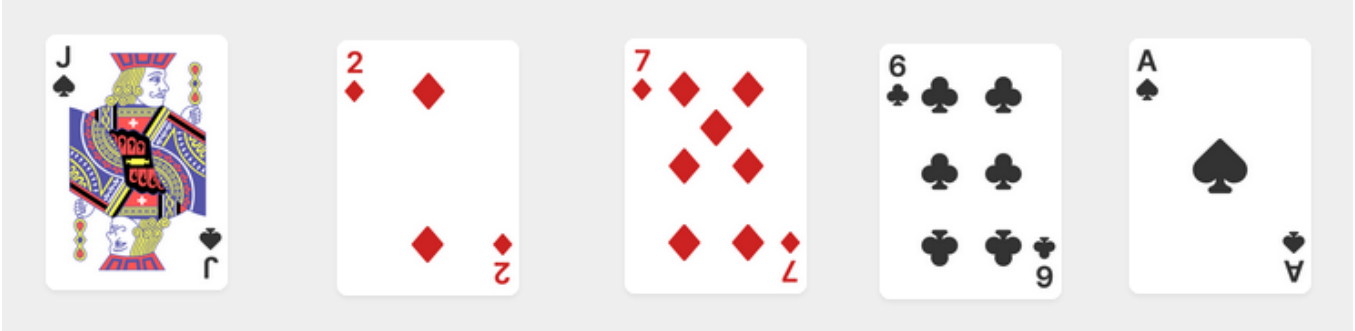
The annual database includes nearly all of the data recorded by the police officer after a stop such as the age of the person stopped, if a person was frisked, if there was a weapon or firearm recovered, if physical force was used, and the exact location of the stop within the precinct. The NYPD uploads this databe to their website annually. The most recent annual dataset and codebook is located below. It contains over 100 variables and 12,404 observations, each of which represents a stop conducted by an NYPD officer.

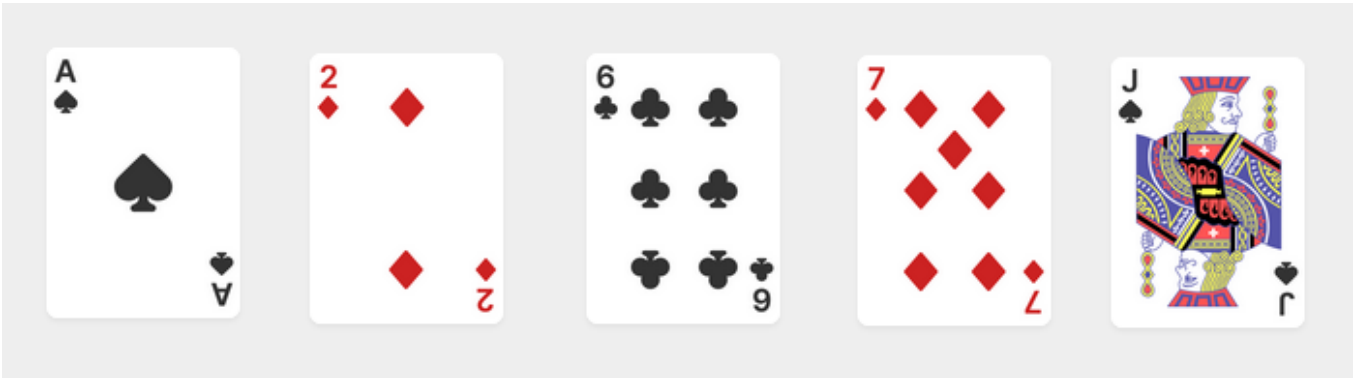


Computer Hardware



Sort some cards

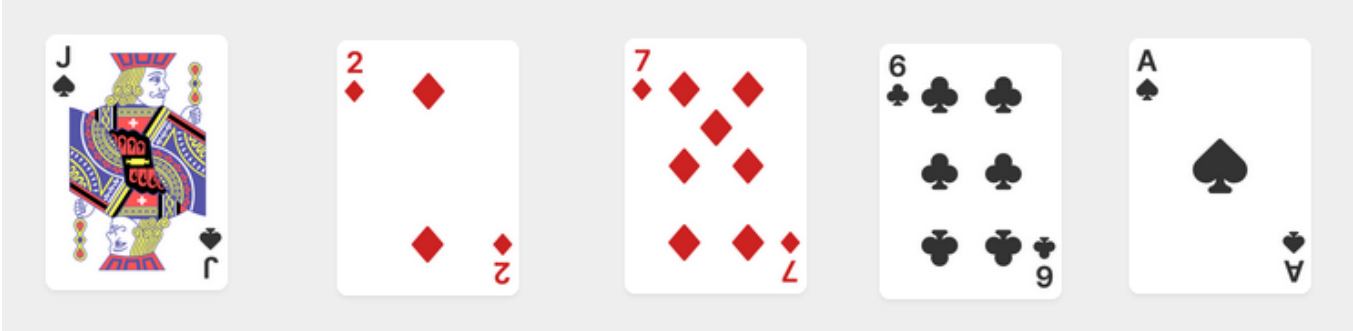


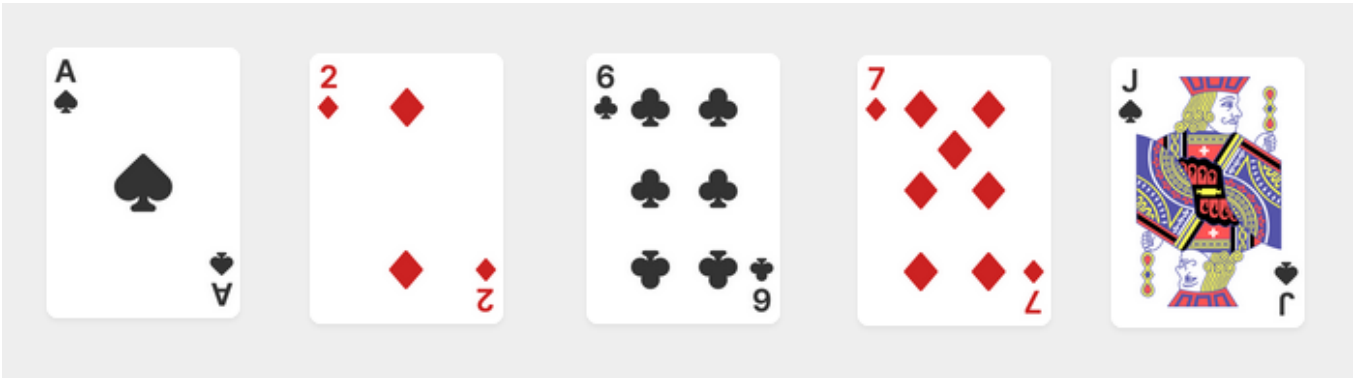


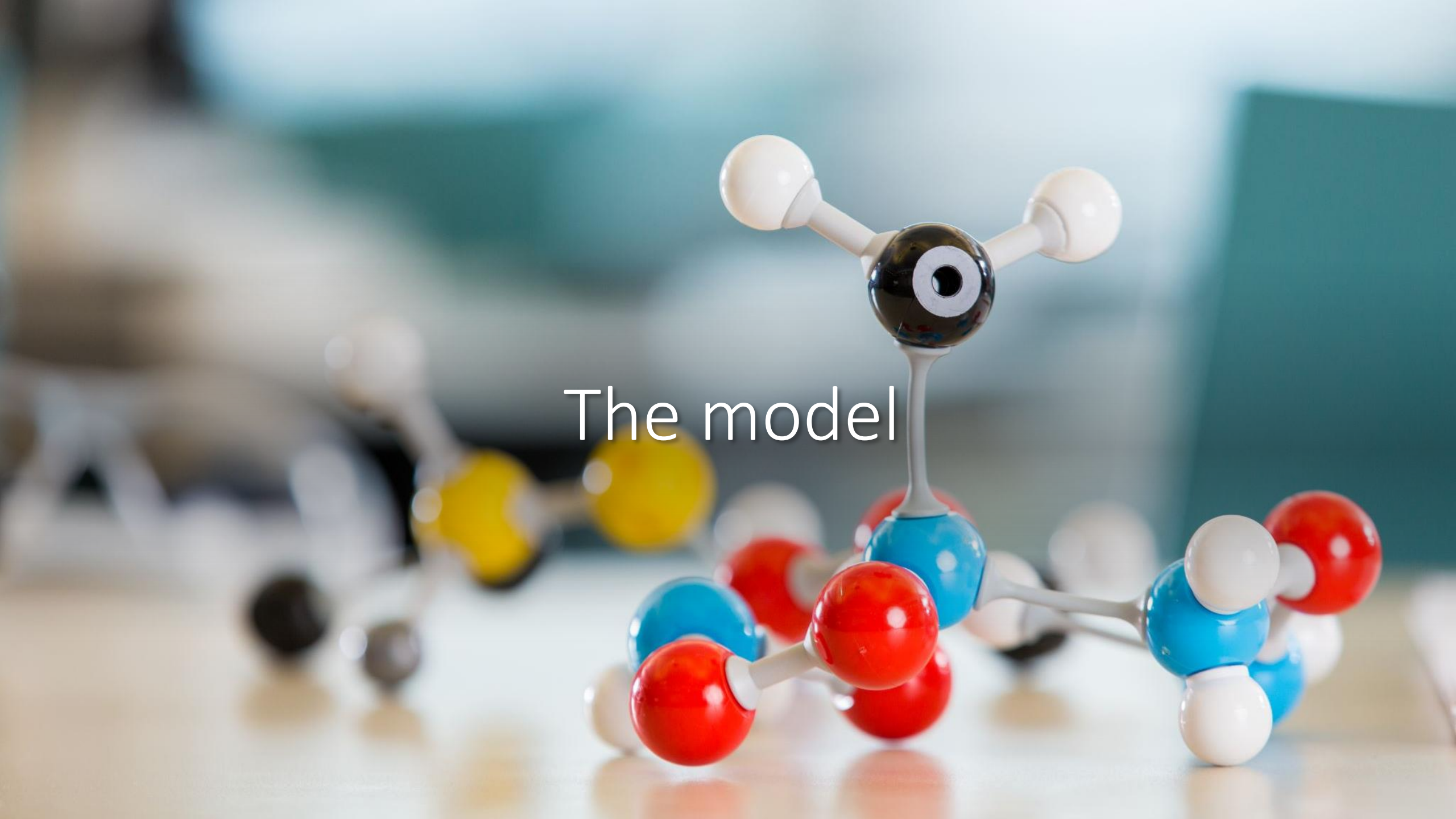

Can you write precise
instructions to sort cards ?

Algorithms

Sort some cards





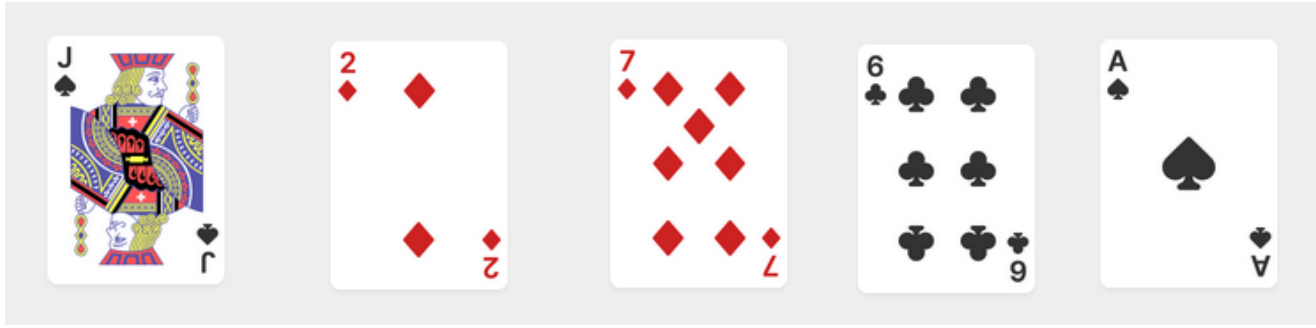

The model

What is important ?

- Paper or plastic ?
- The design ?
- Images ?
- Suit ?
- 2, 3, 4, 5, 6, 7, 8, 9, 10
- A, J, Q, K
- 1, 11, 12, 13

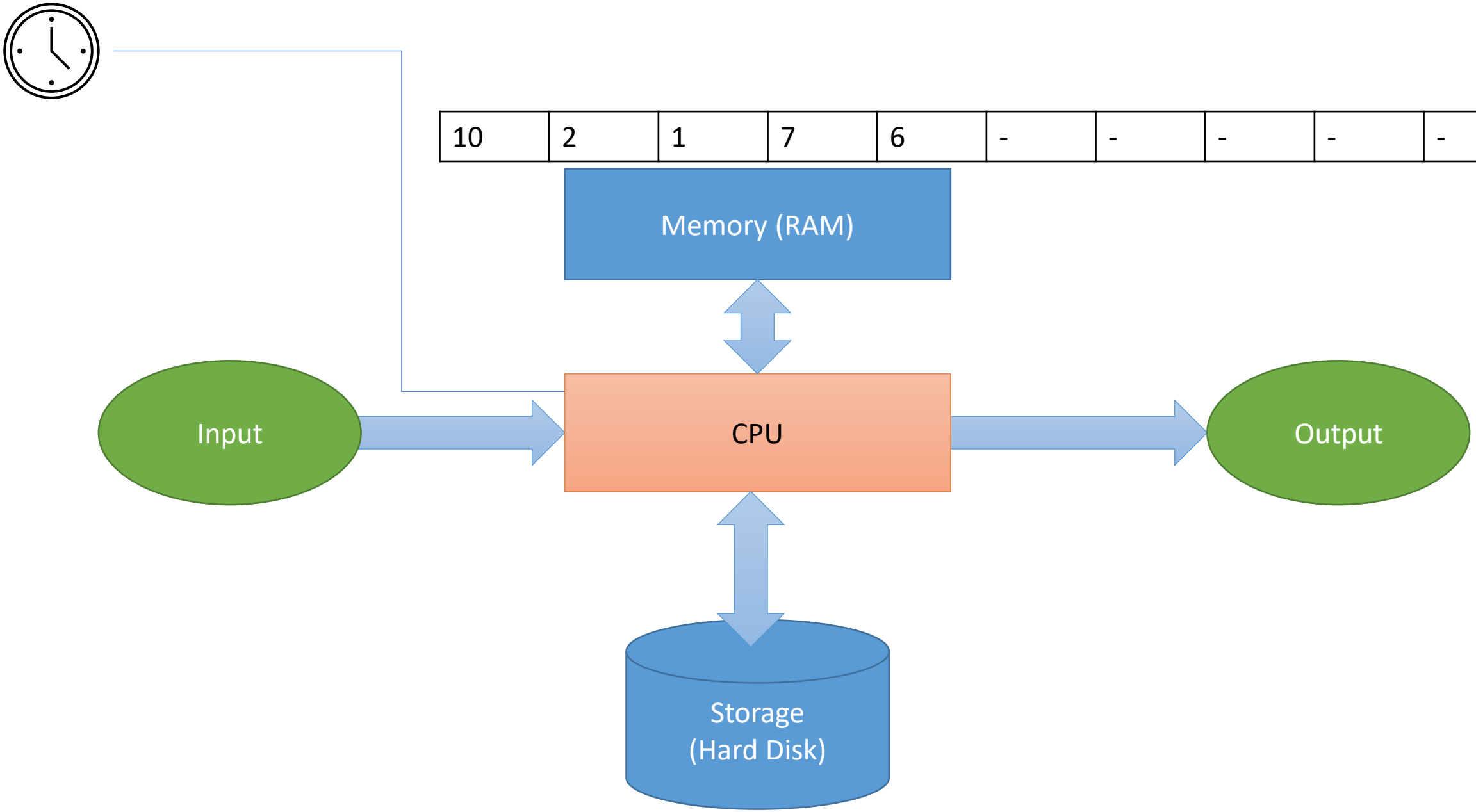
Representation

- We can represent each card by a number from 1-13
- A set of cards will be stored on the hard-disk or in memory (RAM) as a **list** of numbers

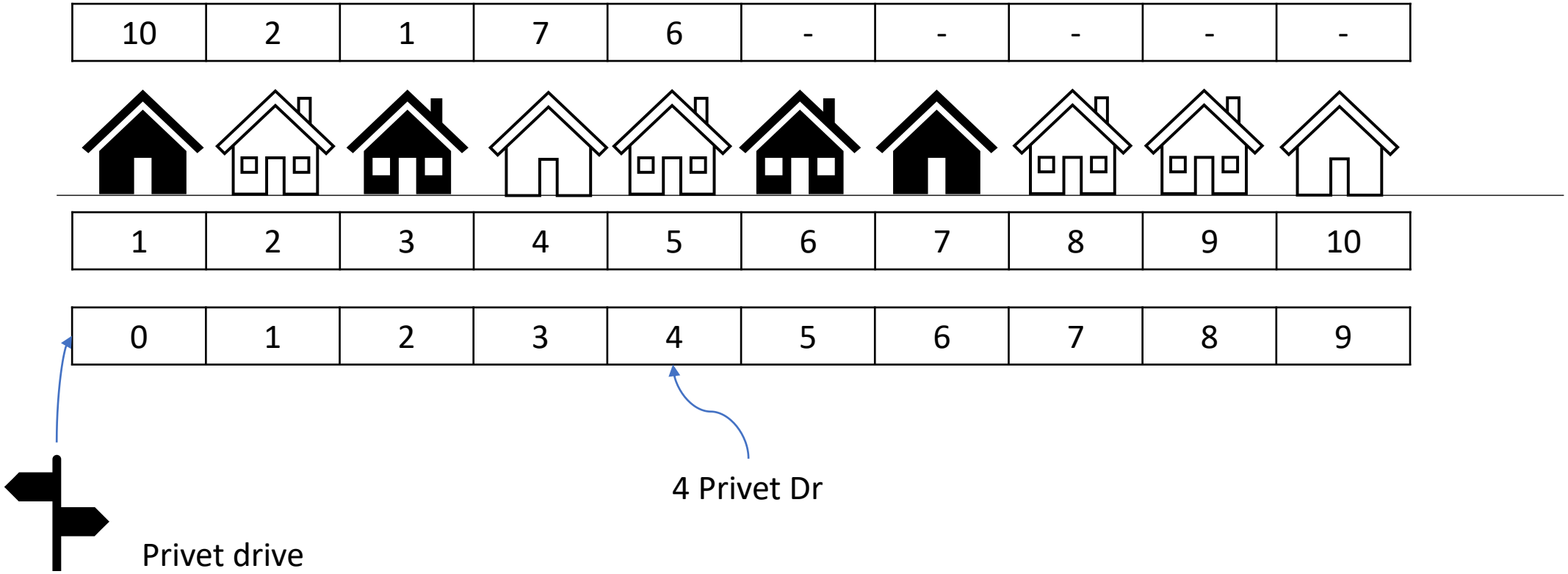


11	2	7	6	1

1	2	6	7	11



10	2	1	7	6	-	-	-	-	-	-	-	-	-	-	-

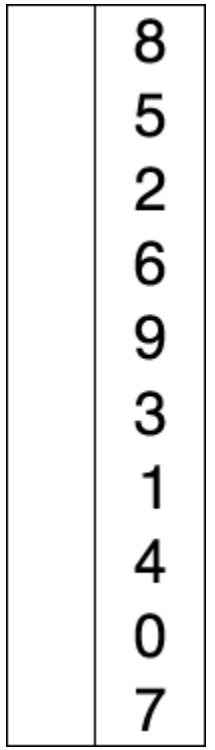


`privet[4]`

Write instructions to sort cards

Algorithm - Selection Sort

- Find the smallest number in the list (1st or 0th number)
- Place it in the 0th position
  - Where to put the number in the 0th position ?
  - Swap
- Repeat by **selecting** the 1st, 2nd … numbers and placing in the appropriate location
- Effectively divides the list into 2 parts, a sorted and an unsorted part
- We operate on the unsorted part, and always find the smallest number in the unsorted part



Algorithm – Find smallest number in a list

10	2	1	7	6	-	-	-	-	-

- Need a variable to store the smallest number (thus far)
  - `min`
- Initialize `min` to the first number
  - `min = cards[0]` or `min = cards[i]`
- compare min with other cards, updating min if needed
  - `if cards[i] < min, min = cards[i]`

Algorithm – Find smallest number in a list

10	2	1	7	6	-	-	-	-	-

- Need a variable to store the *index of the* smallest number (thus far)
  - `min_idx`
- Initialize `min_idx` to the first index
  - `min = 0` or `min = i`
- compare min with other cards, updating min if needed
  - `if cards[i] < cards[min_idx], min_idx = i`

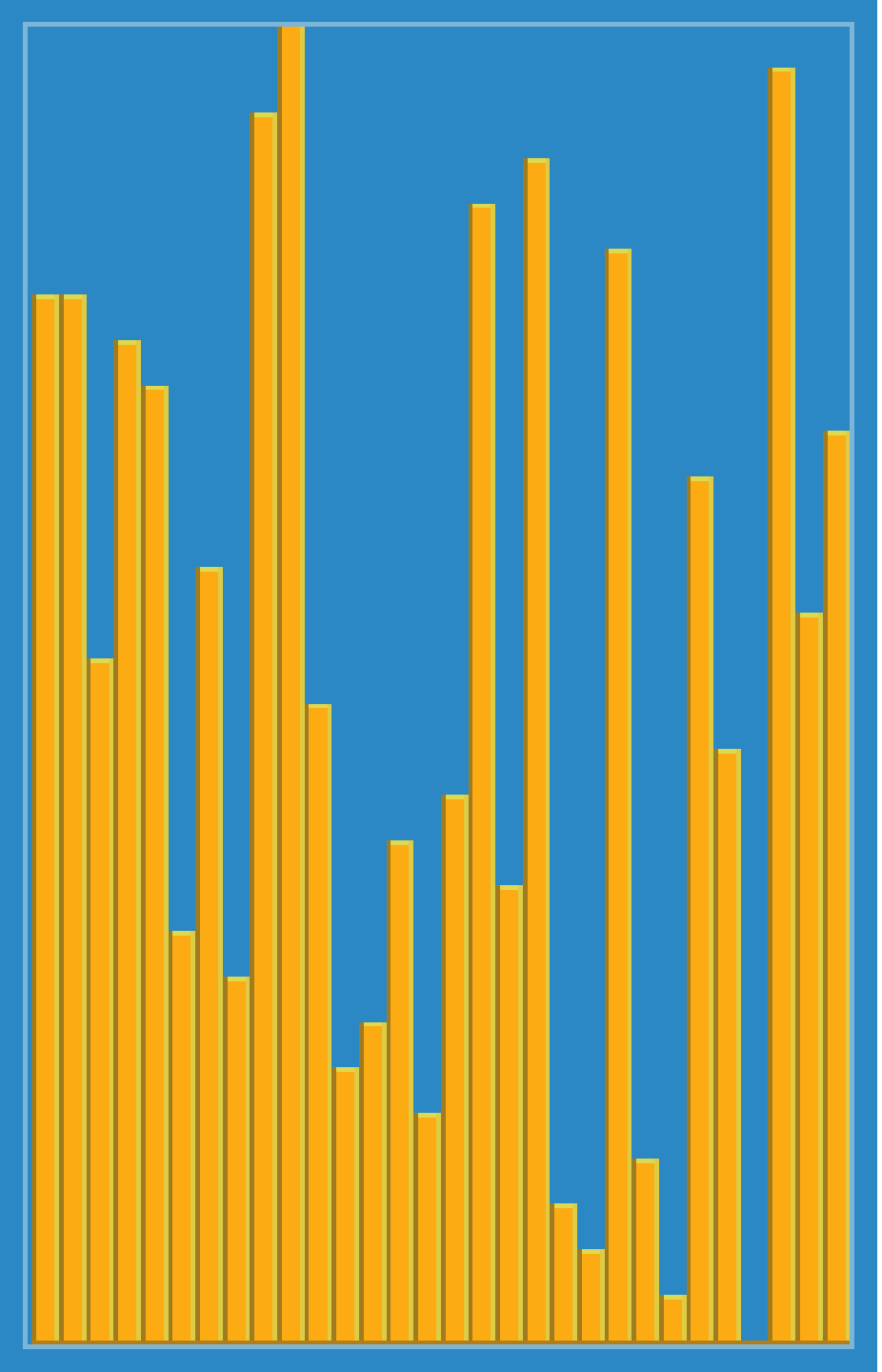
Selection sort - pseudocode

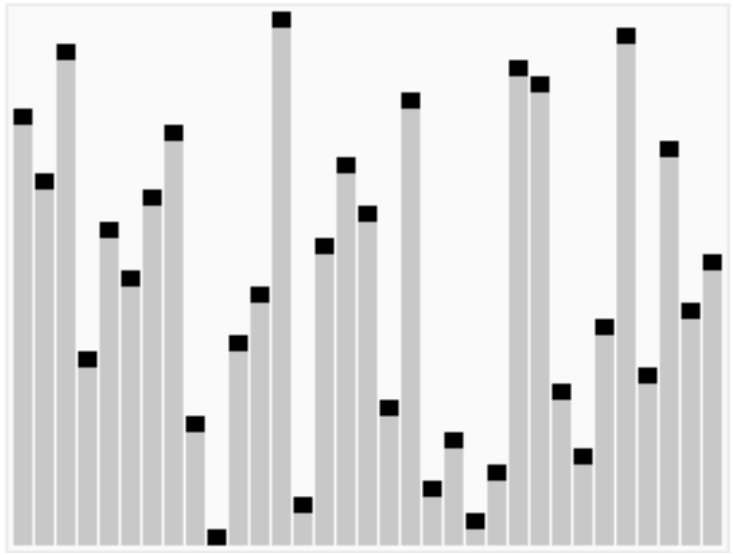
- Data `n`, `card[0], … card[n-1]` (input)
- Index `i` which indicates the current selection
  - Goes from 0 to n-1 (or 1 to n)
    - Find location $j \geq i$ of the smallest number in `card`
    - Swap `card[j]` and `card[i]`

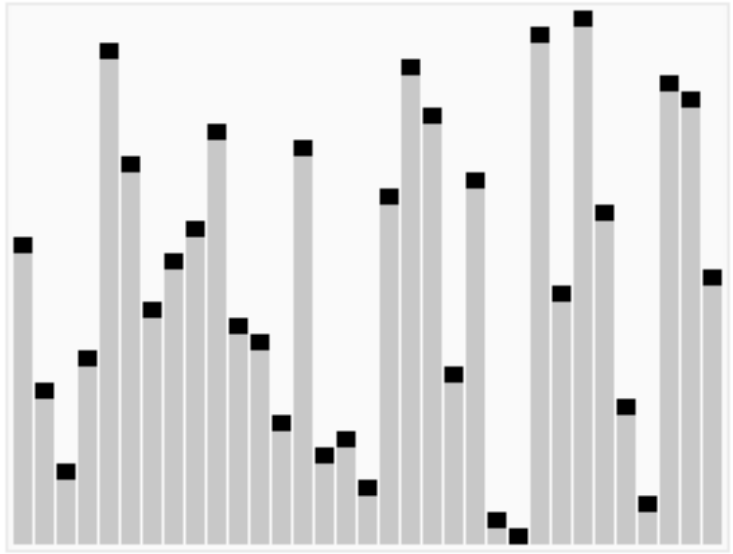
Selection Sort - Python

```
def selectionSort(card, n):

    for step in range(n):
        min_idx = step

        for i in range(step + 1, n):

            # select the minimum element
            if card[i] < card[min_idx]:
                min_idx = i

        # put min at the correct position - swap
        (card[step], card[min_idx]) = (card[min_idx], card[step])


card = [11, 2, 7, 6, 1]
n    = len(card)
selectionSort(card, n)
print('Sorted Array in Ascending Order:')
print(card)
```

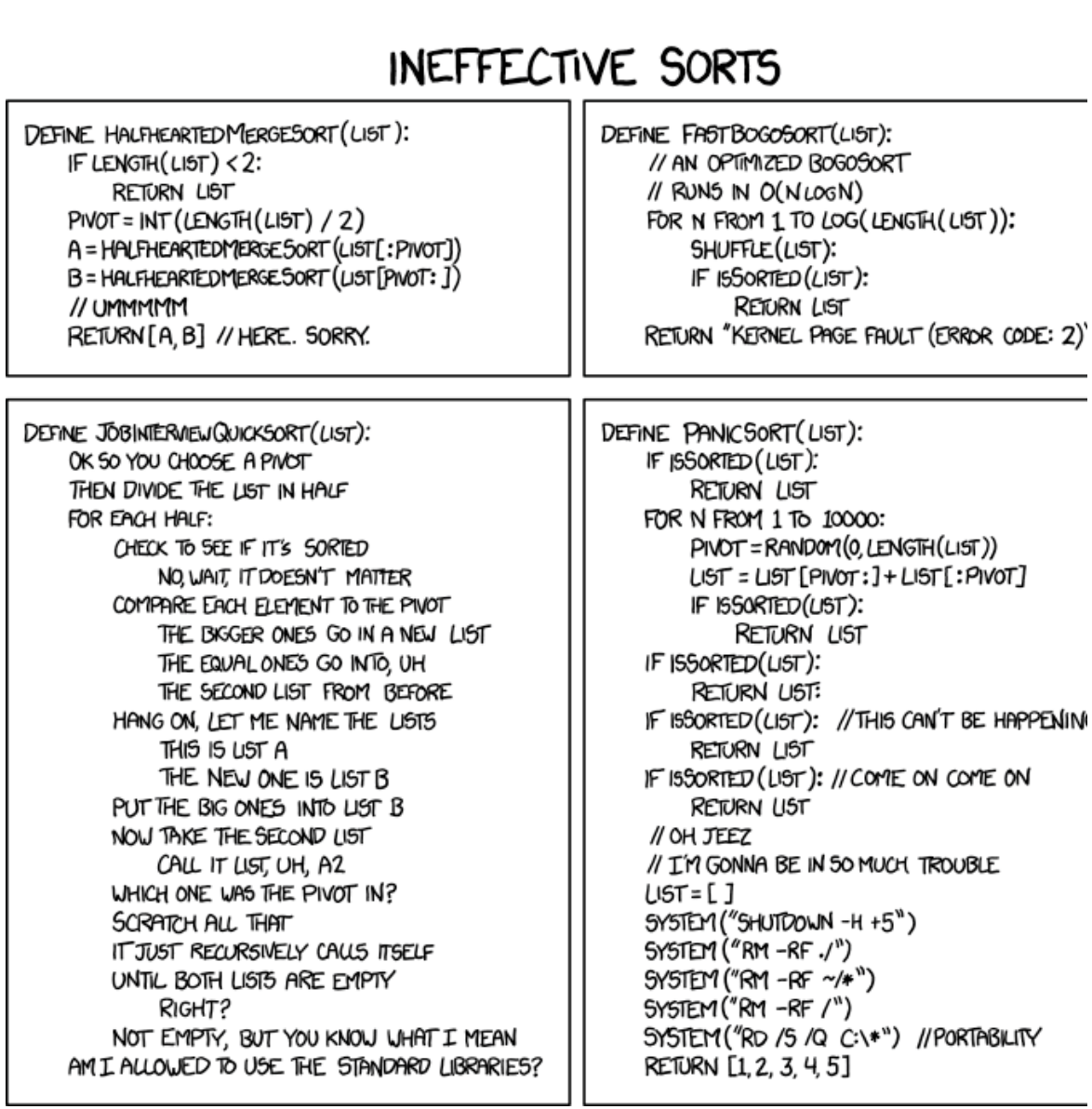

demo







6 5 3 1 8 7 2 4



Can you design your own Sorting algorithm ?