19CSE100 Problem Solving and Algorithmic Thinking

Problem Representation & Transformation

Spit Not So Game

SPIT NOT
SO FAT
FOP AS
IF IN
PAIN

Rules:

1. 2 player game
2. Claim a word in turns
3. First to hold 3 words with a common letter wins

An Example

Player1: SPIT
Player2: SO
Player1: FAT
Player2: NOT
Player1: FOP
Player2: IF
Player1: PAIN

SPIT NOT
SO FAT
FOP AS
IF IN
PAIN

An Example

Player1: SPIT
Player2: SO
Player1: FAT
Player2: NOT
Player1: FOP
Player2: IF
Player1: PAIN

Player 1 wins as
SPIT
FOP
PAN
all contains P

Let's Play

SPIT NOT
SO FAT
FOP AS
IF IN
PAIN

Reflections

Did you find any winning strategy?

Patterns help solve problems

NOT	IN	PAN
SO	SPIT	AS
FOP	IF	FAT

1. Words in row(s), column(s), diagonal have one letter in common
2. Choosing a word is equivalent to choosing a cell/block
3. Do you know a game that resembles this?

Example Revisited

Player1: SPIT
Player2: SO
Player1: FAT
Player2: NOT
Player1: FOP
Player2: IF
Player1: PAN

NOT **O**	IN	PAN **X**
SO **O**	SPIT **X**	AS
FOP **X**	IF **O**	FAT **X**

What did we do?

Appropriate problem representation or transformation to convert it to a problem whose solutions are well known

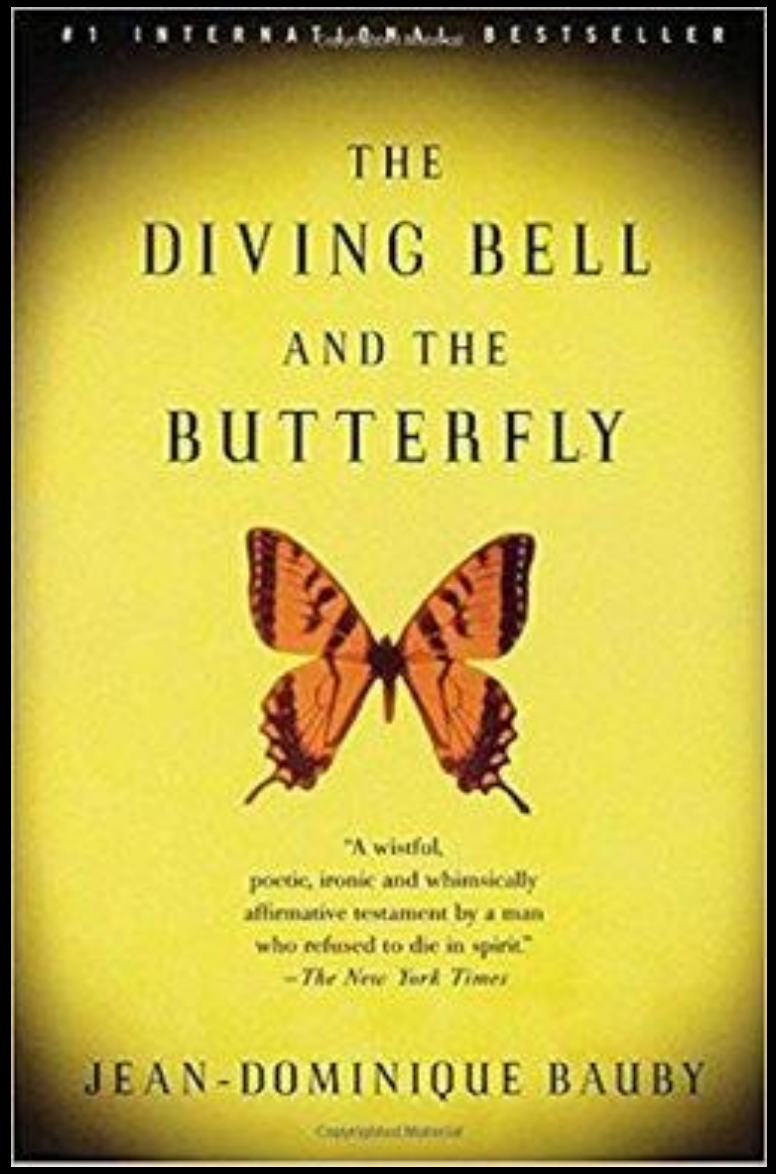
Do you know?

Engineers play this trick often!!!

Locked-in Syndrome

https://www.youtube.com/watch?v=h_mmvxPUnaI

Triumph of Human Spirit



200,000 blinks
10 months
4 hrs/day

www.amazon.in; Wikipedia

Devise Communication

Can you devise a means for Bauby to communicate?

As Simple as A B C …

Count blinks and map it to the alphabets

2 part algorithm – *protocol*

(one for the Bauby and one for the helper)

Helper can Speak!!!

Helper reads alphabets and Bauby blinks at the right alphabet

Beyond Alphabets

How to handle punctuations?

What if there is a mistake?

Evaluation is very important

Helper can Think too!!!

Halfway through blinking helper can predict the word

Predictive texting in your smartphones!

Helper Can Speak!!!

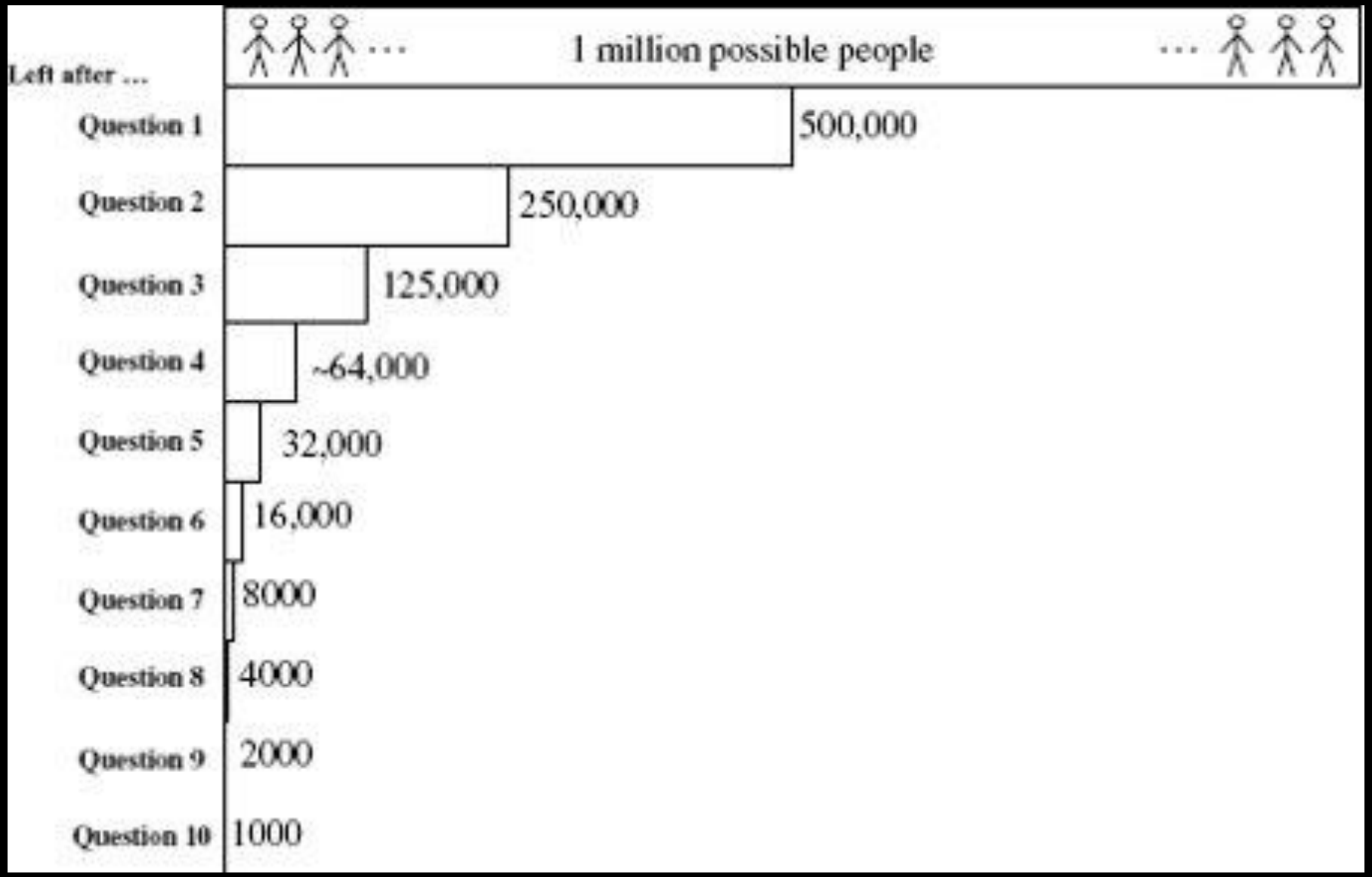
How Fast is this Solution?

Best/Worst/Average cases

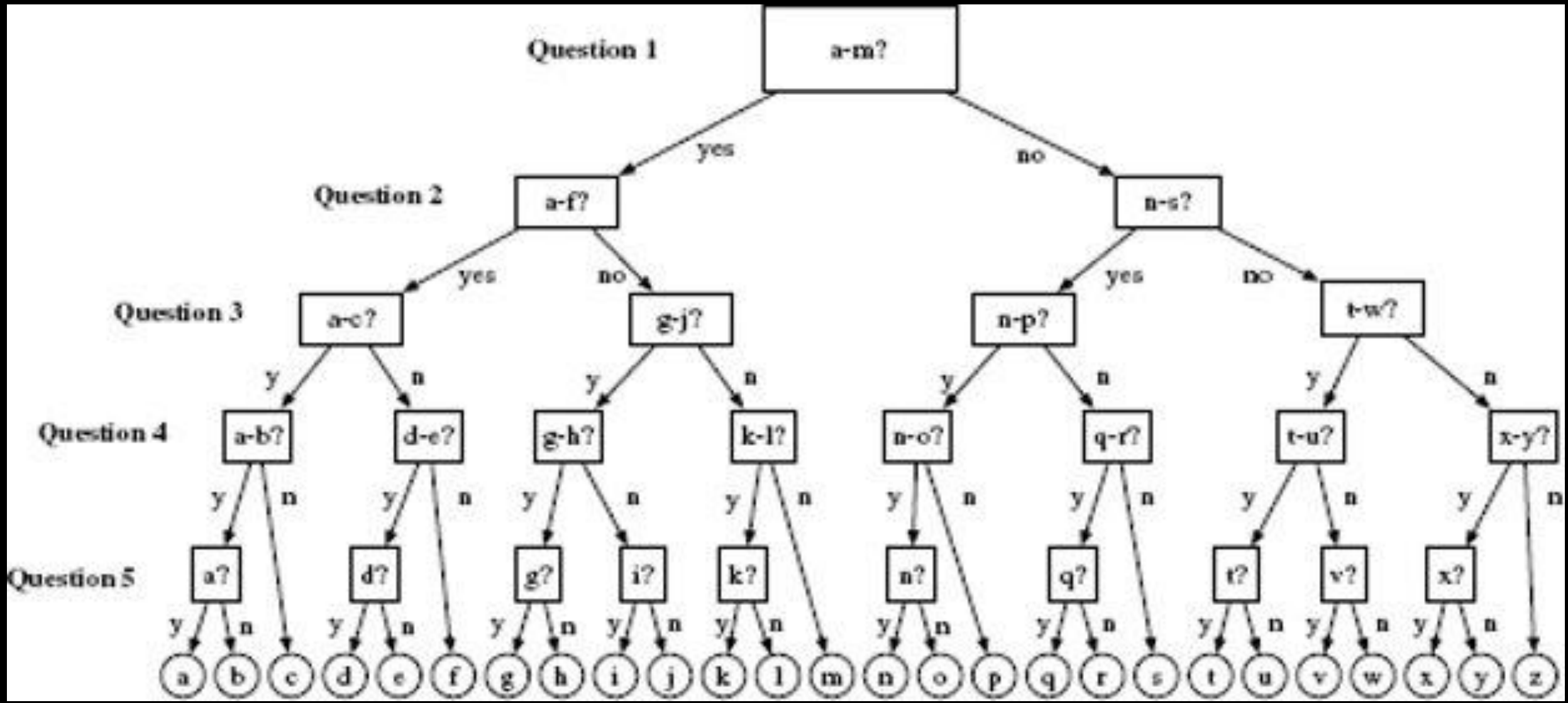
13 questions

Can it be reduced further?

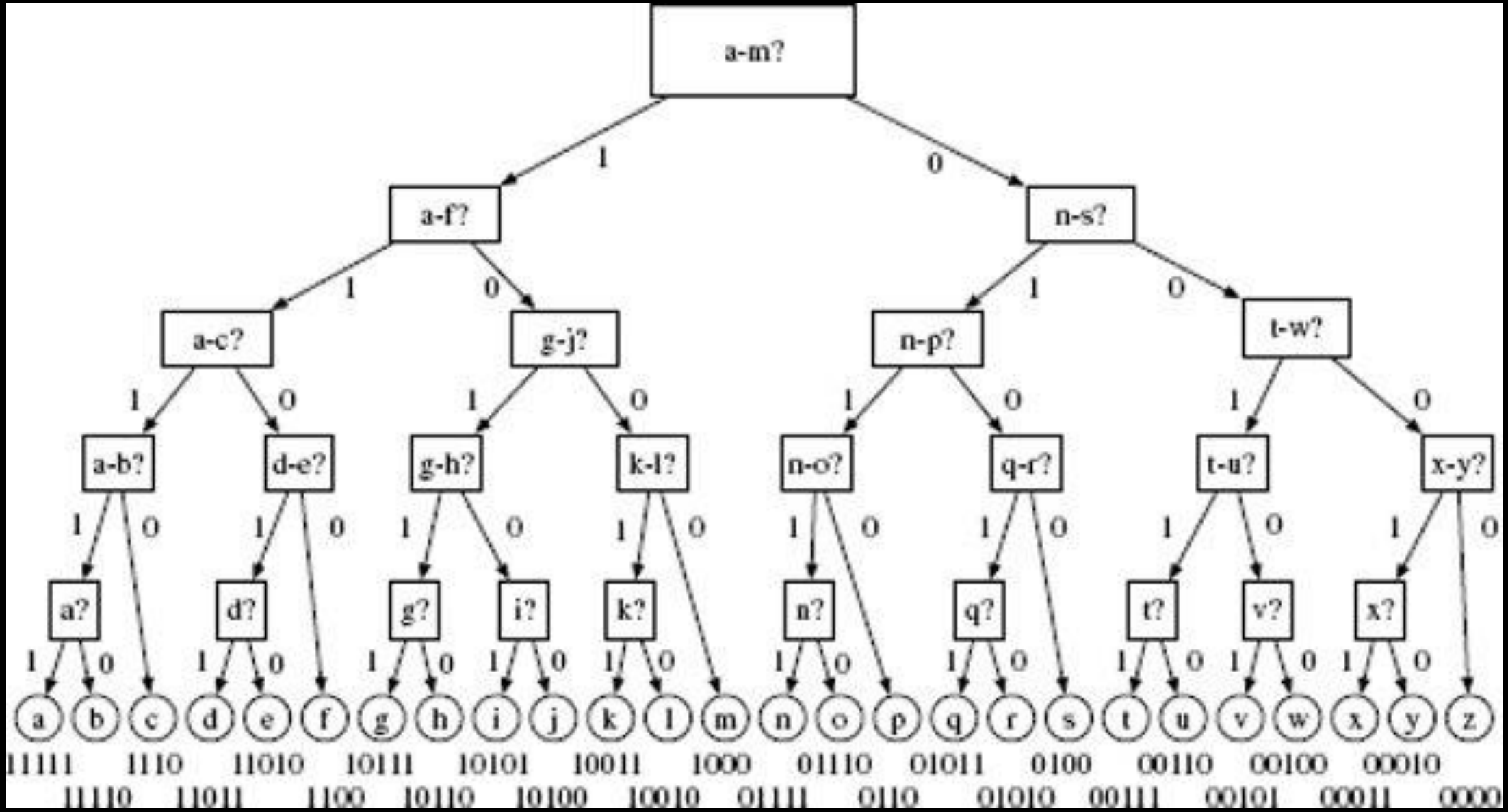
20 Questions Game



5 Questions


Question 1
a-m?
yes
no
Question 2
a-f?
n-s?
yes
no
yes
no
Question 3
a-c?
g-j?
n-p?
t-w?
y
n
y
n
y
n
y
n
Question 4
a-b?
d-e?
g-h?
k-l?
n-o?
q-r?
t-u?
x-y?
Question 5
a?
d?
g?
i?
k?
n?
q?
t?
v?
x?
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

Patterns


a-m?
a-f?
n-s?
a-c?
g-j?
n-p?
t-w?
a-b?
d-e?
g-h?
k-l?
n-o?
q-r?
t-u?
x-y?
a?
d?
g?
i?
k?
n?
q?
t?
v?
x?
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
11111 1110 11010 10111 10101 10011 1000 01110 01011 0100 00110 00100 00010
11110 11011 11001 10110 10100 10010 01111 0110 01010 00111 00101 00011 00001

Patterns

Code	Letter	Code	Letter
11111	a	01111	n
11110	b	01110	o
1110	c	0110	p
11011	d	01011	q
11010	e	01010	r
1100	f	0100	s
10111	g	00111	t
10110	h	00110	u
10101	i	00101	v
10100	j	00100	w
10011	k	00011	x
10010	l	00010	y
1000	m	00000	z

Understanding People

Do solutions work in practice?

Can people use with ease and w/o mistakes?

usability and user experience

How Bauby did it?

Letter Frequency

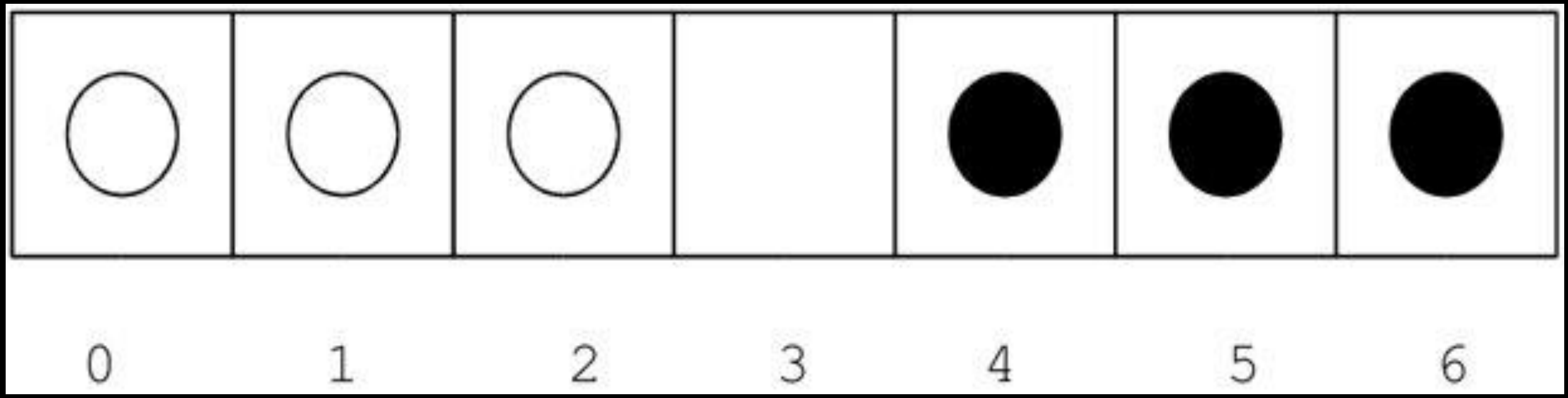
https://travelchick.wordpress.com/2008/07/31/jean-dominique-baubys-alphabet/

What did we do?

Writing a book into problem of communicating individual letters one at a time

Search algorithms – *linear* and *binary*

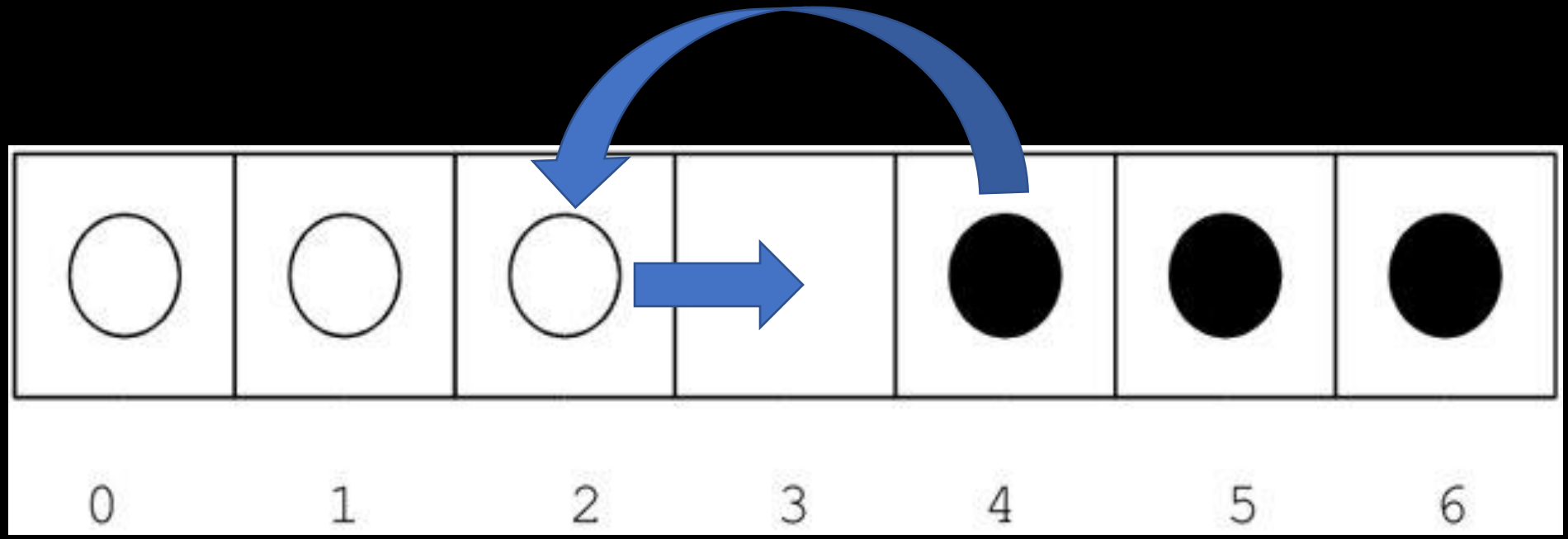
Let's Play



Write instructions that swap positions of black and white pieces

Kordemsky 1975, Puzzle 94

Instructions



Move piece in square 2 to 3

Jump piece in square 4 to 2

Kordemsky 1975, Puzzle 94

Let's Evaluate

How many instructions your solution has got?

Let's Evaluate

Some solutions are better than others!!

Let's Evaluate

Do you think there is a best solution? If yes, how do you define it?

Best Solution

Move piece in square 2 to square 3
Jump piece in square 4 to square 2
Move piece in square 5 to square 4
Jump piece in square 3 to square 5
Jump piece in square 1 to square 3
Move piece in square 0 to square 1
Jump piece in square 2 to square 0
Jump piece in square 4 to square 2

Best Solution contd.

Jump piece in square 6 to square 4
Move piece in square 5 to square 6
Jump piece in square 3 to square 5
Jump piece in square 1 to square 3
Move piece in square 2 to square 1
Jump piece in square 4 to square 2
Move piece in square 3 to square 4

Reflection

Can we call all these solutions, you have seen, as *algorithms*?!