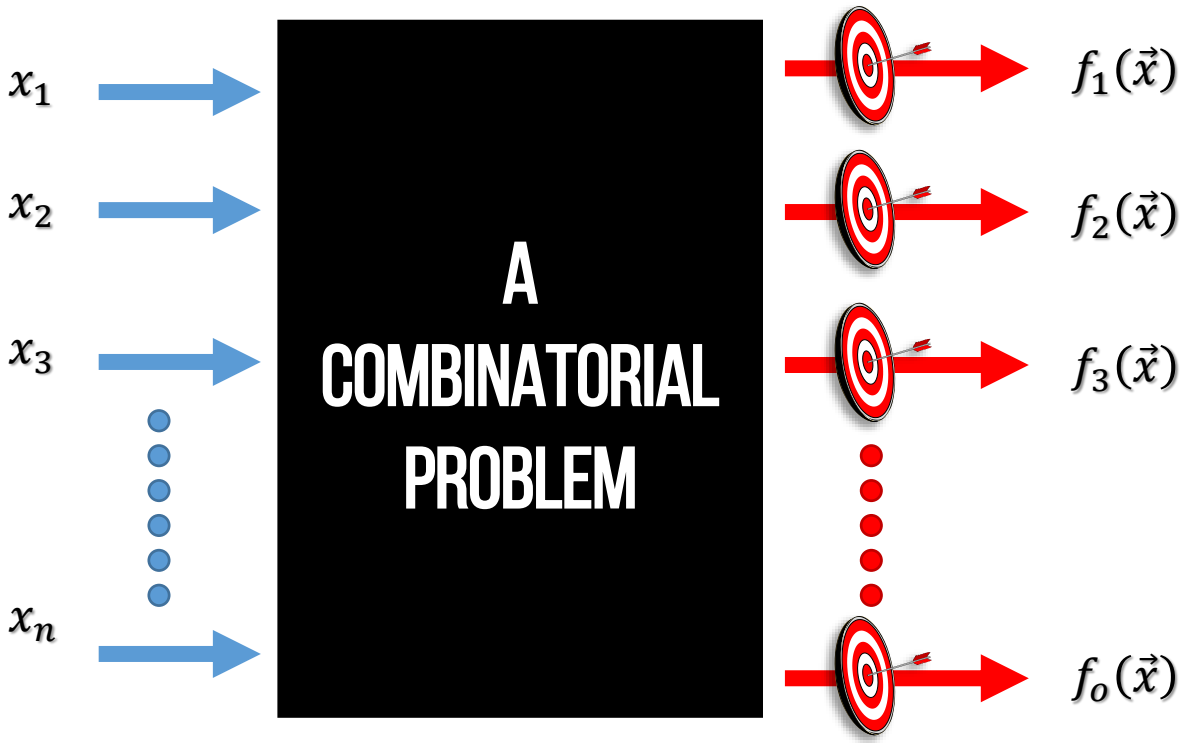
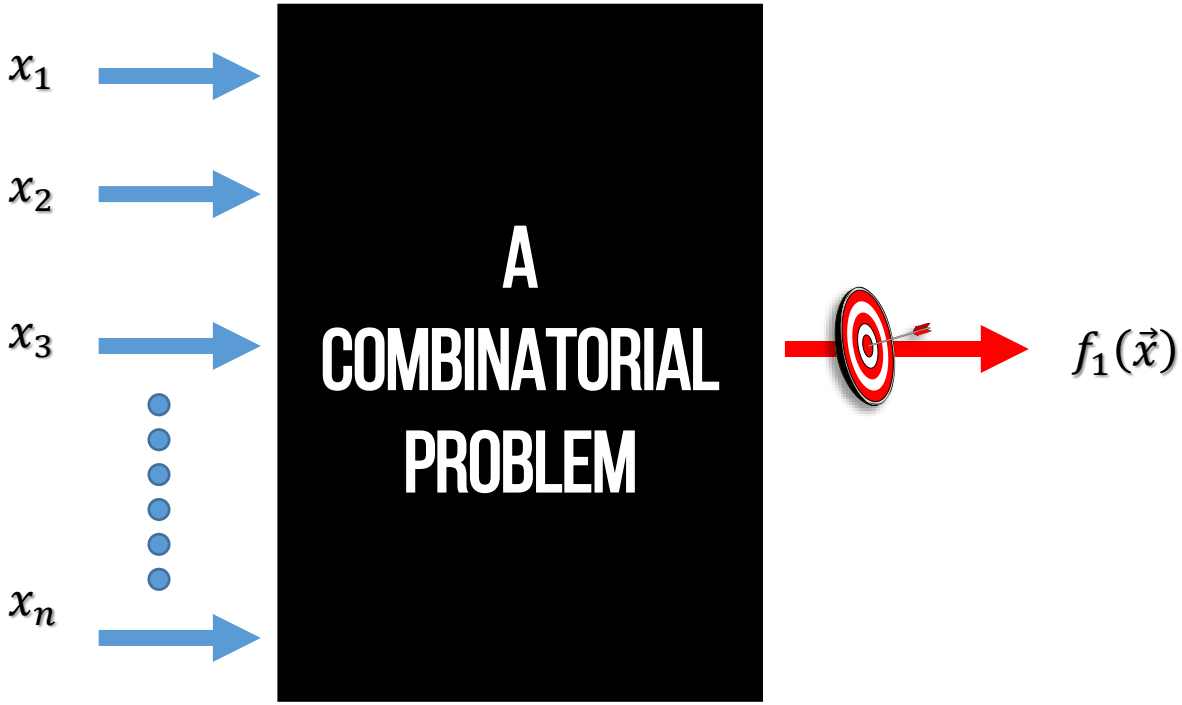
COMBINATORIAL OPTIMIZATION PROBLEMS

WHAT IS A COMBINATORIAL PROBLEM?



WE FOCUS ON SINGLE-OBJECTIVE COMBINATORIAL PROBLEMS



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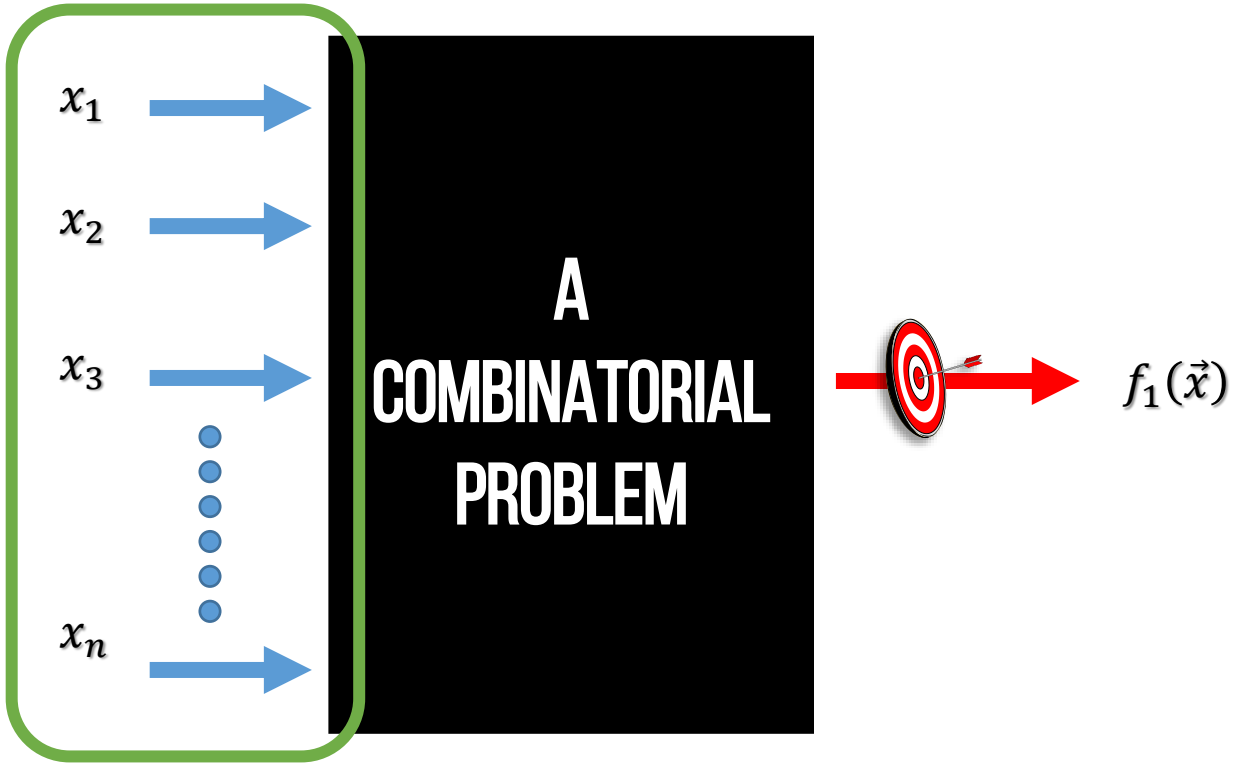
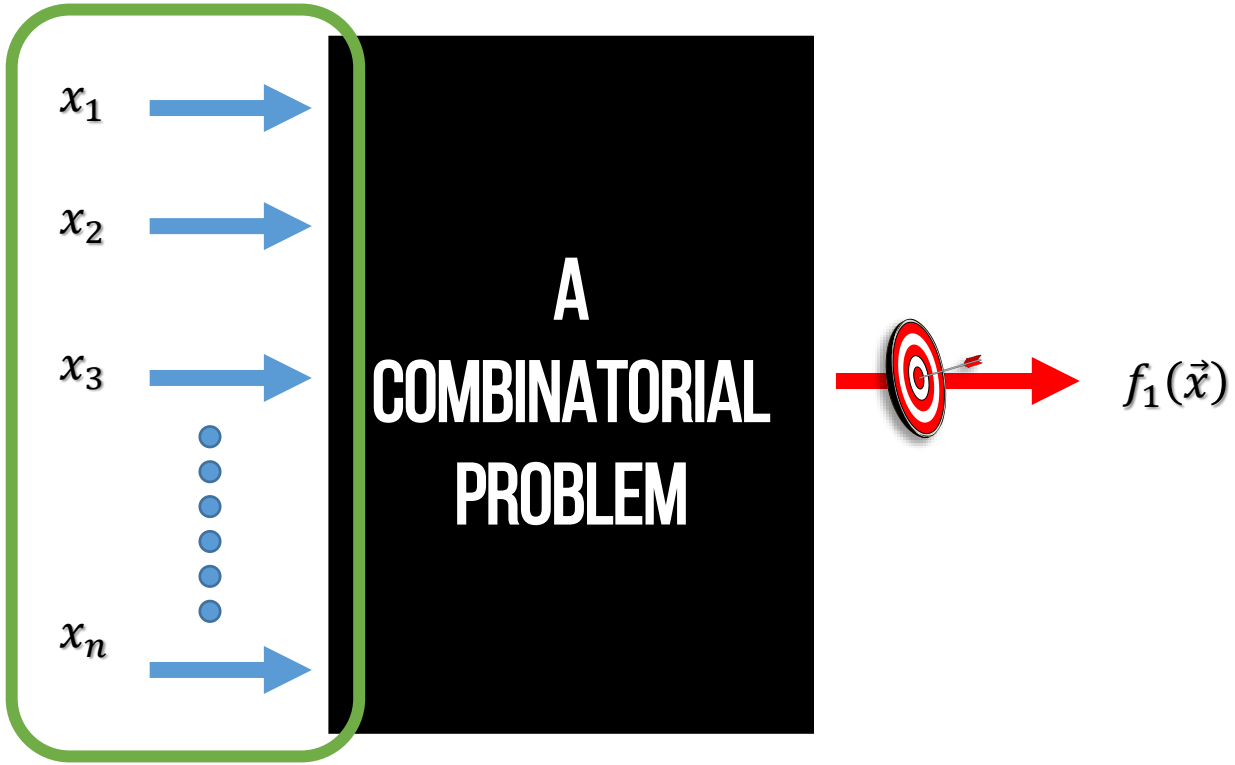


The type of inputs and the way we handle them make a problem combinatorial and different from other problems.

INPUTS (PARAMETERS) OF COMBINATORIAL PROBLEMS



The inputs are chosen from:

A FINITE SET OF **OBJECTS**

EXAMPLE 1

x_1

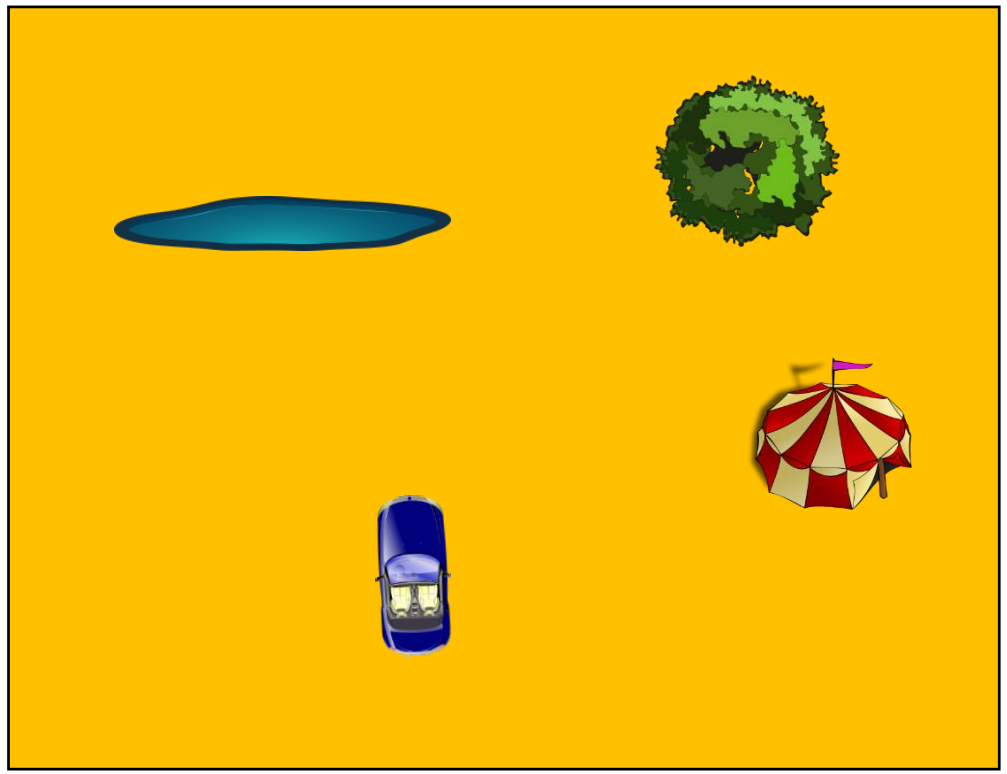
x_2

x_3

CARD GAME PROBLEM

$f_1(\vec{x})$
SORT

EXAMPLE 2



EXAMPLE 2

x_1

x_2

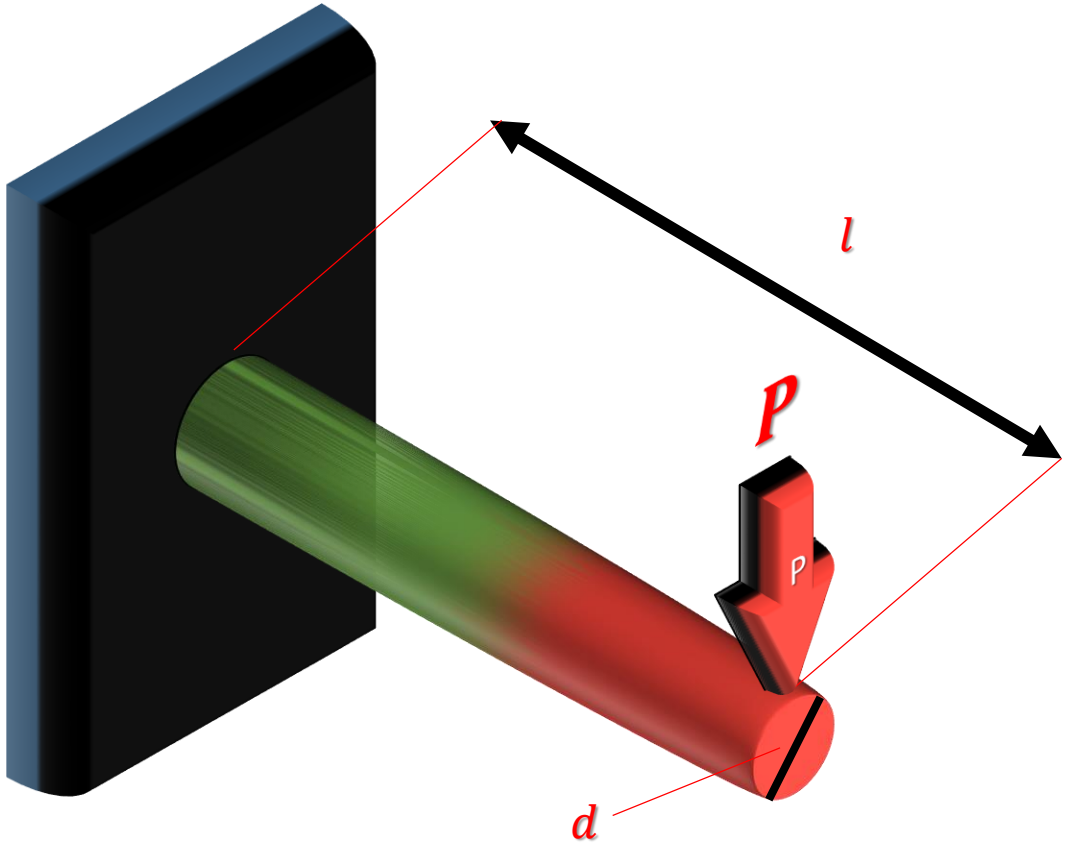
x_3

x_4

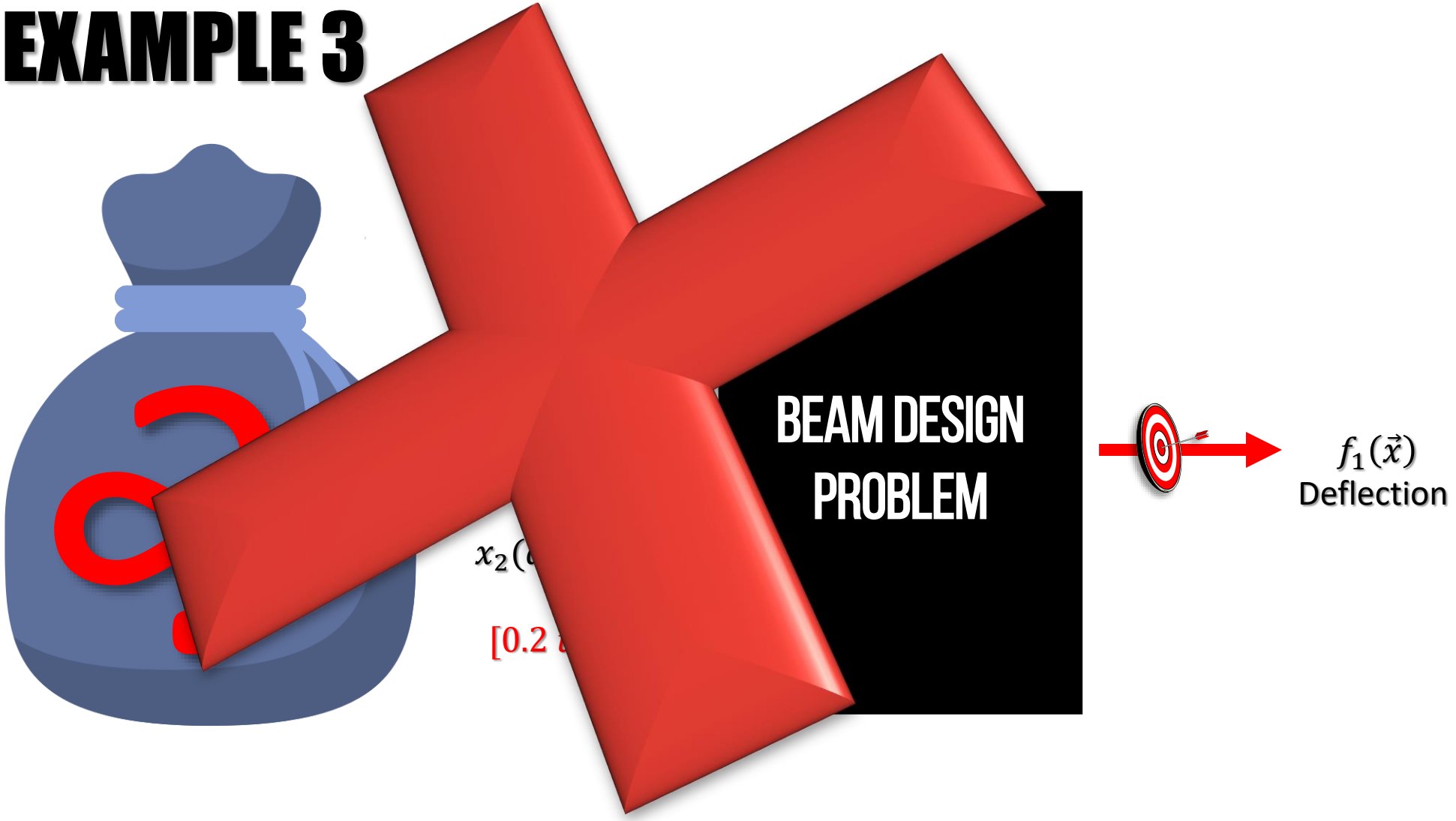
DRONE NAVIGATION PROBLEM

$f_1(\vec{x})$
Distance

EXAMPLE 3



EXAMPLE 3



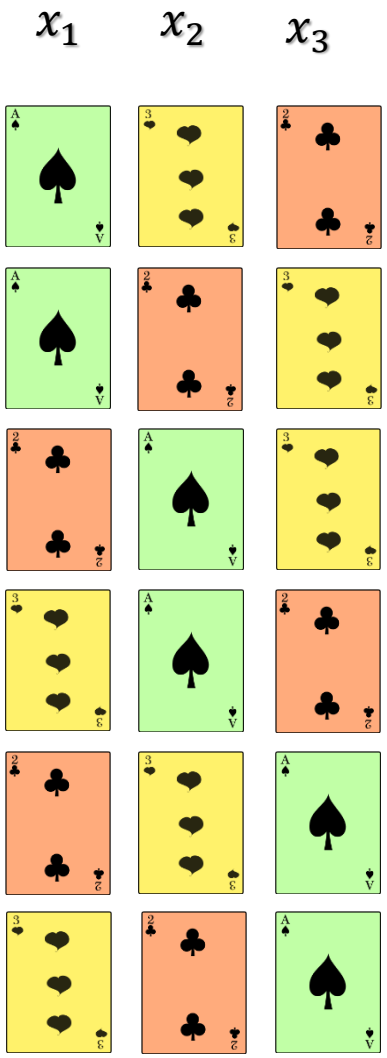
$f_1(\vec{x})$
Deflection

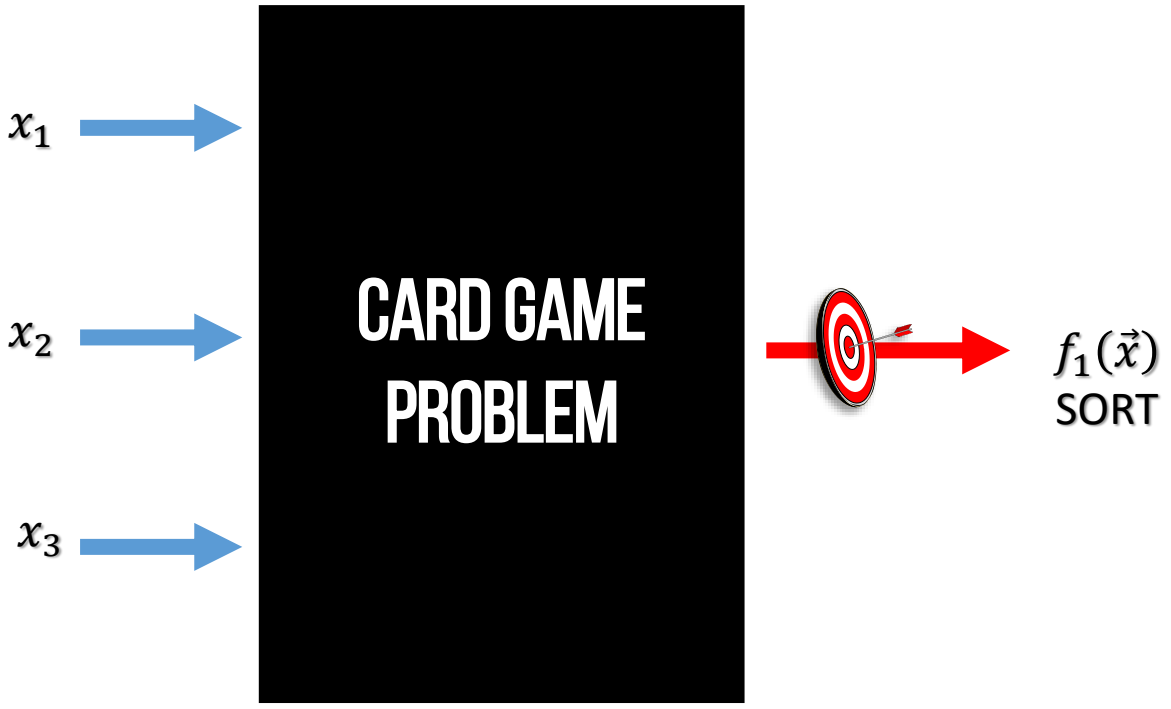
So this **IS NOT** a combinatorial problem because:

- No discreet values
- No finite set

SEARCH SPACE OF COMBINATORIAL PROBLEMS

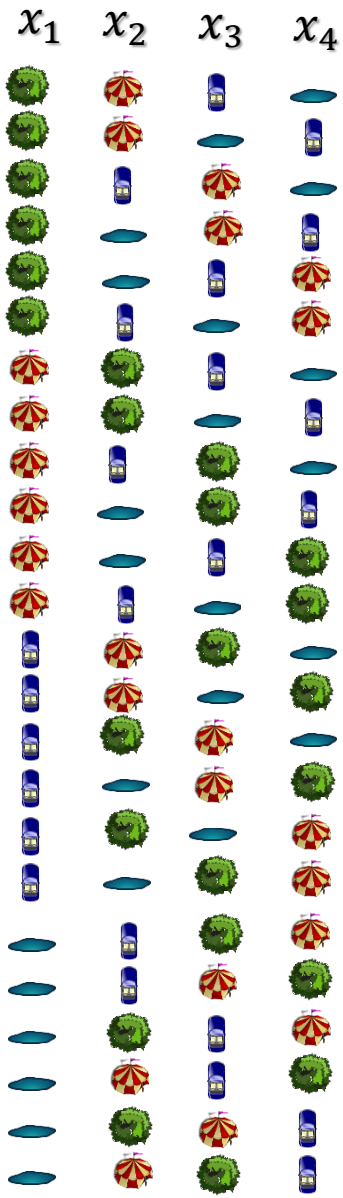
CARD GAME EXAMPLE



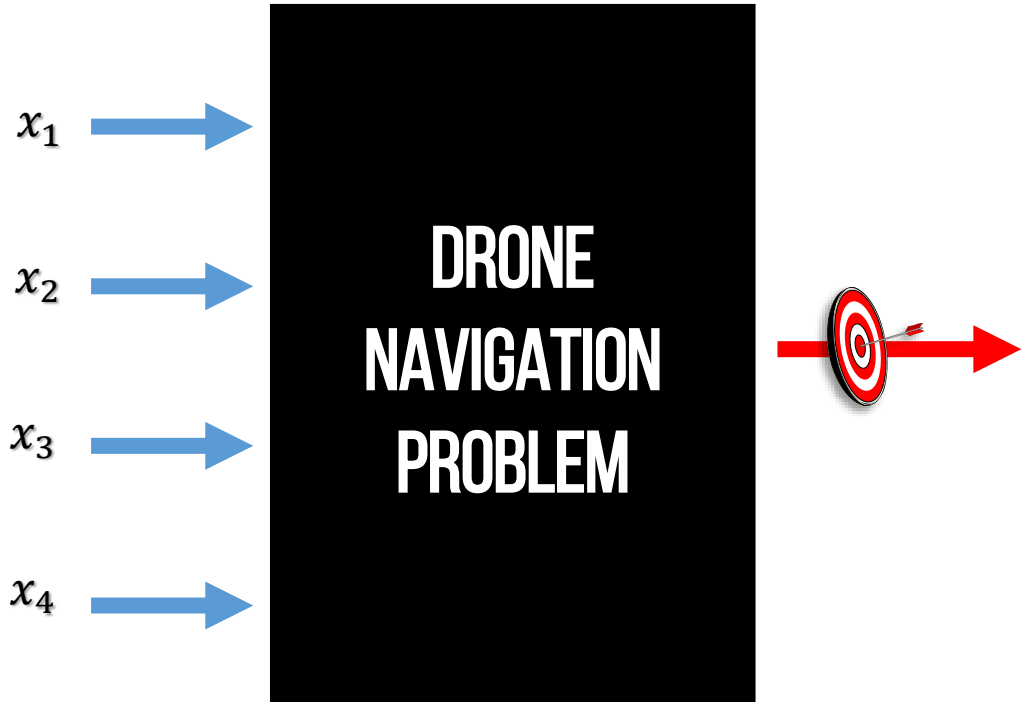


Size of search space = 6

DRONE NAVIGATION EXAMPLE



Size of search space = 24



SO, WHAT IS THE SEARCH SPACE OF A COMBINATORIAL PROBLEM?

Search space of a **combinatorial** problem

=

All the **combinations** of the “objects”

SO, HOW TO CALCULATE THE SIZE OF SEARCH SPACE WHEN THE NUMBER OF OBJECTS IS EQUAL TO THE NUMBER OF VARIABLES?

$$n! = \prod_{i=n}^{1} i = n(n-1)(n-2)\ldots 3 \times 2 \times 1$$

Where n is the number of objects (variables)