Introduction to Mathematical Modeling

Online lecture

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Course outlines

- Optimization problems and techniques
- The applications of optimization in real world
- Automata theory, computability, and complexity

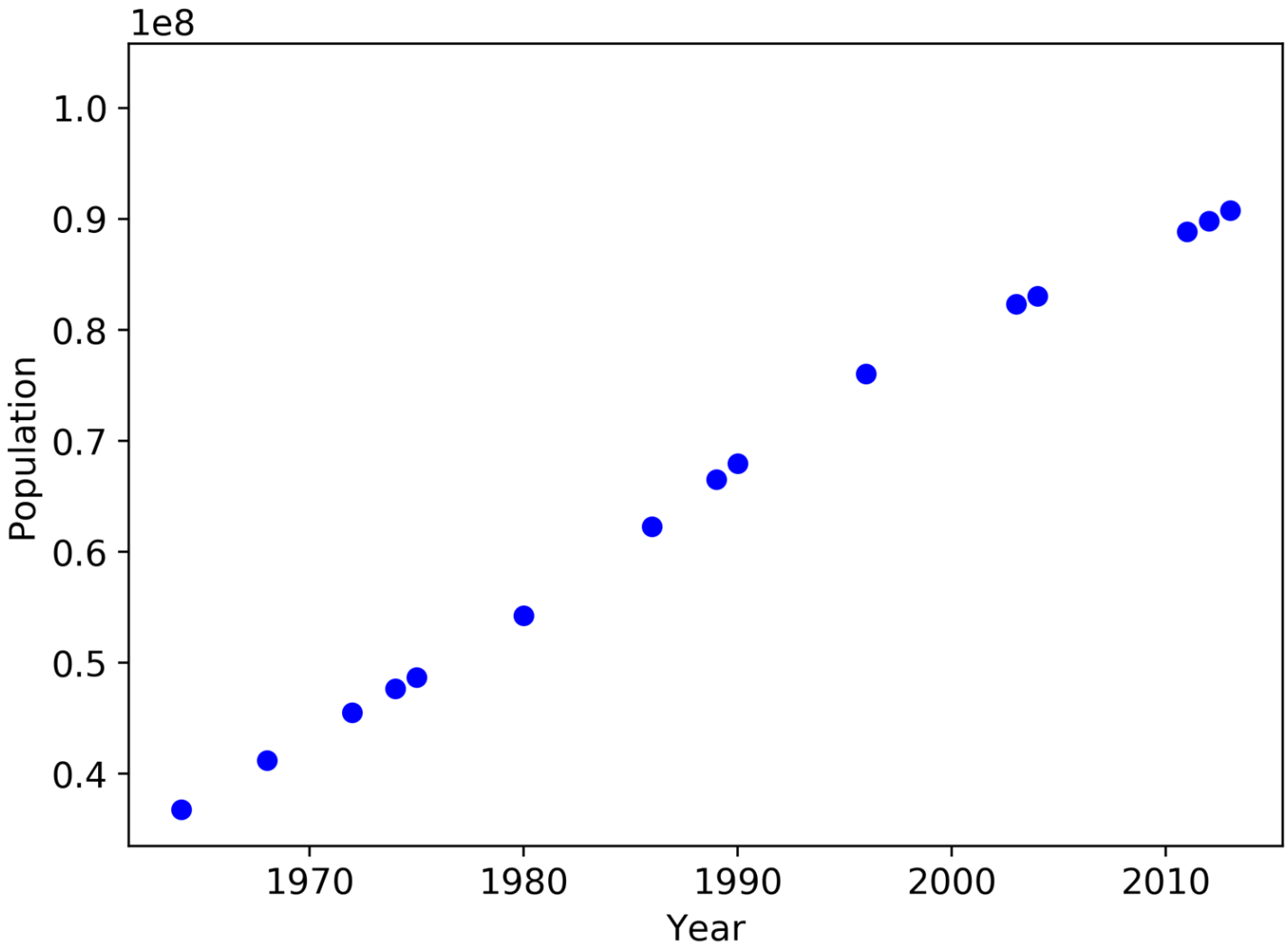
An elegant example

How do we know Vietnam population in 2021?

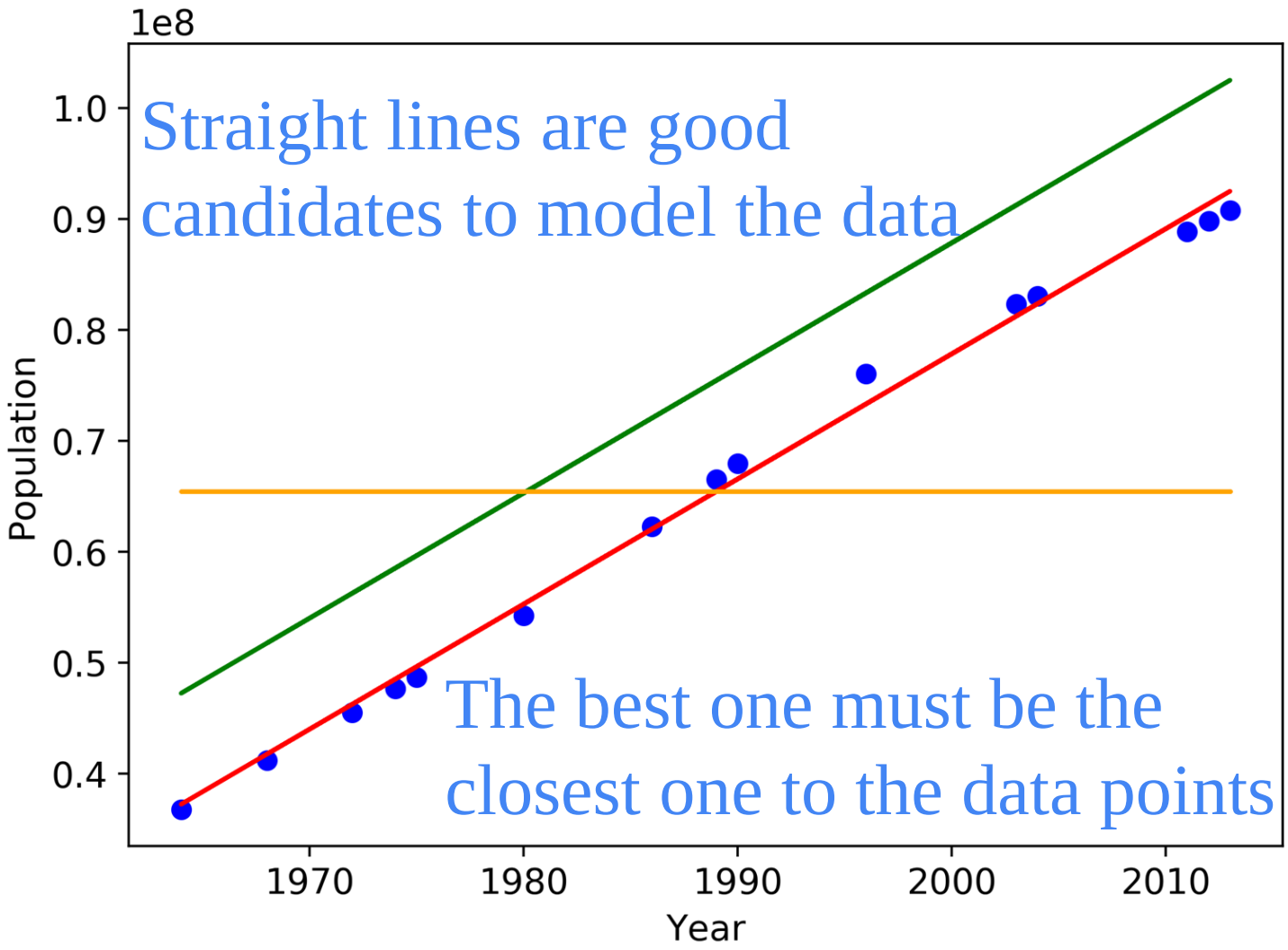
	Year	Population
0	1960	32670039
1	1961	33666110
2	1962	34683407
3	1963	35721217
4	1964	36779999
5	1965	37858951

...

An elegant example



An elegant example



An elegant example

Straight line: $f(x) = ax + b$ for $a, b \in \mathbb{R}$

Data coordinates: (x_i, y_i) for $i = 1, 2, \ldots, n$

x_i: the ith year

y_i: the population in the ith year

An elegant example

Total distance square:

$$\Delta(a,b) = \sum_{i=1}^{n}(y_i - f(x_i))^2 = \sum_{i=1}^{n}(y_i - ax_i - b)^2$$

The best fitting the data:

$$\min_{a,b} \Delta(a,b)$$

An elegant example

The best model:

$$f(x) = a_{\min} x + b_{\min}$$

The population in 2021:

$$f(2021) = 2021 a_{\min} + b_{\min}$$