### Binary Search -- A Fundamental Algorithm



Binary search is a clever, though common sense way to search an ordered set of items. Tests are made, called *probes*, asking whether the desired item is smaller or larger. If the probe is chosen in the middle of the sequence, 1/2 of the possibilities must be eliminated with any answer. Now the details...

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## Reminder ... Algorithm vs Program

- The process just described on the title slide is the binary search algorithm ... the idea given abstractly
- A program for binary search -- your goal -- will encode the algorithm for a specific situation, in a specific language, with specific assumptions

Today's Topics: Analyze the binary search algorithm
Review the Day Finder application
Reason through the logic of using
binary search in the Day Finder
context

## Algorithm Analysis

- Understanding the problem ...
  - + Inputs:
  - + Outputs:
  - + How the inputs are transformed to the outputs:

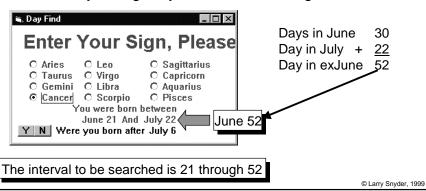
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### CSE 100 Analyzing Properties Of Solution

- ❖ End points ... inclusive
- Before/after questions ... stay with one form
- Probing odd-length and even-length intervals (\)
- New interval's endpoints ... one is kept, one changes
- Termination ... when is it over?

After M? N
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
After G? Y
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
After J? Y
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
After L? N
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
After K? Y
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
The letter is L

- CSE 100 Guessing Days In A Sign
  - The "complicating" problem with searching for a birthday in a sign, is that the signs span parts of two months
  - Not to worry ... logically extend the starting month



### **CSE 100** Transforming Probe To A Date

- The size of the interval is: (52 - 21) = 31
- ❖ The midpoint of the interval is: 31 \ 2
- ❖ The probe, low end + midpoint: 21 + 15 = 36
- What day is June 36?



## Guess? What?

What information is needed by the Guess procedure?

🖦 Day Find		_	
Enter	Your	Sign, Please	
O Aries	O Leo	C Sagittarius	
C Taurus	C Virgo	C Capricorn	
C Gemini	O Libra	O Aquarius	
	C Scorpic	O Pisces	
You were born between			
June 21 And July 22			
Y N Were you born after July 6			

Guess( \_\_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_

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# Using Binary Search In Day Finder

Inherit the initial configuration from Zodiac

- The Guess Procedure asks one probe at a time ...
- ❖ When is Guess called?



🖹 Day Find		_   _   ×	
Enter `	Your S	ign, Please	
O Aries	O Leo	C Sagittarius	
O Taurus	O Virgo	C Capricorn	
O Gemini	C Libra	C Aquarius	
	C Scorpio	O Pisces	
You were born between			
June 21 And July 22			
Y N Were you born after July 6			



- Where do the initial values come from?
- How are these values updated?

Guess( \_\_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_