

Sorting

CS101

NIFR 2023

Agenda

Sorting

- Sorting: Primer
- Swapping Elements
- Searching: Primer
- Exercise: Selection sort & Binary Search

What are algorithms?

Data + Algorithm

Ingredients

for 16 servings

2 ½ cups warm water
(600 mL)

1 teaspoon sugar

2 teaspoons active dry yeast

7 cups all-purpose flour
(875 g), plus more for
dusting

6 tablespoons extra virgin
olive oil, plus more for
greasing

1 ½ teaspoons kosher salt

¼ cup semolina flour (30 g)

OPTIONAL TOPPINGS

TOMATO SAUCE

28 oz canned whole
tomatoes (795 g)

1 tablespoon kosher salt

MARGHERITA

tomato sauce

fresh mozzarella cheese,
torn into small pieces

fresh basil leaf

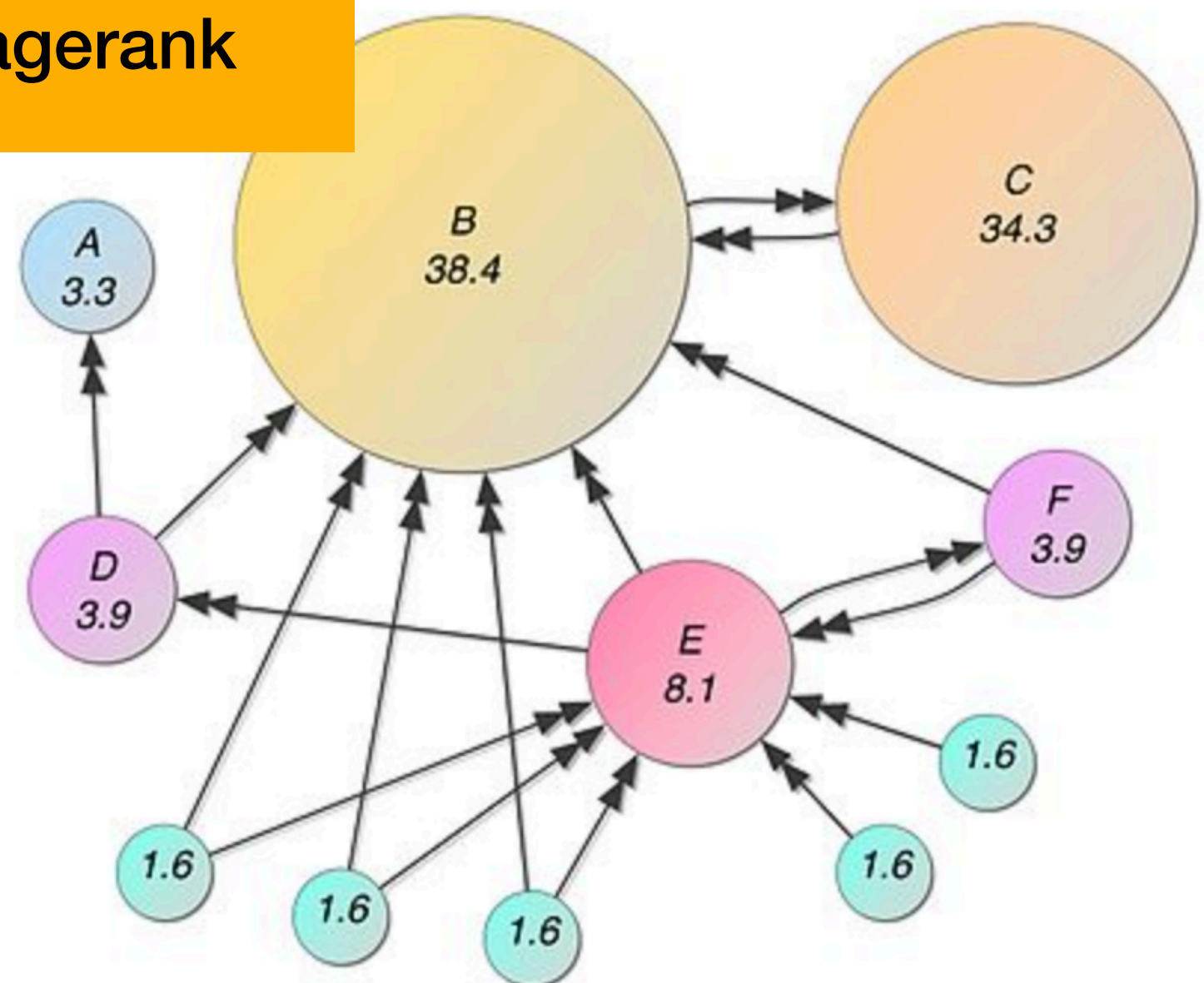
Preparation

- 1 “Bloom” the yeast by sprinkling the sugar and yeast in the warm water. Let sit for 10 minutes, until bubbles form on the surface.
- 2 In a large bowl, combine the flour and salt. Make a well in the middle and add the olive oil and bloomed yeast mixture. Using a spoon, mix until a shaggy dough begins to form.
- 3 Once the flour is mostly hydrated, turn the dough out onto a clean work surface and knead for 10-15 minutes. The dough should be soft, smooth, and bouncy. Form the dough into a taut round.
- 4 Grease a clean, large bowl with olive oil and place the dough inside, turning to coat with the oil. Cover with plastic wrap. Let rise for at least an hour, or up to 24 hours.
- 5 Punch down the dough and turn it out onto a lightly floured work surface. Knead for another minute or so, then cut into 4 equal portions and shape into rounds.
- 6 Lightly flour the dough, then cover with a kitchen towel and let rest for another 30 minutes to an hour while you prepare the sauce and any other ingredients.

Data + Data structure



Pagerank



Compression

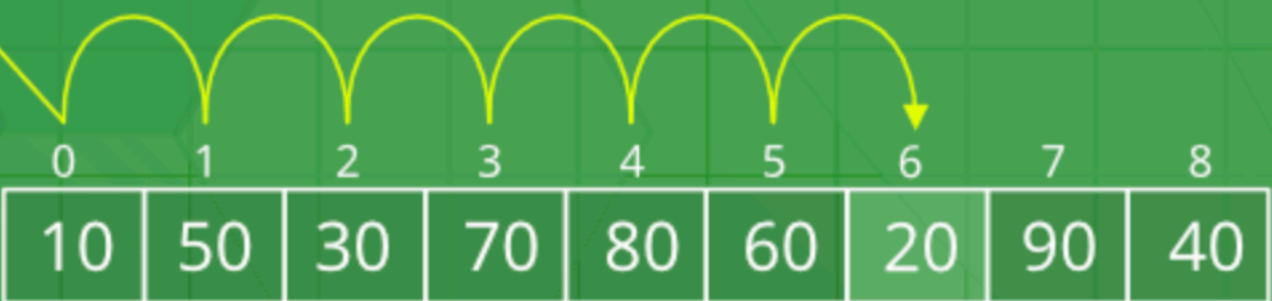
Hello World my friend = 10Kb

↓ ↓ ↓ ↓
😊 😄 😊 😂 = 2Kb

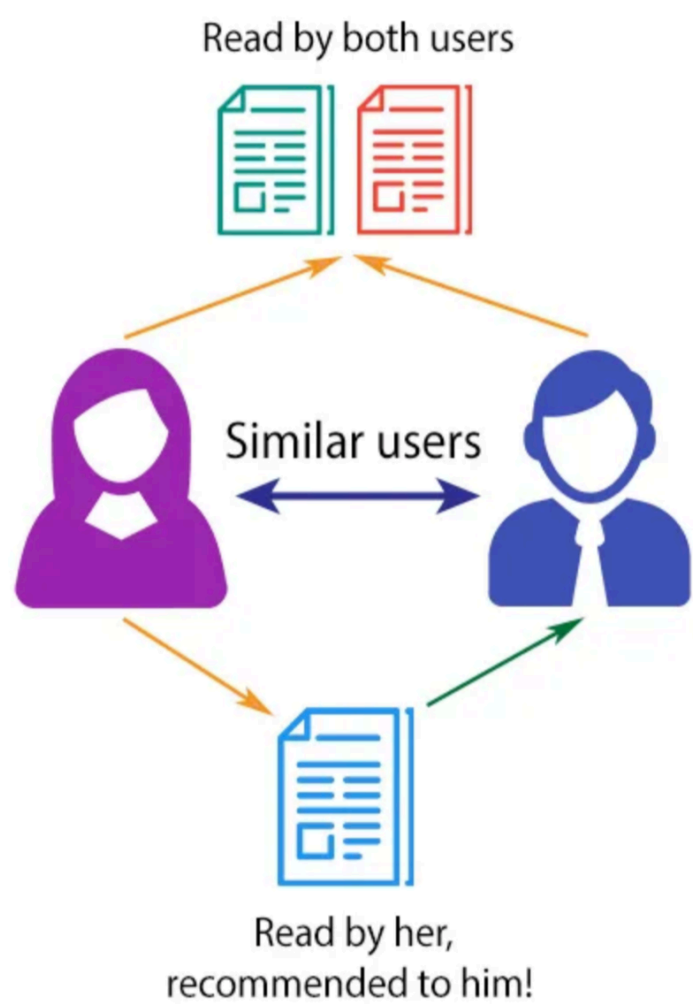
Searching

Linear Search

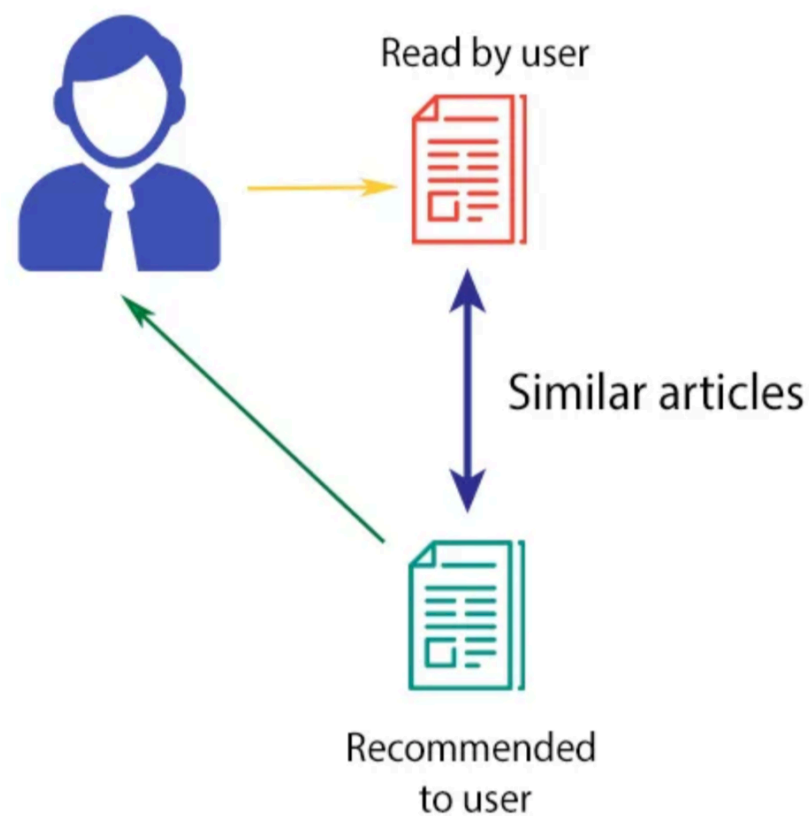
Find '20'



COLLABORATIVE FILTERING



CONTENT-BASED FILTERING



Recommendation



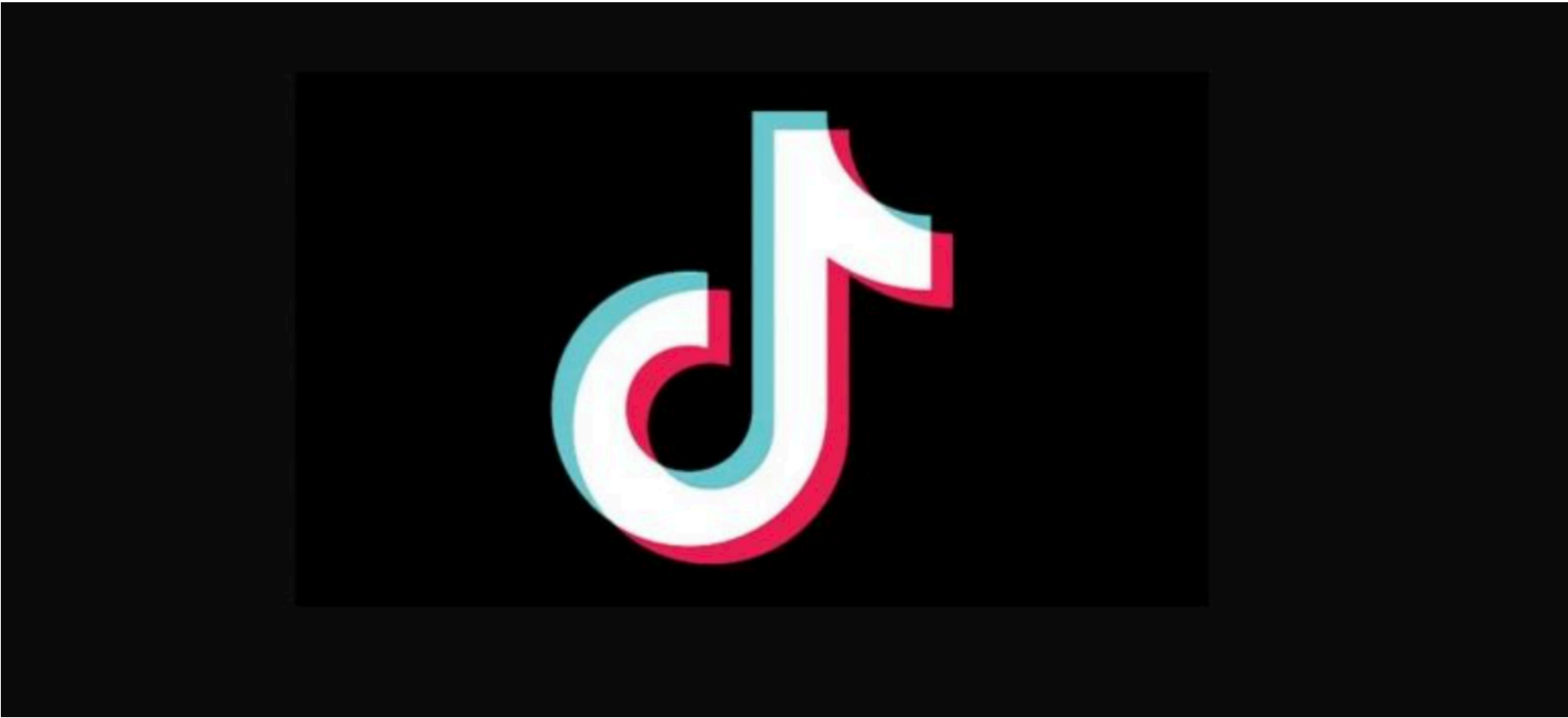
algorithm

/ˈalgərɪð(ə)m/

noun

a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer.

"a basic **algorithm** for division"



Y

Hacker News

[new](#) | [past](#) | [comments](#) | [ask](#) | [show](#) | [jobs](#) | [submit](#)

login

1. ▲ CMU CS Academy: a free online computer science curriculum by Carnegie Mellon (cmu.edu)
210 points by bobbiechen 5 hours ago | hide | 55 comments

2. ▲ WebKit Supports Nested CSS (webkit.org)
190 points by gslin 6 hours ago | hide | 77 comments

3. ▲ Scientists find first observational evidence linking black holes to dark energy (umich.edu)
154 points by negativelambda 7 hours ago | hide | 33 comments

4. ▲ Bing: "I will not harm you unless you harm me first" (simonwillison.net)
2628 points by simonw 17 hours ago | hide | 1370 comments

5. ▲ The Little Learner: A Straight Line to Deep Learning (mitpress.mit.edu)
284 points by dgarrett 11 hours ago | hide | 59 comments

6. ▲ Prompt Engine – Microsoft's prompt engineering library (github.com/microsoft)
203 points by mmaia 10 hours ago | hide | 50 comments

7. ▲ SOBA: Potential blood test for Alzheimer's disease (pnas.org)
118 points by WaitWaitWha 9 hours ago | hide | 19 comments

8. ▲ Squares in Squares (erich-friedman.github.io)
244 points by yowzadave 12 hours ago | hide | 36 comments

9. ▲ Show HN: Ractor – a Rust-based actor framework with clusters and supervisors (github.com/slawlor)
67 points by snowboarder63 7 hours ago | hide | 18 comments

10. ▲ Clojure in the Tyre Manufacturing Industry (michelin.io)
116 points by jgrodziski 11 hours ago | hide | 44 comments

▲ DanielBMarkham on May 28, 2014 | prev | next [–]

I've come to the conclusion that HN voting/ranking is like Google search engine ranking: you're not supposed to know how it works. If you did, people would game the system.

So it's a magic act. As a programmer, this frustrates me terribly. I just emailed dang yesterday because I had submitted something that shot up, got a lot of attention, then died just as suddenly. Hell, I didn't know, I thought the system was broken or something. Turns out I was flagged.

... there is a widespread belief that computer science is mostly about programming (i.e., “software”) and the design of gadgets (i.e., “hardware”). In fact, many of the most beautiful ideas in computer science are completely abstract and don’t fall in either of these categories.

- MacCormick, J, Nine Algorithms That Changed The Future

How does the sorting in the comparable interface work?

Working with sorting (individual)

Implementing Selection sort

- Input / Data
 - Algorithm
 - Output / Verification
-
- You can look up the **algorithm** but not direct implementation (java code)
 - Start with pseudocode from input to output

Swapping two elements of an array

Pseudocode + Implementation

Implementing a sorting algorithm

Selection Sort

- When working with arrays - remember the **iteration counter** as a tool
- Remember the **tools** you already have:
 - Loops
 - Logic (if/else)
 - Variables

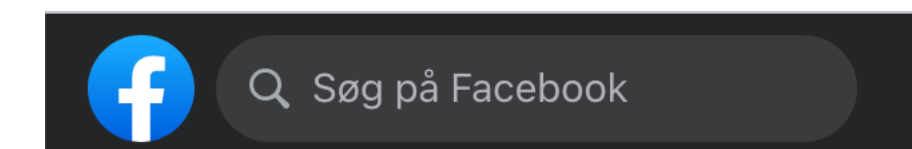
Selection Sort in 3

Initial State

Search algorithms



Q Spotlight Search



Agenda

Search strategies

- Linear search
- Binary search

Linear search

Foundational search strategy

Linear Search



=
33

What characterises a linear search?

- Several repetitive actions (go to next index)
- A **simple** approach to number of iterations
- A check for each element in the data structure (worst case)



What characterises a linear search?

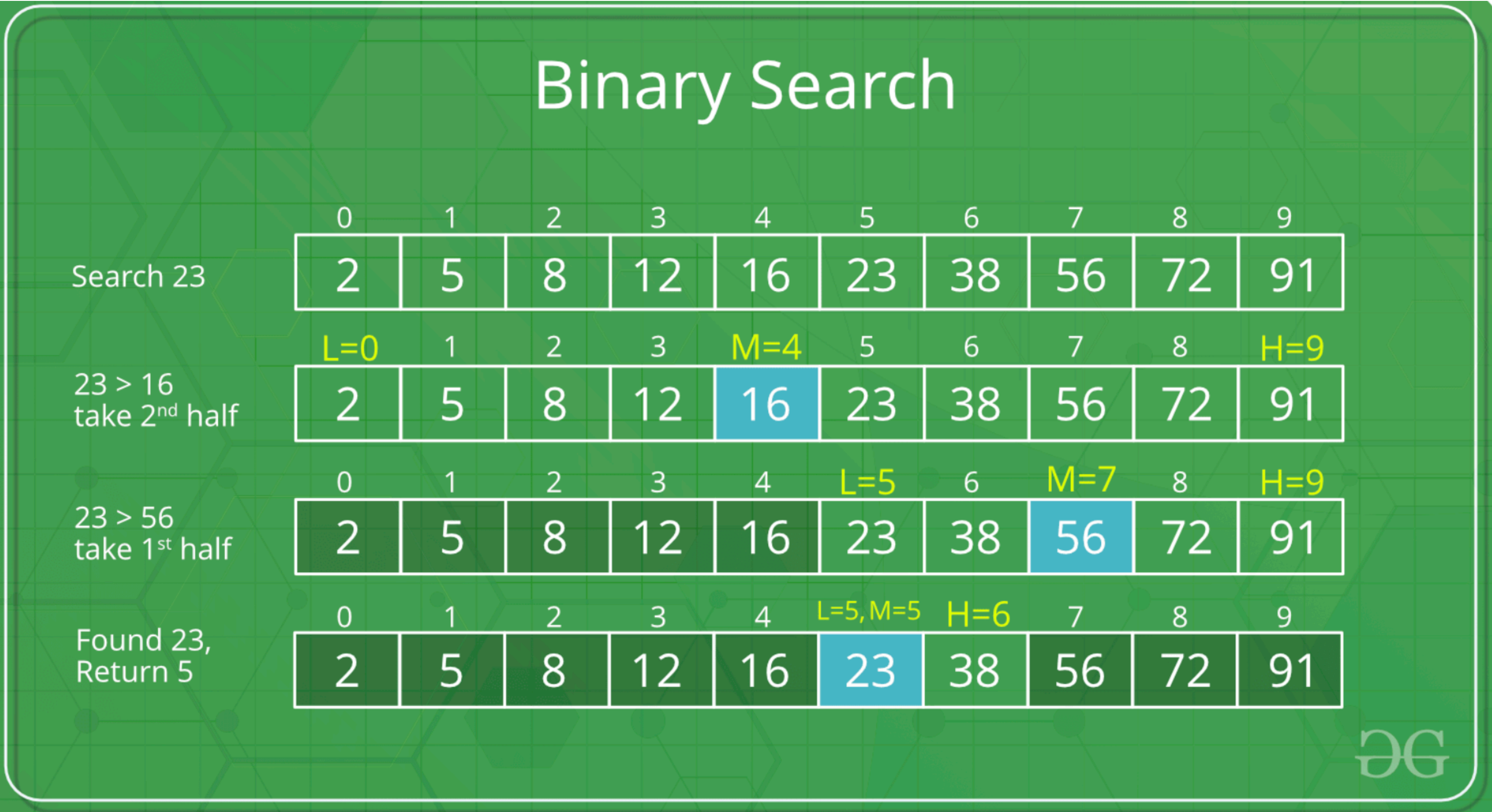
- Several repetitive actions
 - Loop structure
- A simple approach to number of iterations
 - $O(n)$
- A check for each element in the data structure
 - IF ELEMENT_WE_ARE_LOOKING_FOR == CURRENT_ELEMENT
 - Return true
 - Go to next

Implement **linear search** for an array
of numbers

Initial State

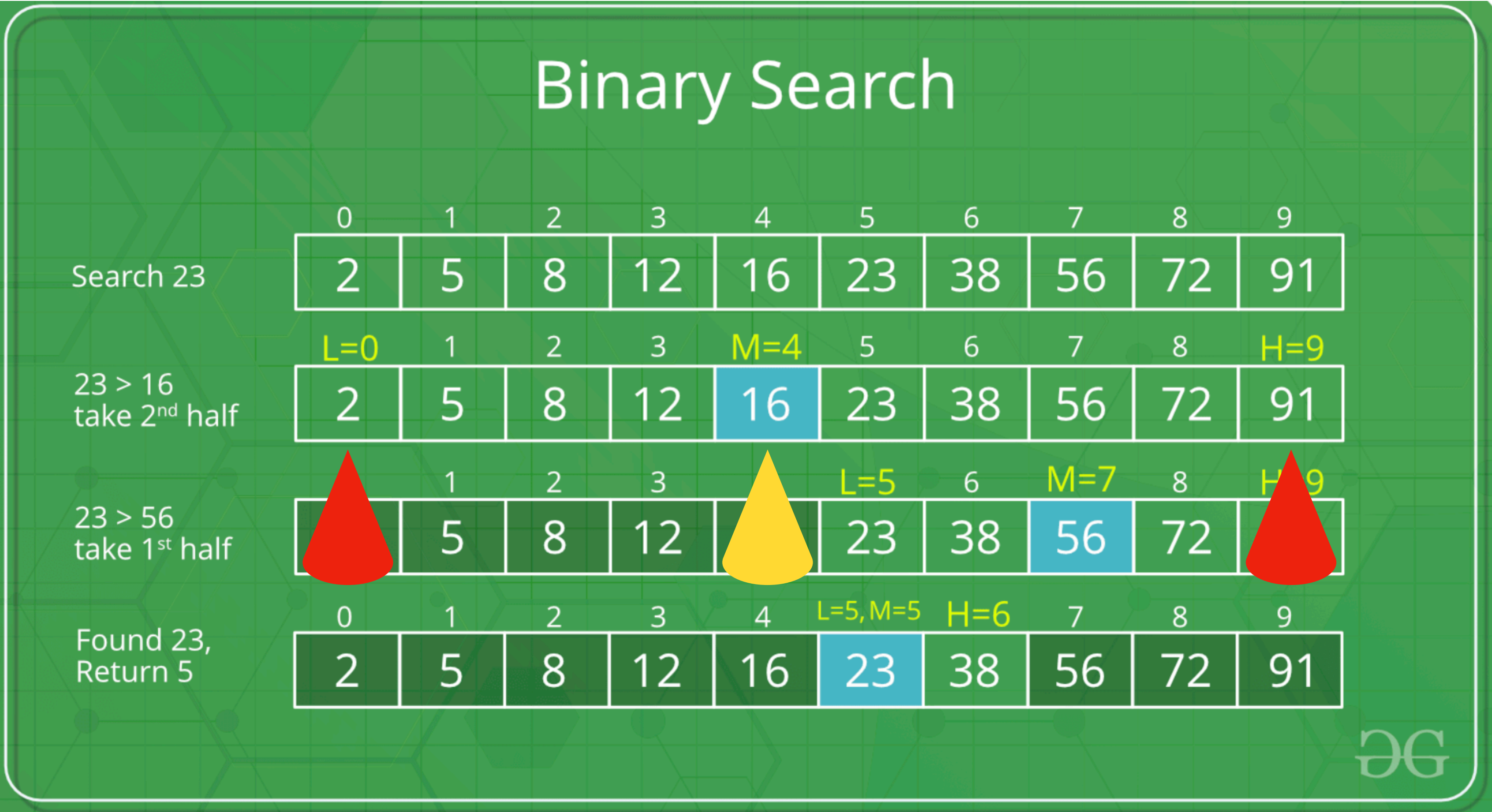
Binary search

23



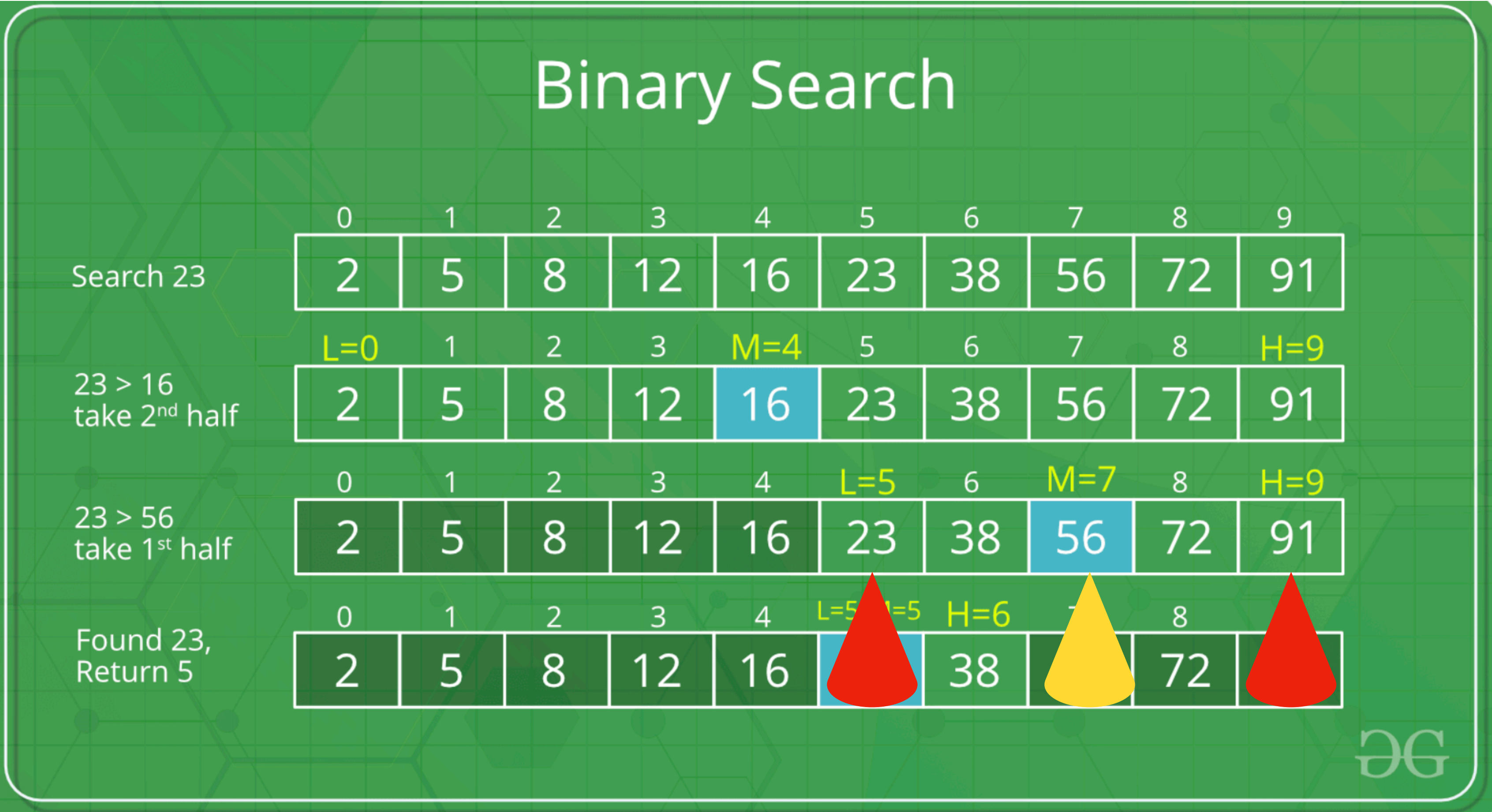
Binary search

23



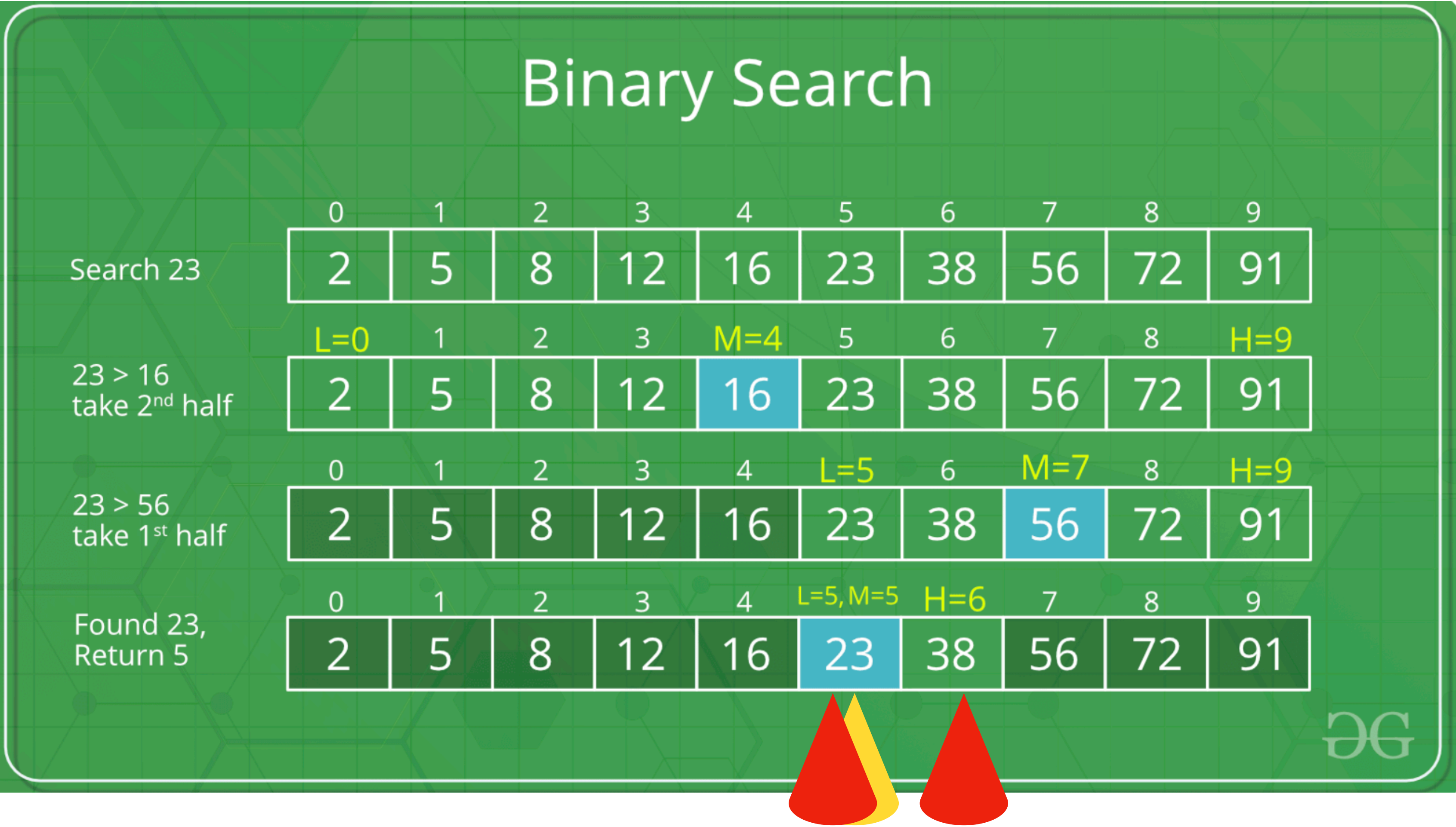
Binary search

23



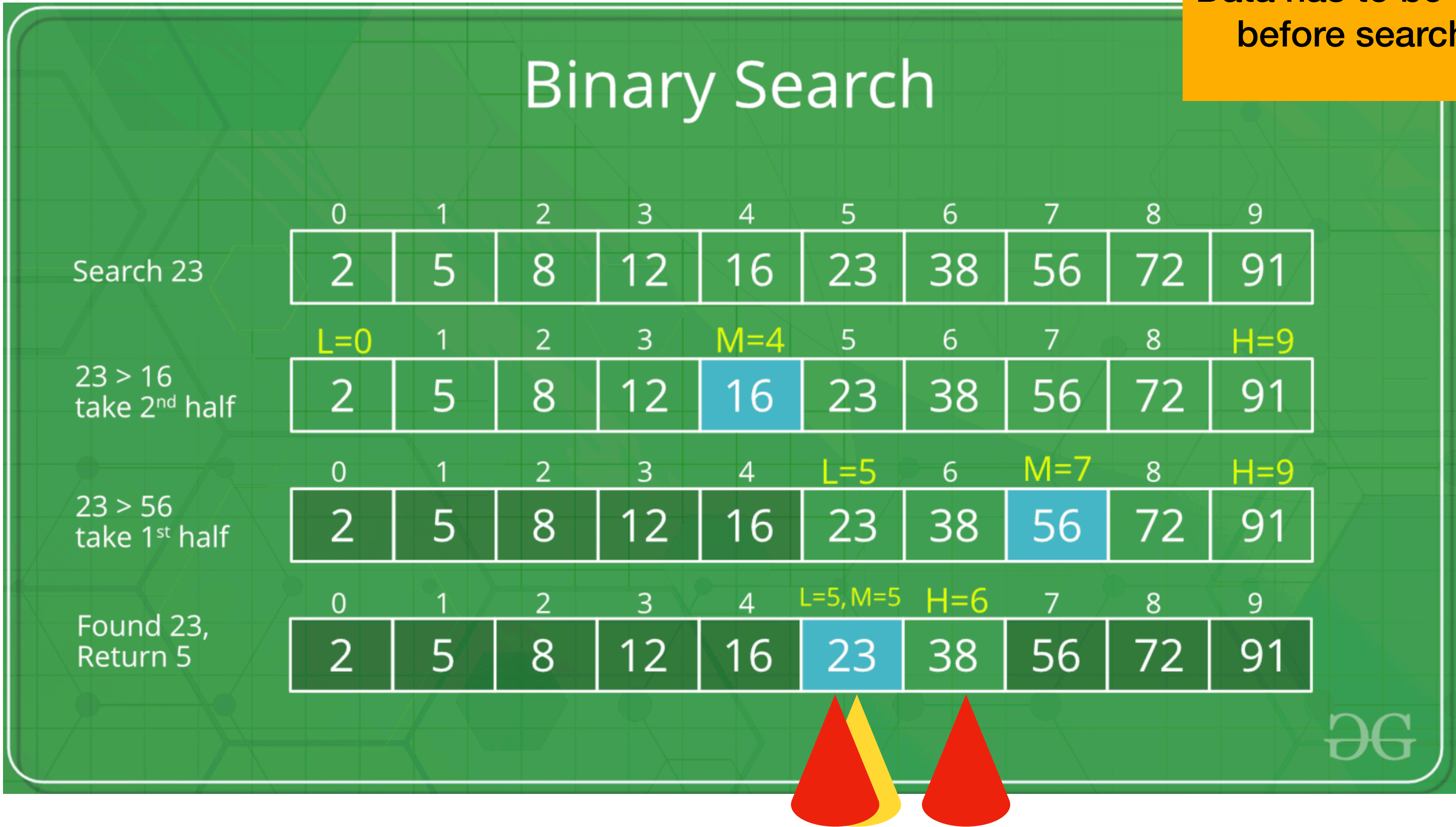
Binary search

23



Binary search

Data has to be sorted
before searching



How to implement binary search

Variables & Concepts

- Low, medium & high = variables in the loops
 - How to find new values for low, medium & high?
- When does the loop determine?

- A) Selection sort exercise
- B) Binary Search exercise

Initial State