

# PROBLEMA CELOR N REGINE

CU INTELIGENTA ARTIFICIALA



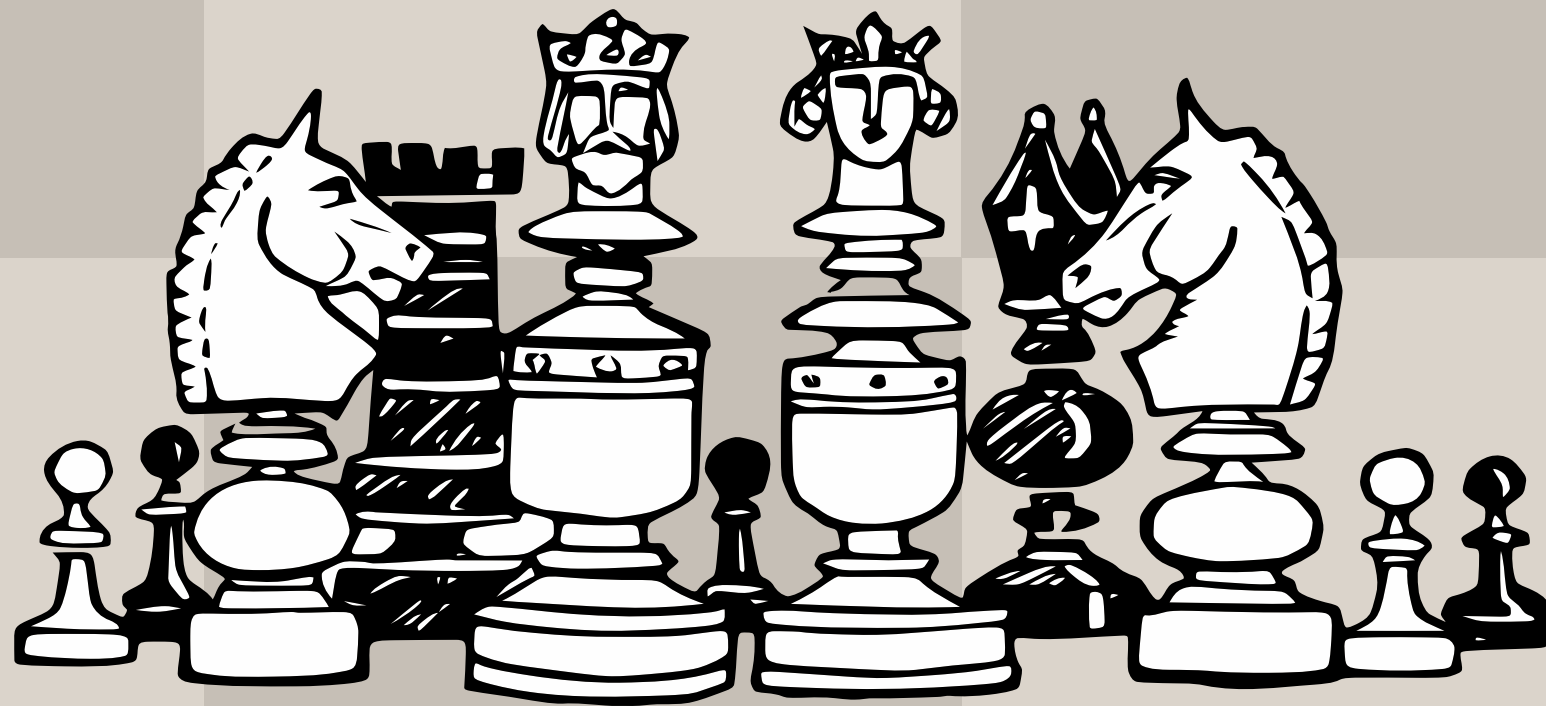
JACLINA-IANA BULAT  
STUDENTA ANUL 3

# PROBLEMA

**Se dau  $N$  dame si o tabla de sah de dimensiune  $N \times N$ .**

**Sa se gaseasca toate modalitatile de a aranja toate damele astfel încât oricare doua dame sa nu se atace.**

**Doua dame se ataca daca se afla pe aceeasi linie, coloana sau diagonala.**

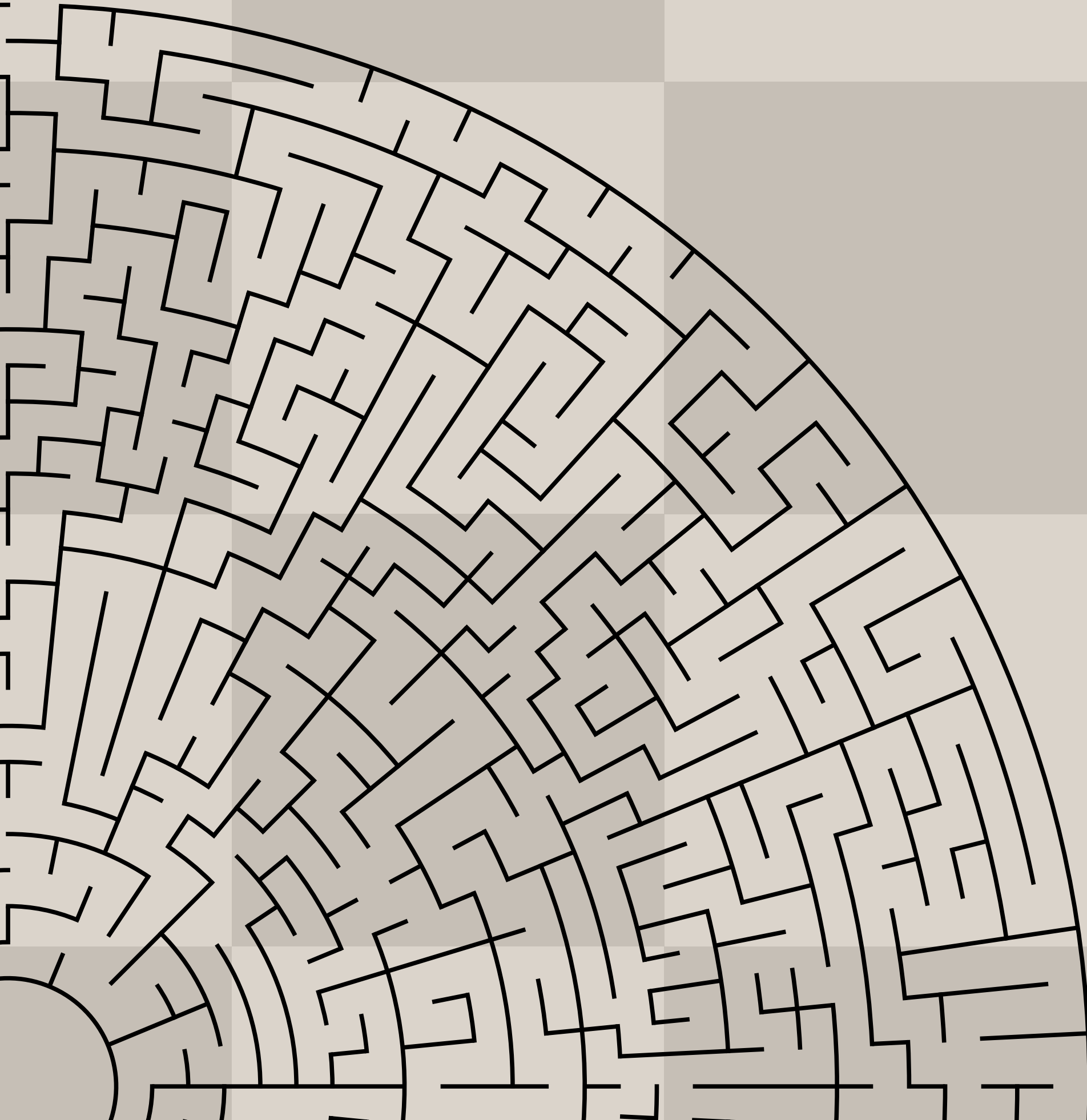


# **SOLUTIA CLASICA**

**In C++ ca sa rezolvam aceasta problema, am  
folosi backtracking ca una din solutii.**

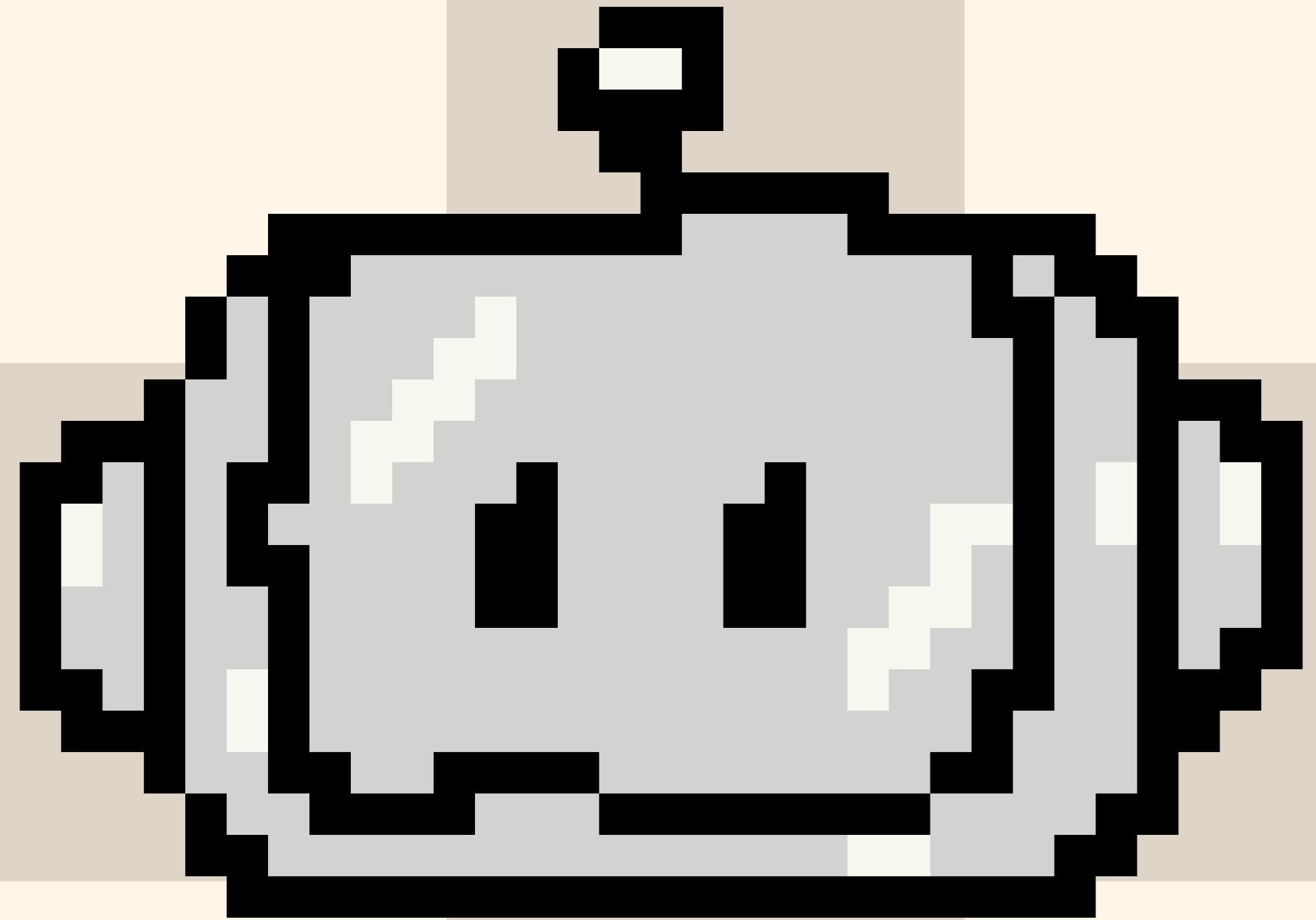
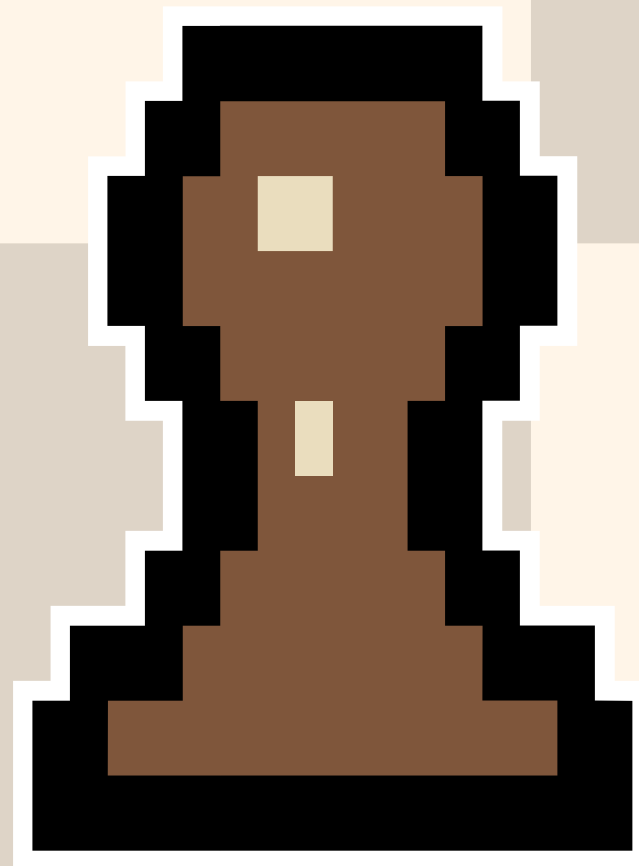
**Insa...cum ar fi sa incercam ceva nou?**

**O alta abordare putin mai complexa la o  
problema simpla?**

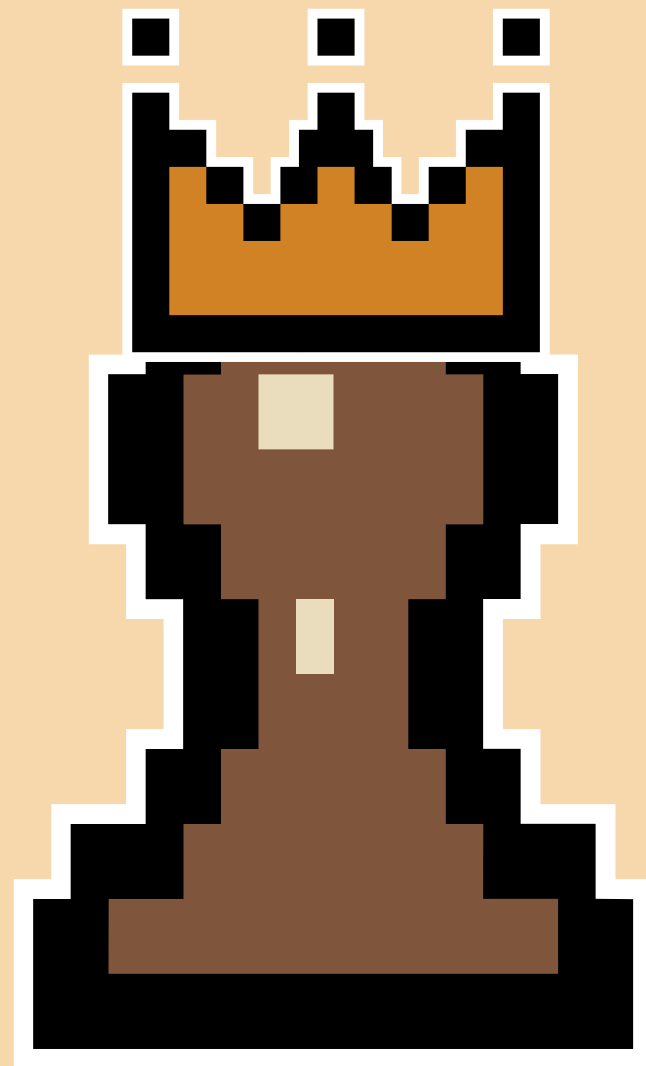


**CUM PUTEM  
REZOLVA  
CU**

**AI**



# 1) INITIALIZAREA POPULATIEI

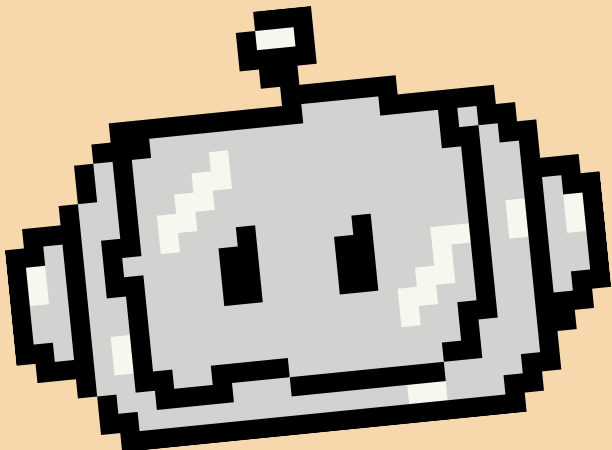
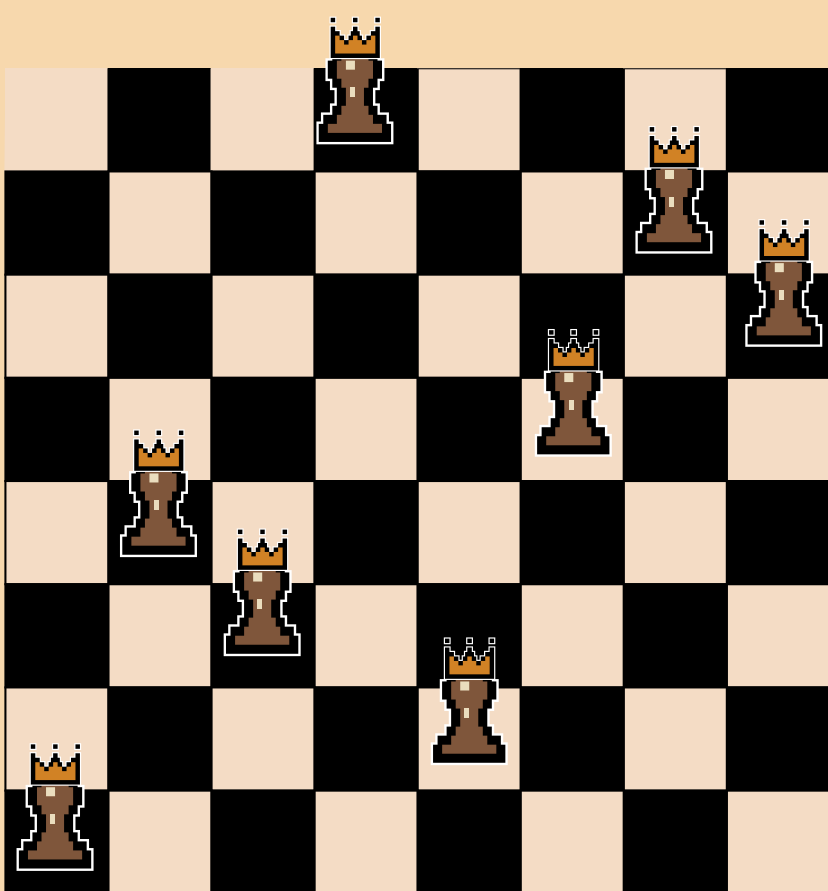
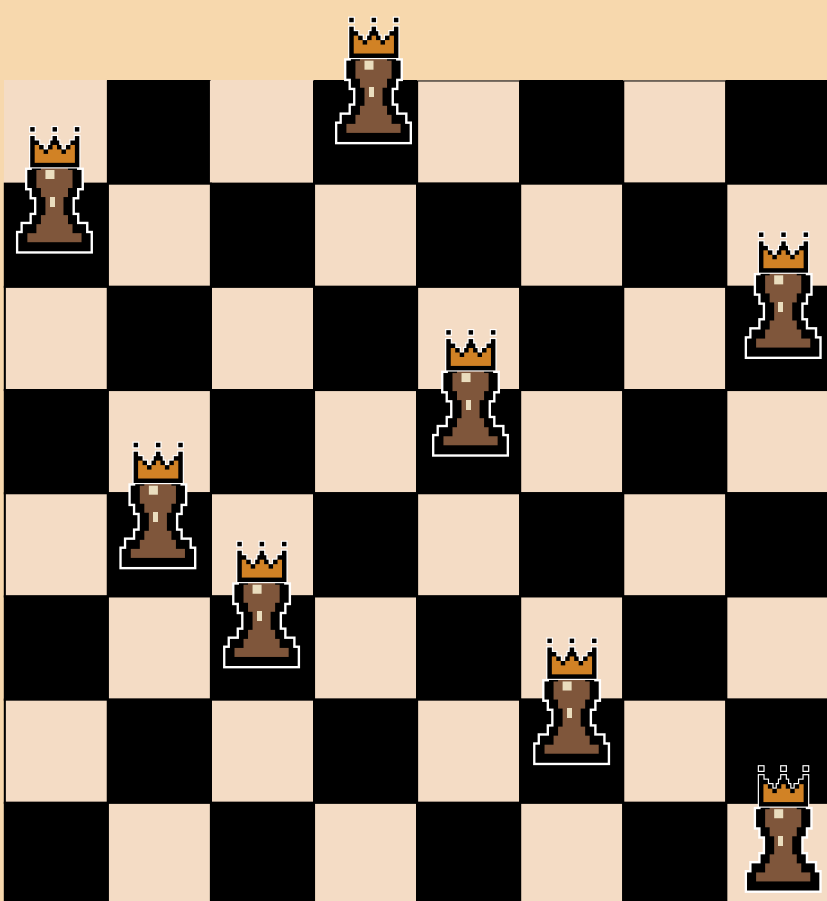
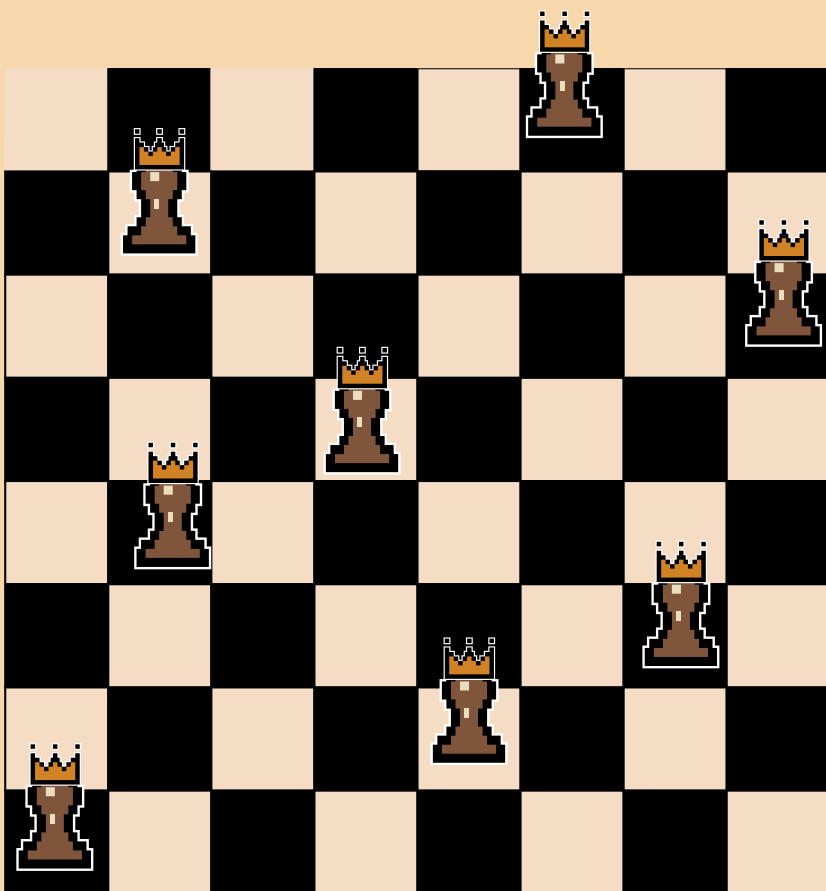
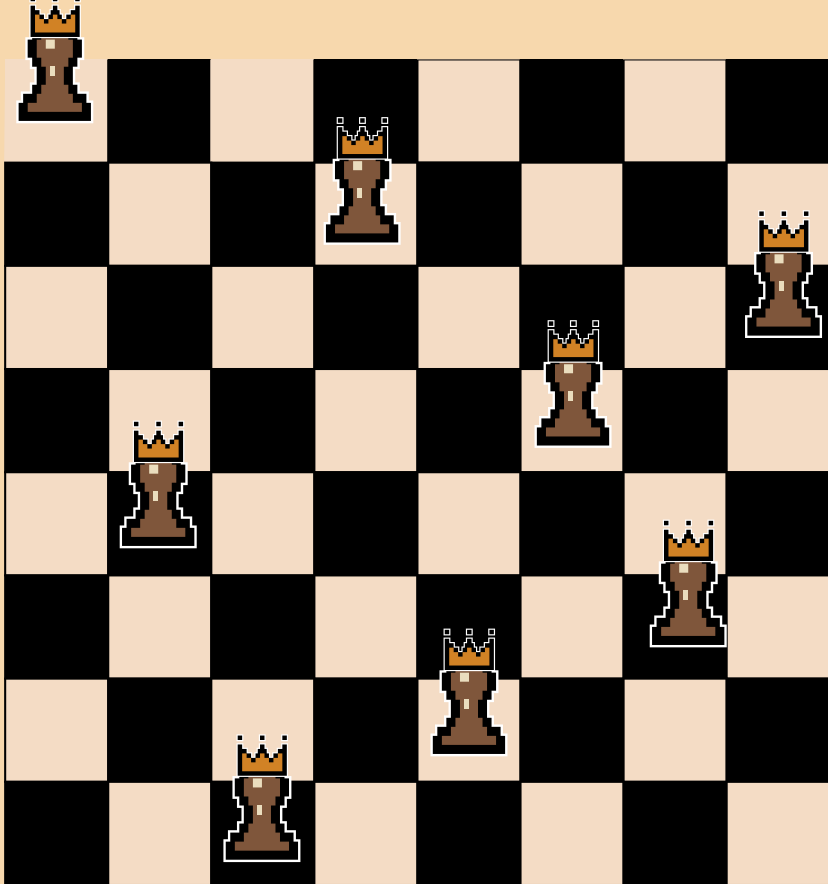
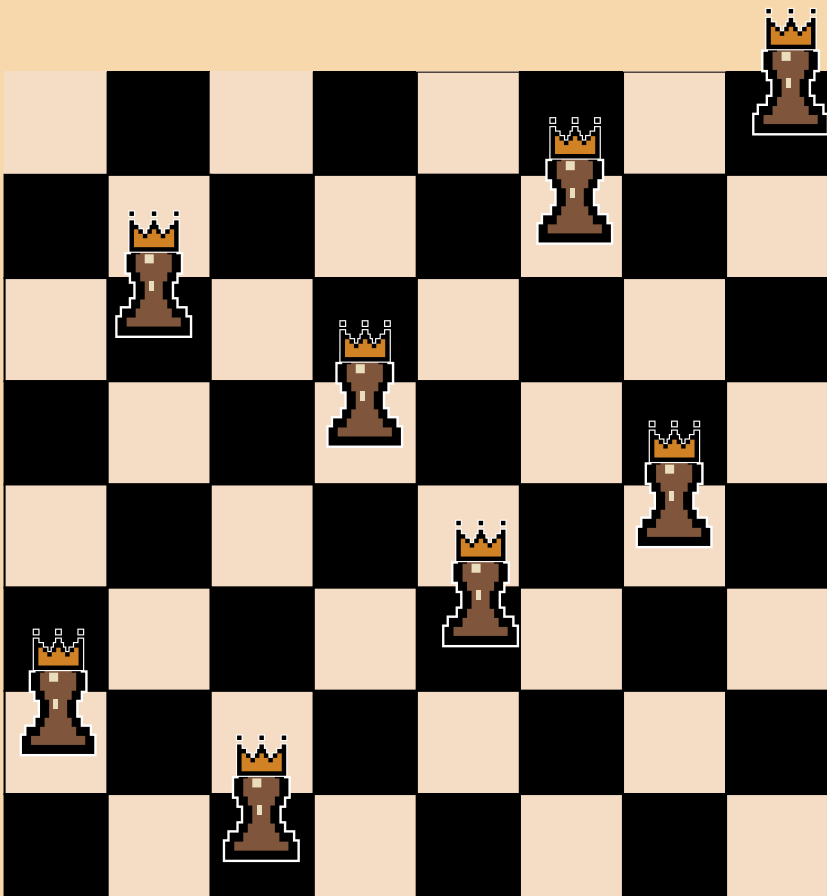
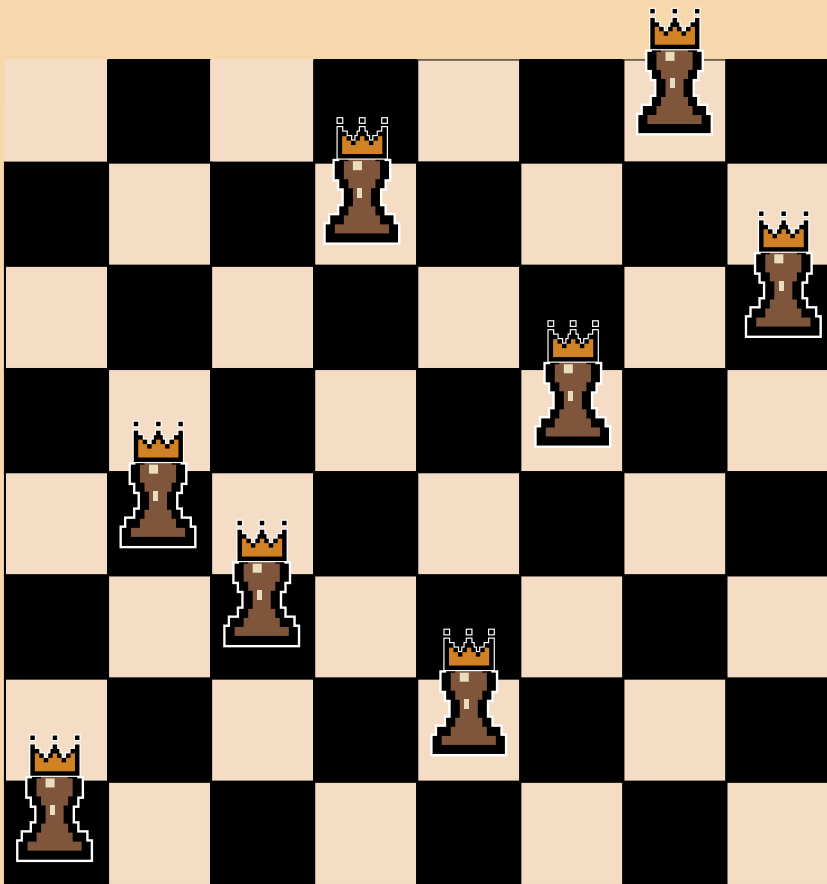


**QUEEN**

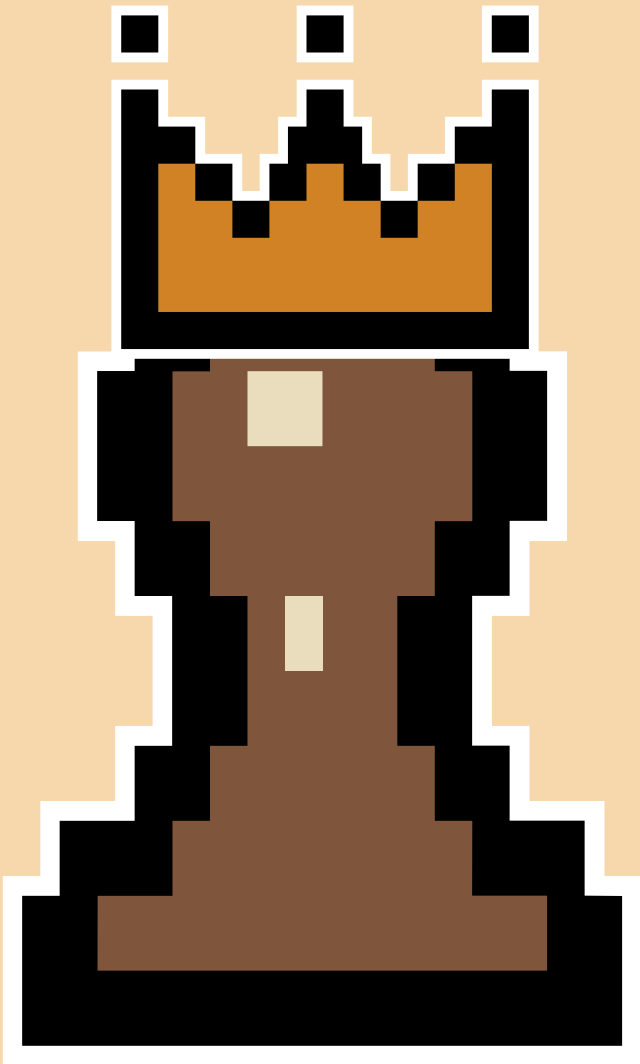
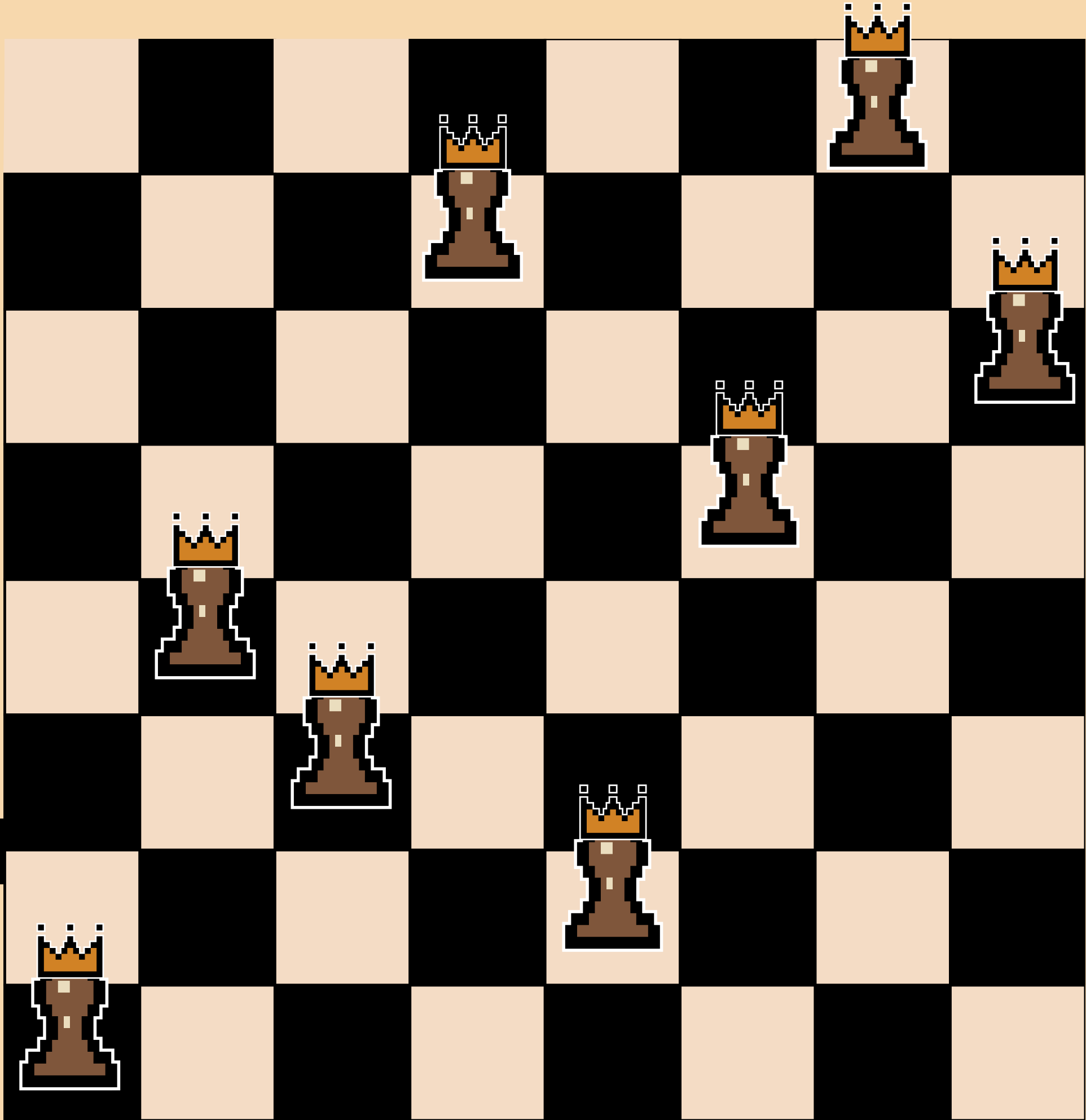
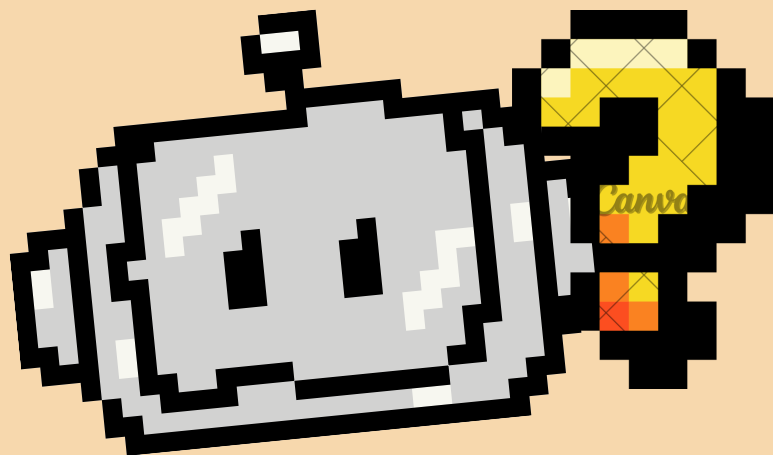
**Formam un sir de regine:**

- **alegem numarul de regine (cromozomi)  $\Rightarrow$  8**
- **cream o permutare pentru cele 8 regine**
  - **reprezinta o tabla de regine**
    - **pozitia in vector  $\Rightarrow$  coloana**
    - **valoarea in vector  $\Rightarrow$  randul**
  - **ex: [7, 4, 5, 1, 6, 3, 0, 2]**
- **cream mai multe permutari care vor reprezenta populatia de table cu regine**

1) INITIALIZAREA POPULATIEI

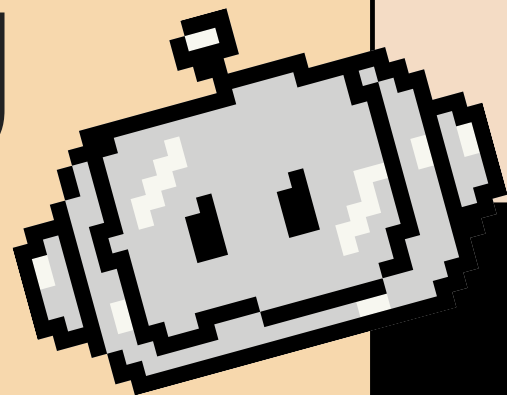


ESTE O  
SOLUTIE  
VALIDA?

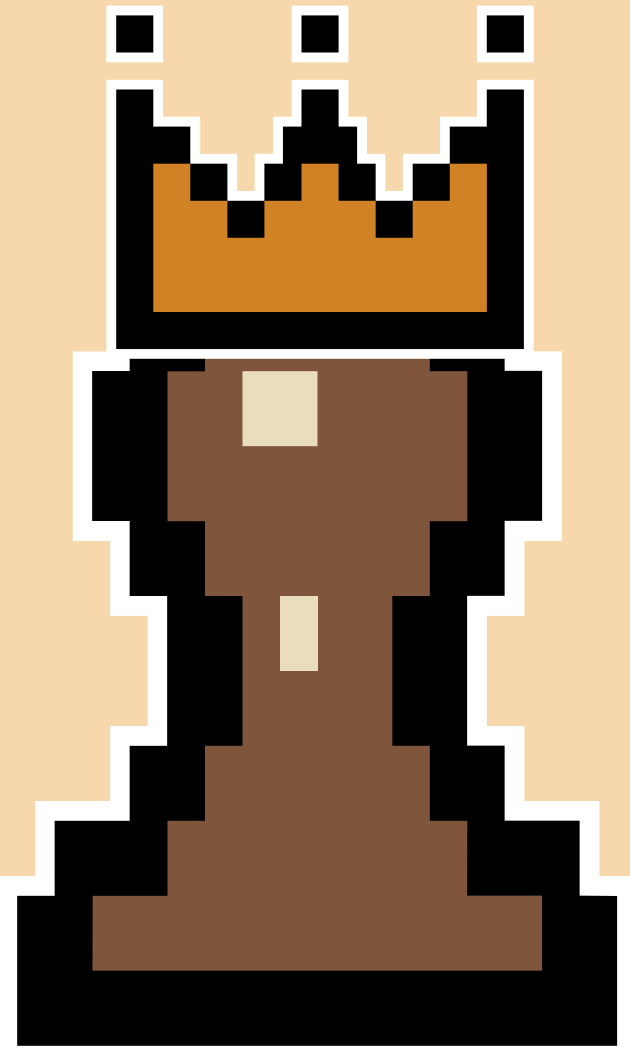
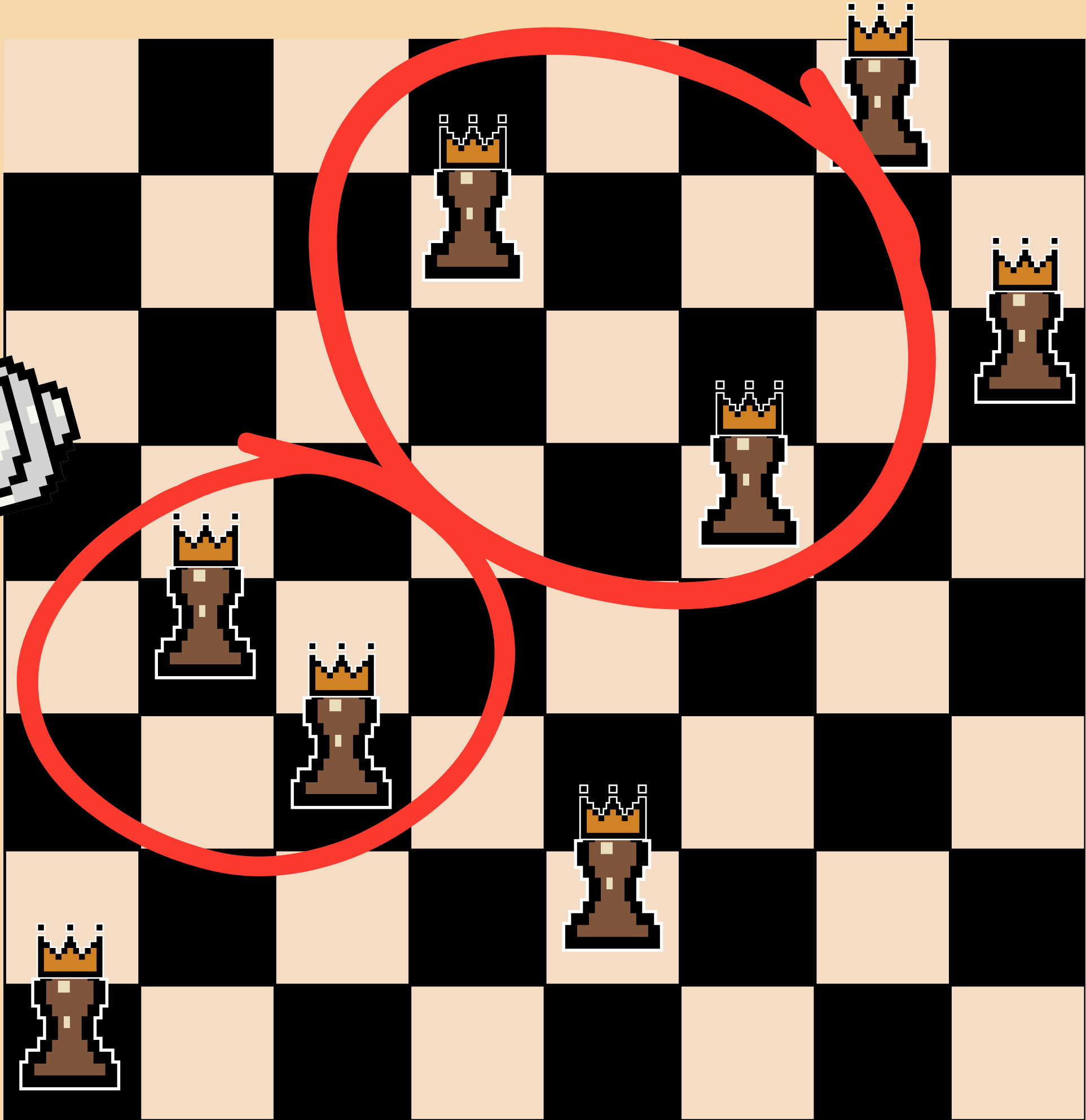


QUEEN

DIN  
PACATE,  
NU



HAI SA VEDEM  
CUM PASTRAM  
DOAR  
SOLUTIILE  
VALIDE



QUEEN



## **2) CALCULAM NIVELUL DE POTRIVIRE**

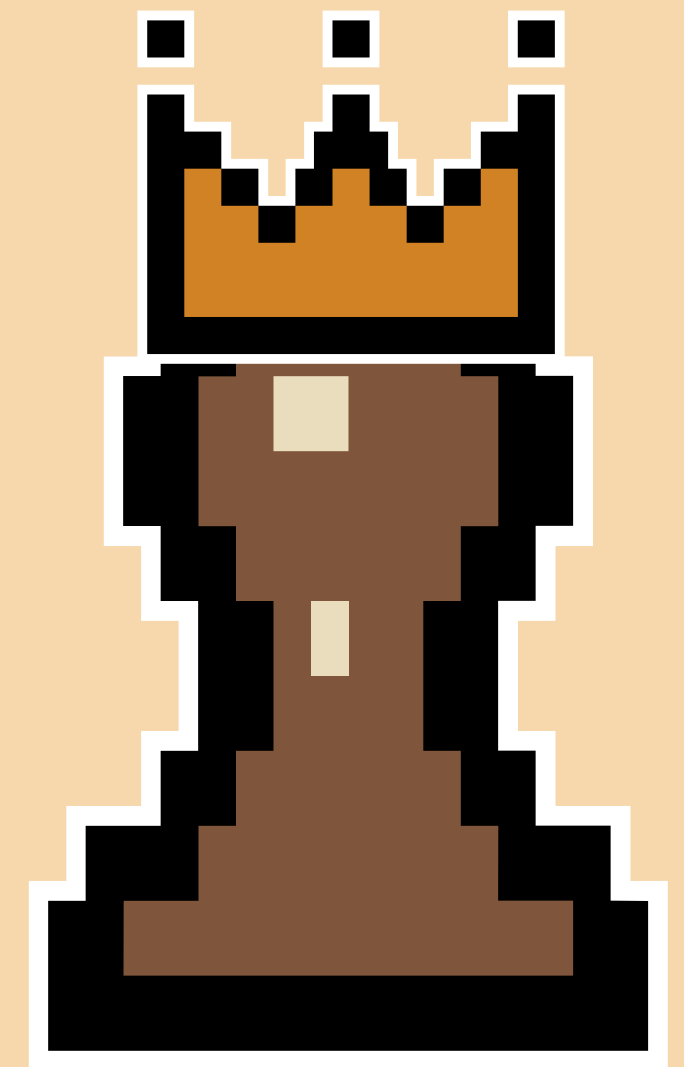
### **1) Cream o matrice aleatorie de valori**

- ele reprezinta ponderea fiecarui careu pe tabla
- reprezinta cat de bine e sa positionam o regina intr-un careu

### **2) “Curatam” populatia de duplicate**

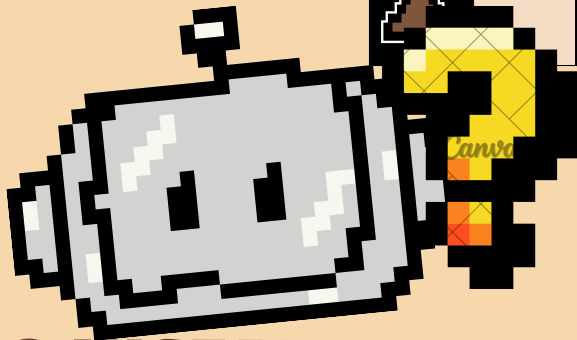
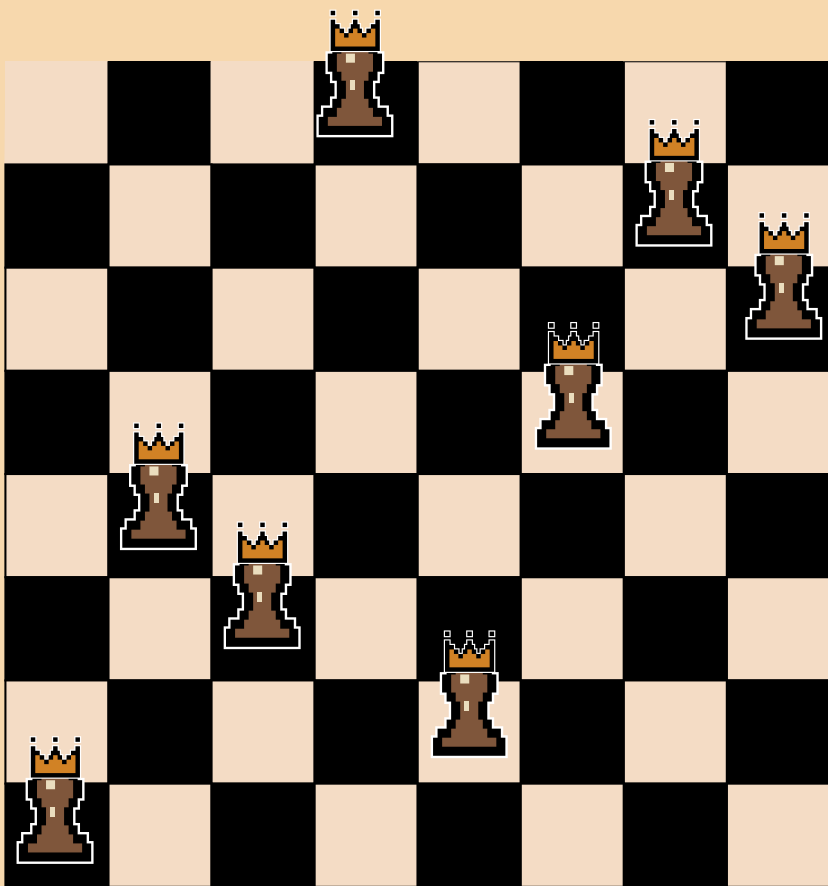
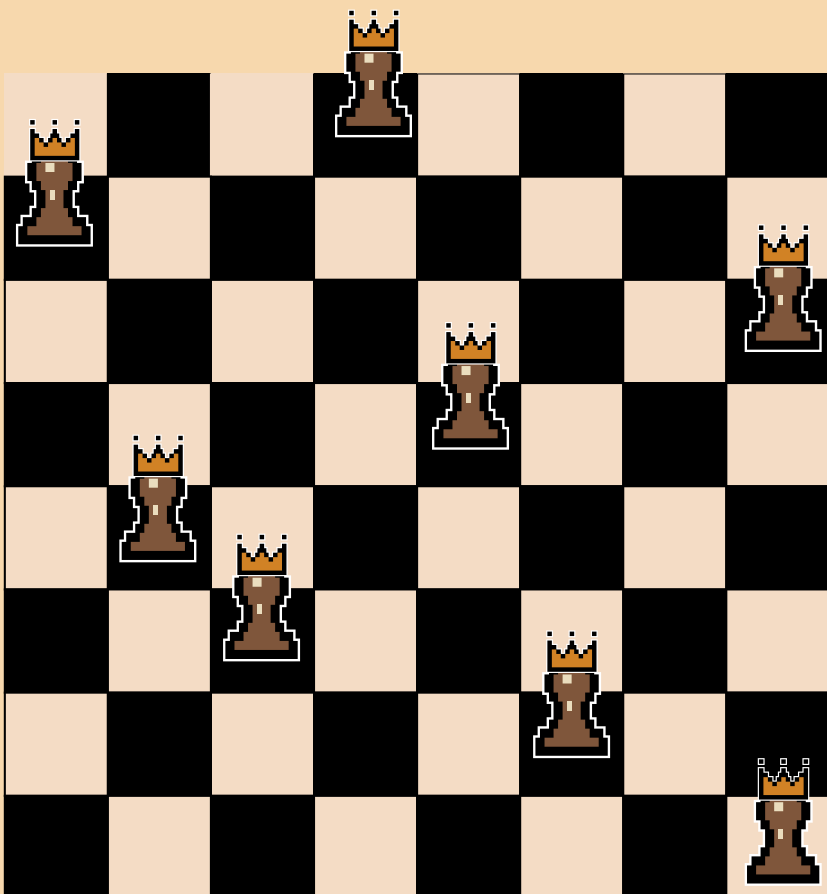
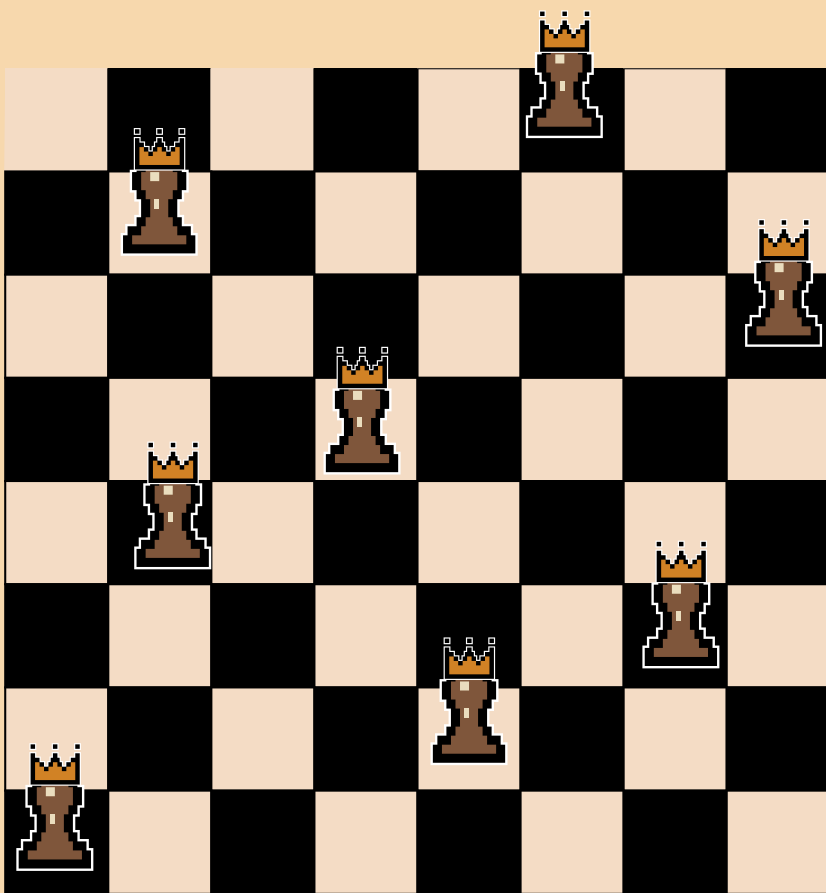
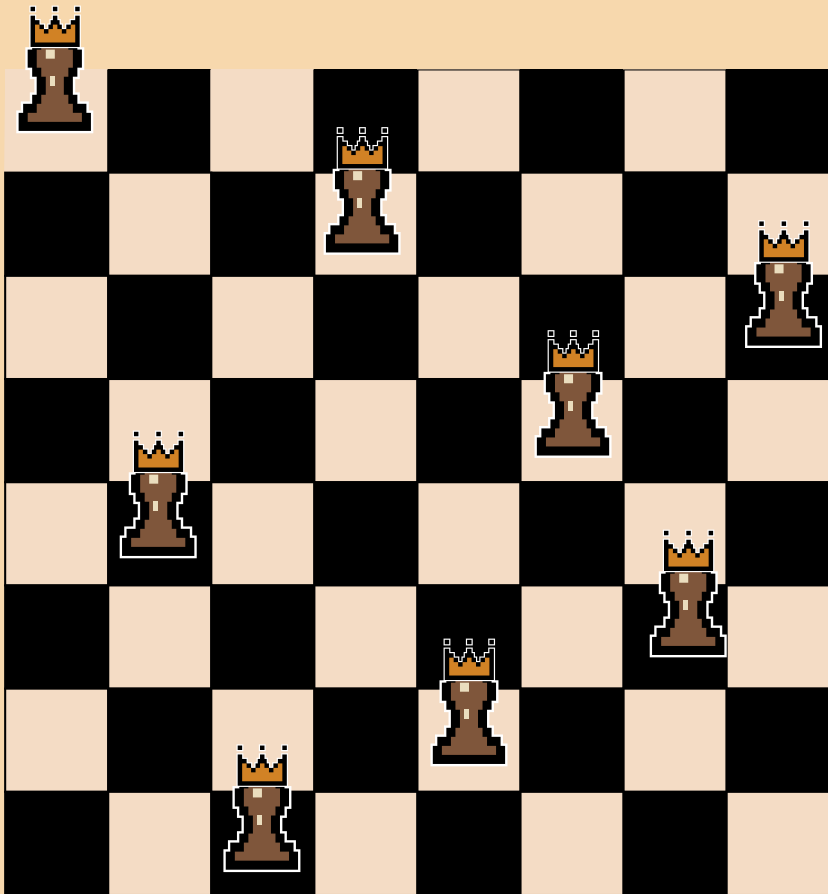
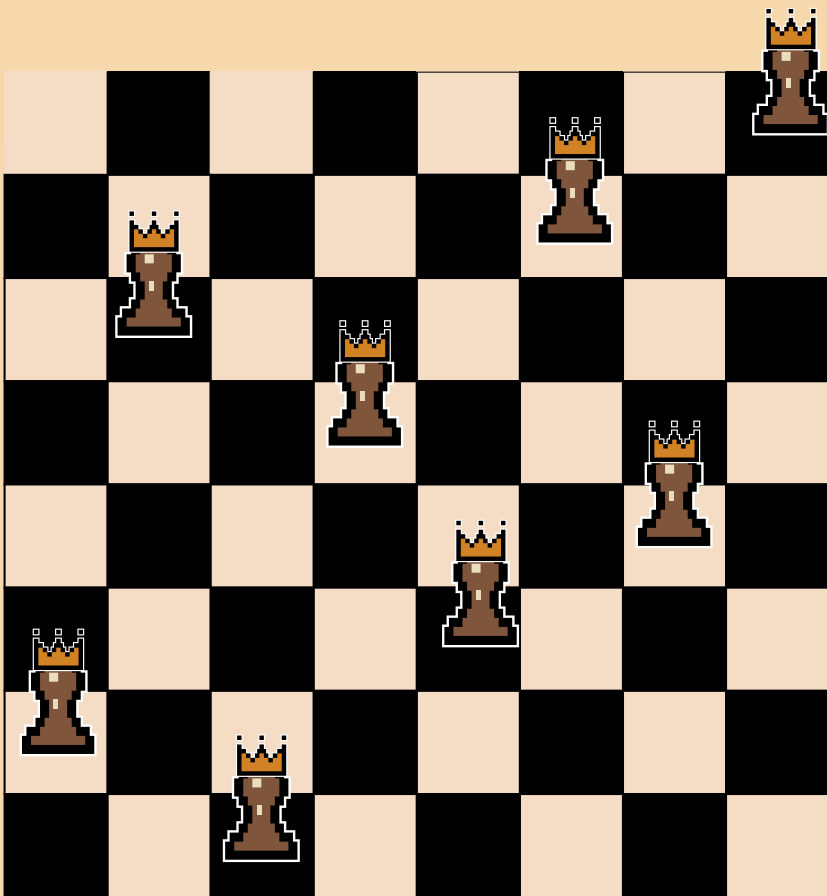
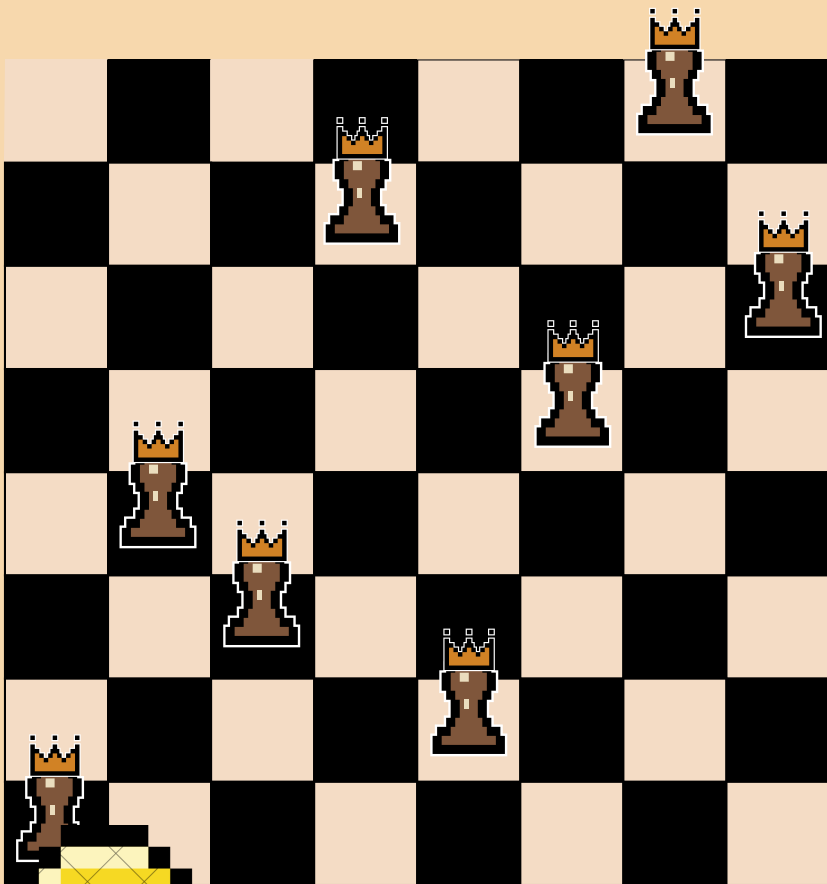
### **3) Calculam gradul de potrivire al unei table**

### **4) In functie de ponderi si de gradul de potrivire penalizam solutiile care au conflicte**



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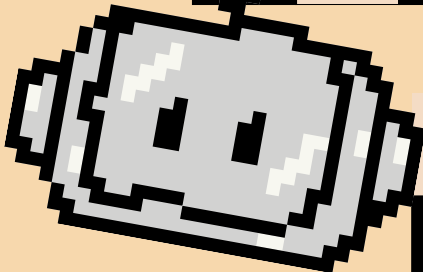
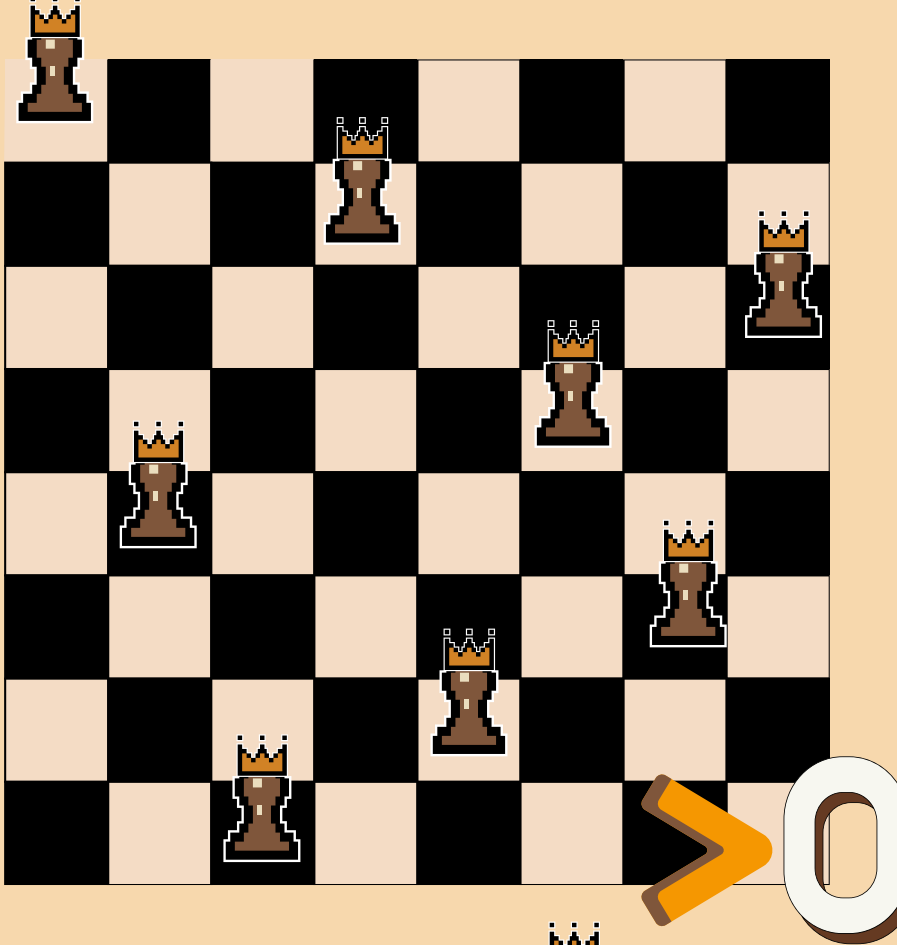
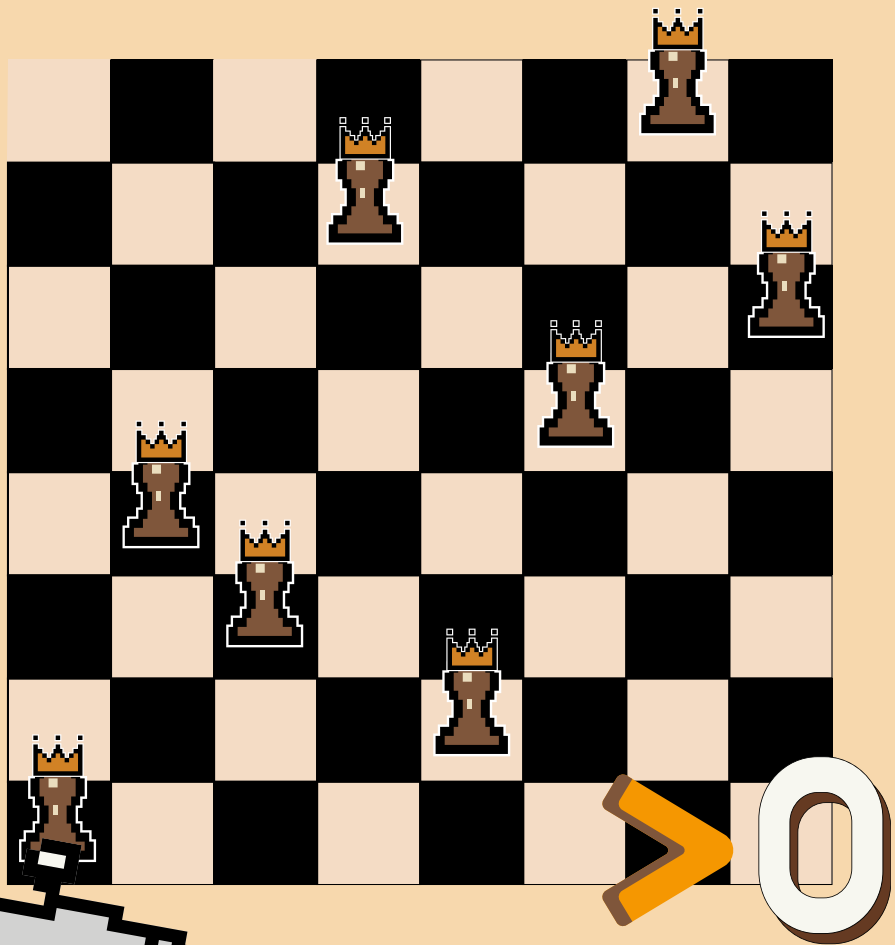
2) CALCULAM NIVELUL DE POTRIVIRE



= 0 INSEAMNA  
VALID

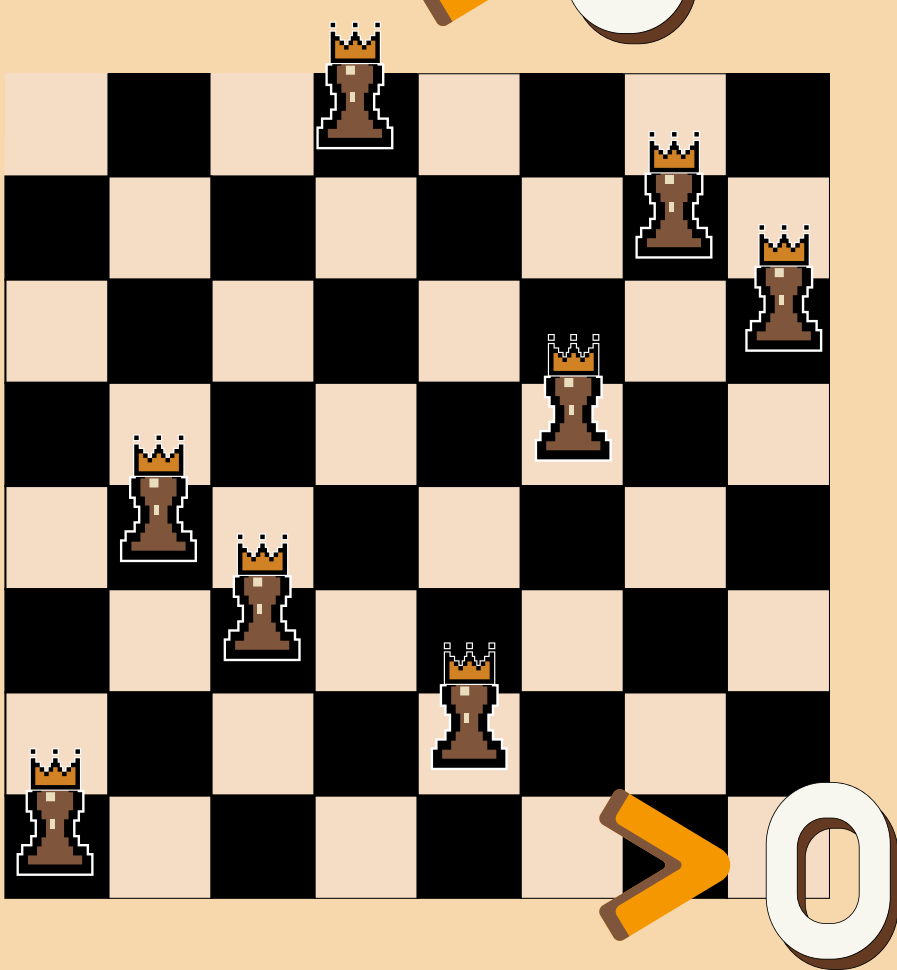
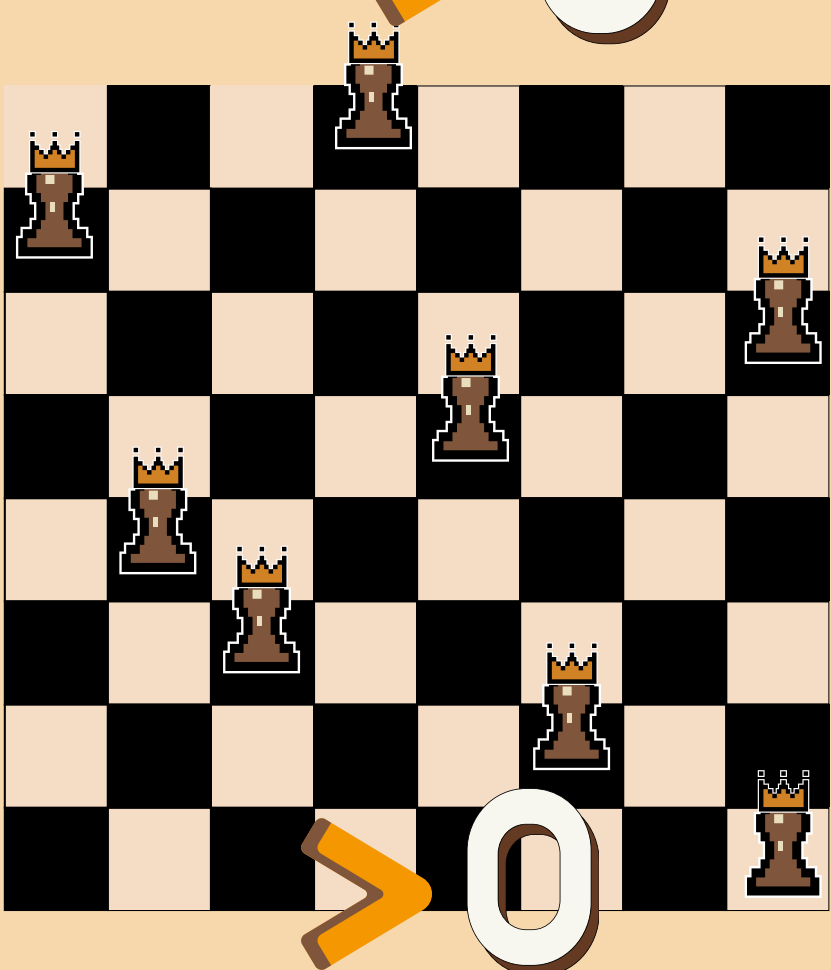
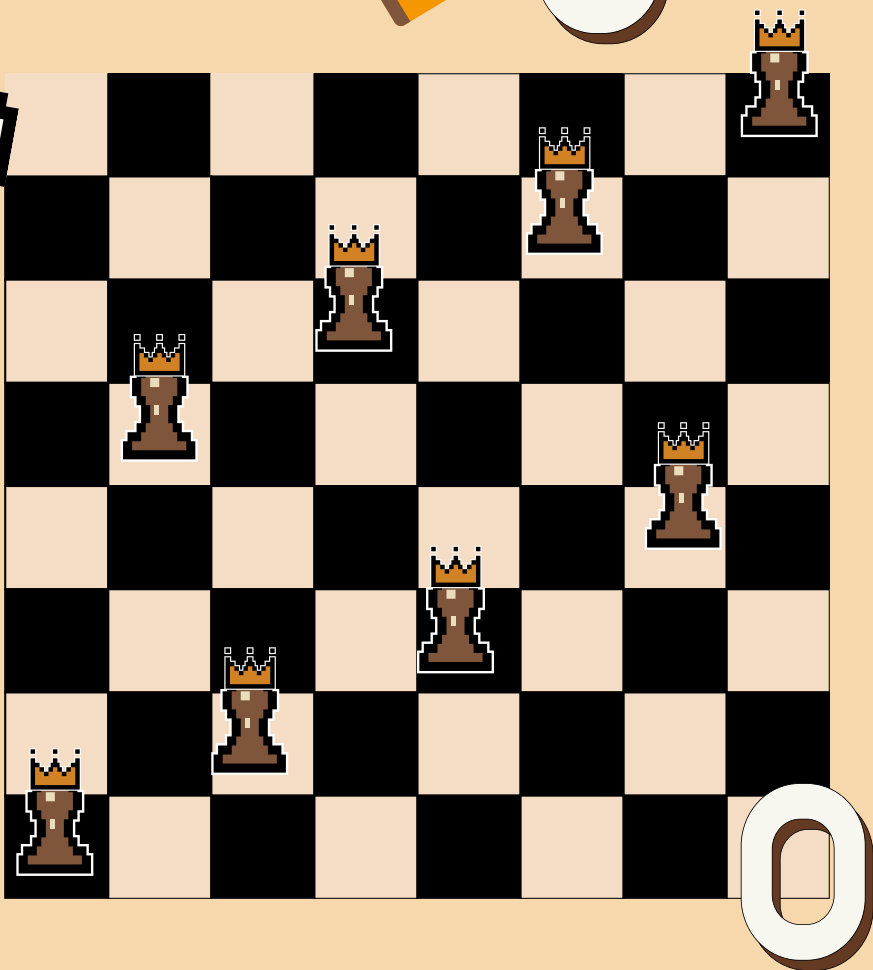
>0 INSEAMNA  
CA EXISTA  
REGINE CARE SE  
ATACA PE  
DIAGONALA

2) CALCULAM NIVELUL DE POTRIVIRE



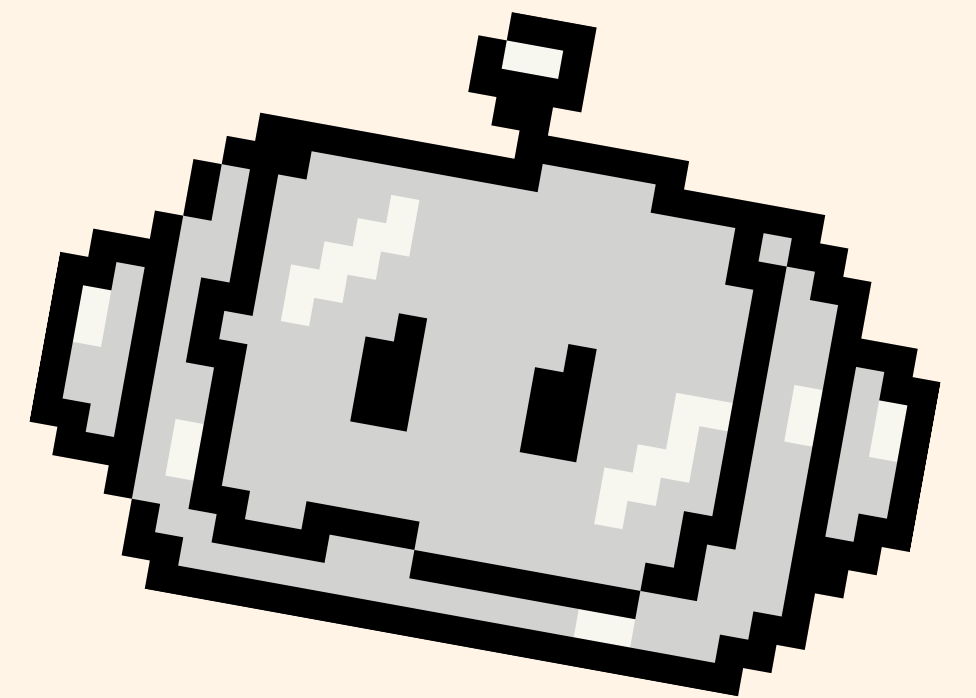
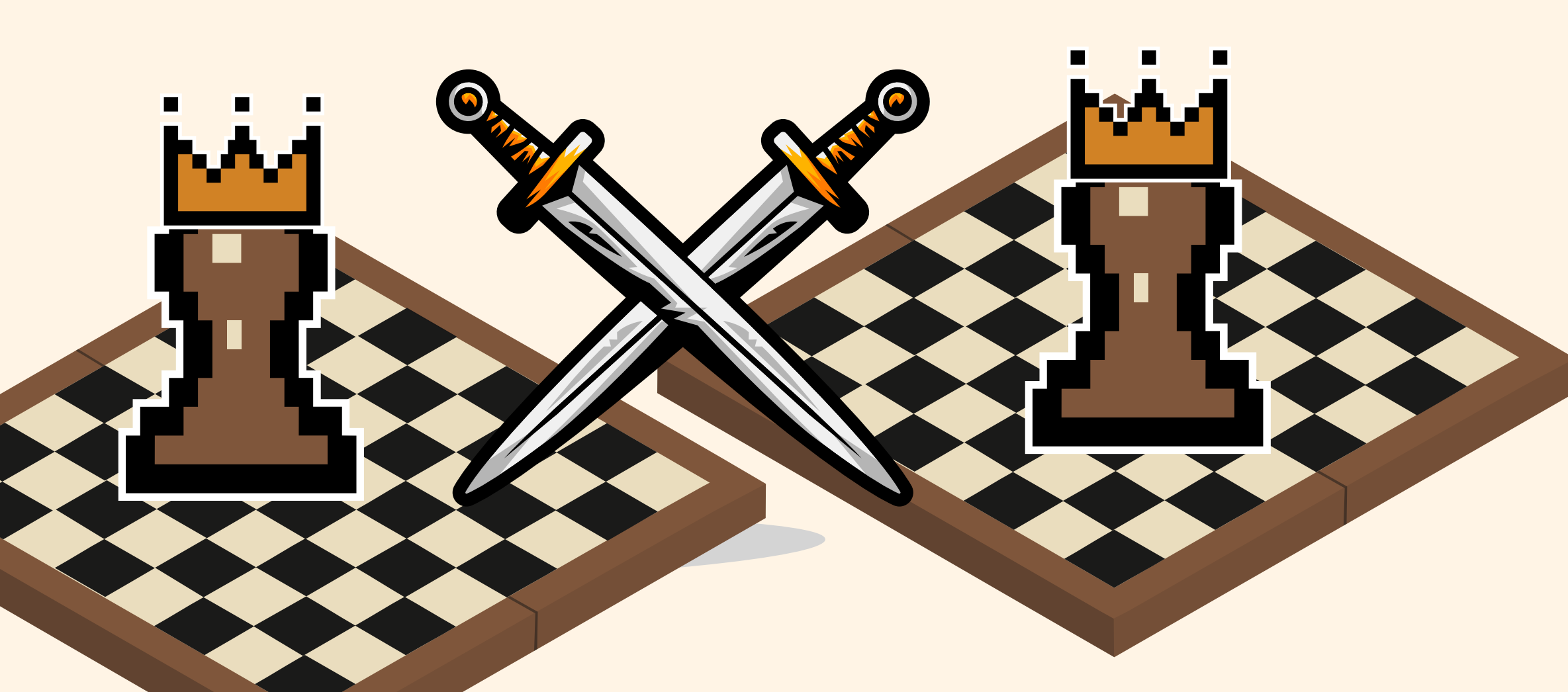
= 0 INSEAMNA  
VALID

>0 INSEAMNA  
CA EXISTA  
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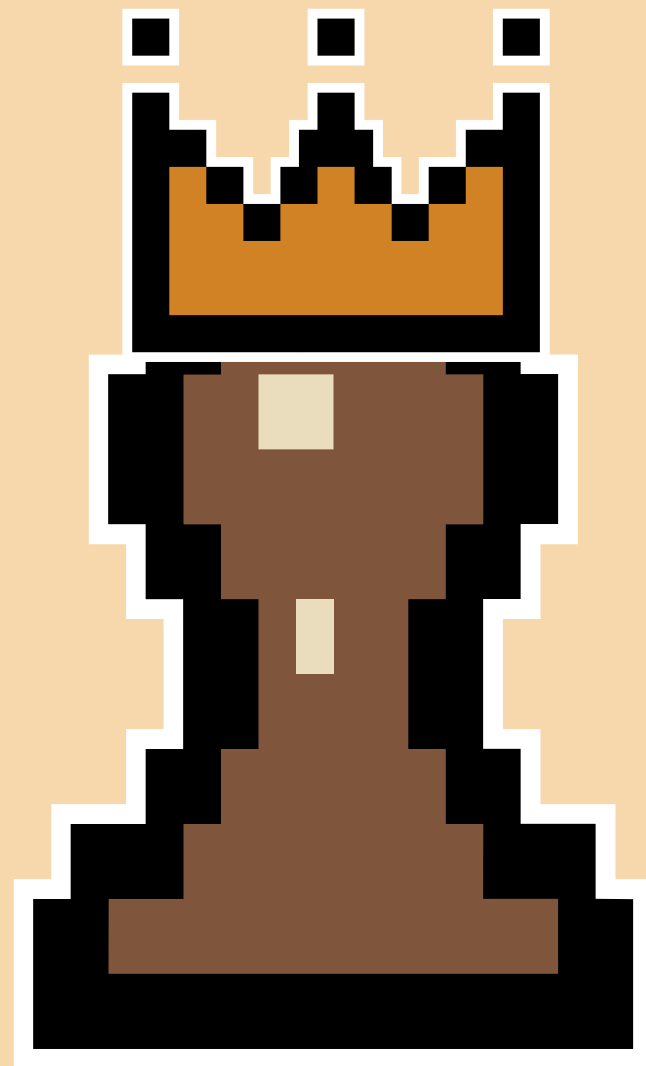


# TURNIR

## REGULI



### 3) SELECTIA TABLELOR CELE MAI “FIT”



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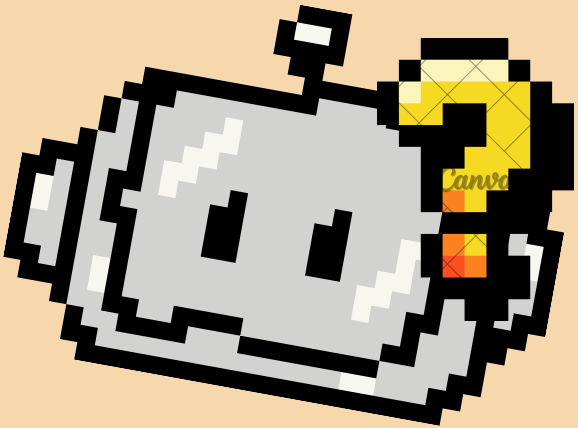
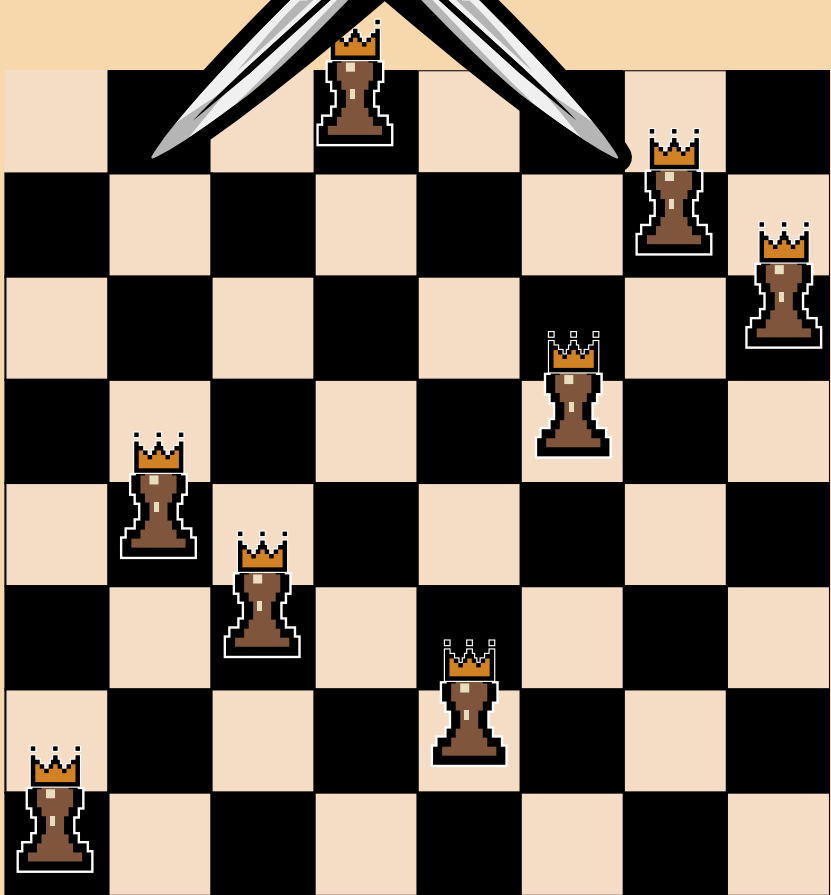
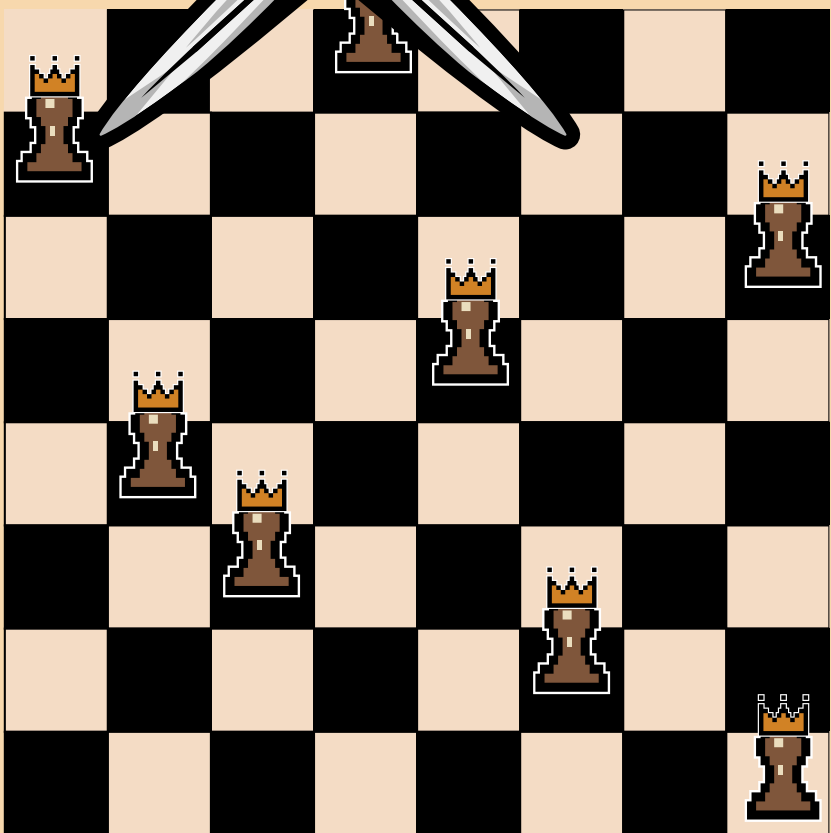
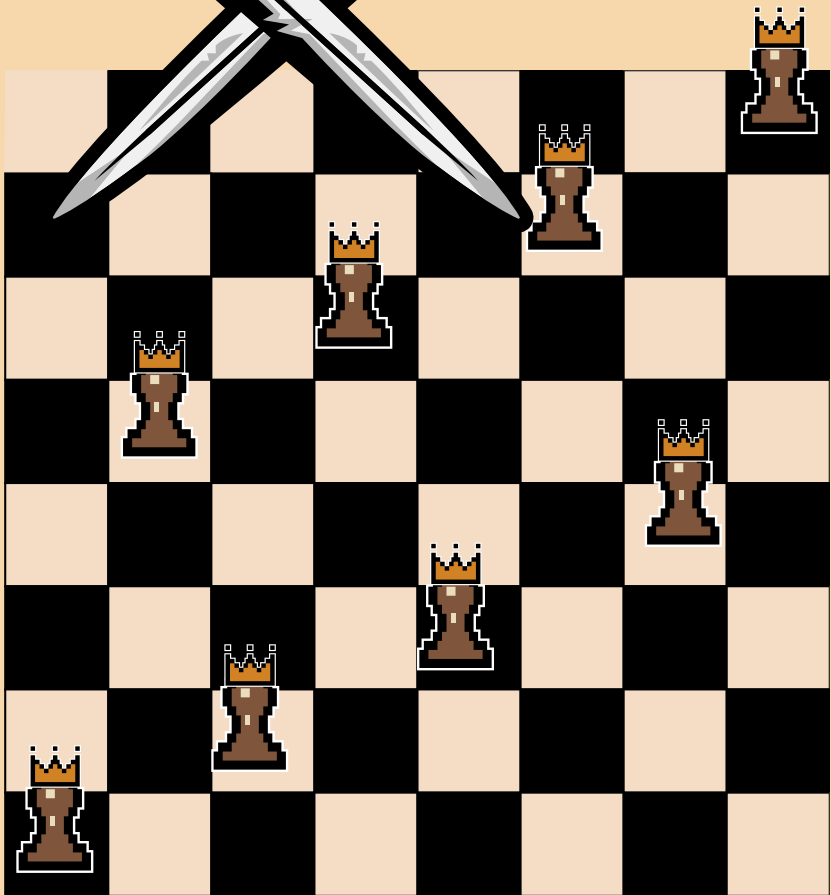
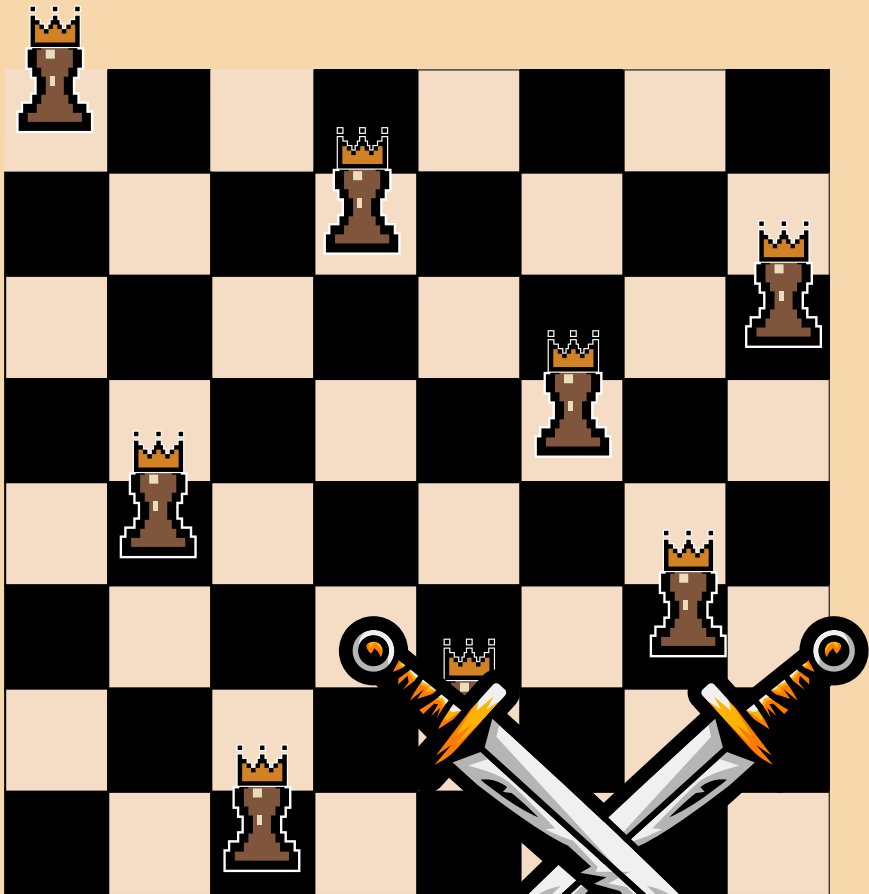
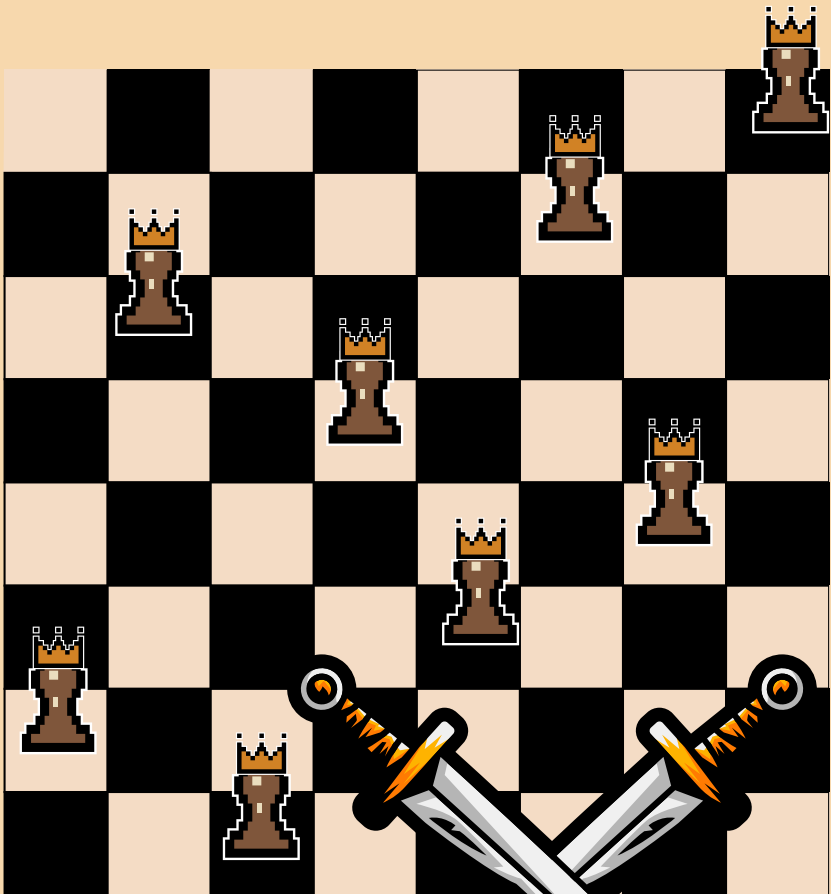
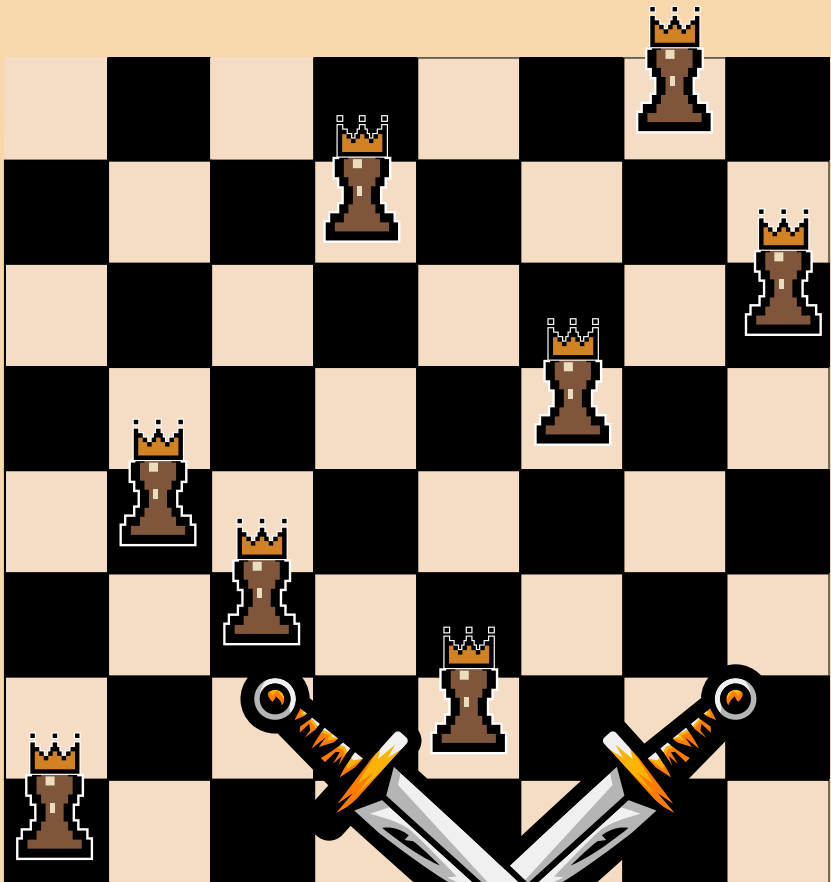
#### Selectia de tip turnir:

- alegem un numar aleatoriu de table (echipe de regine)
- echipele se vor lupta iar castigatorul se alege in functie de nivelul de potrivire

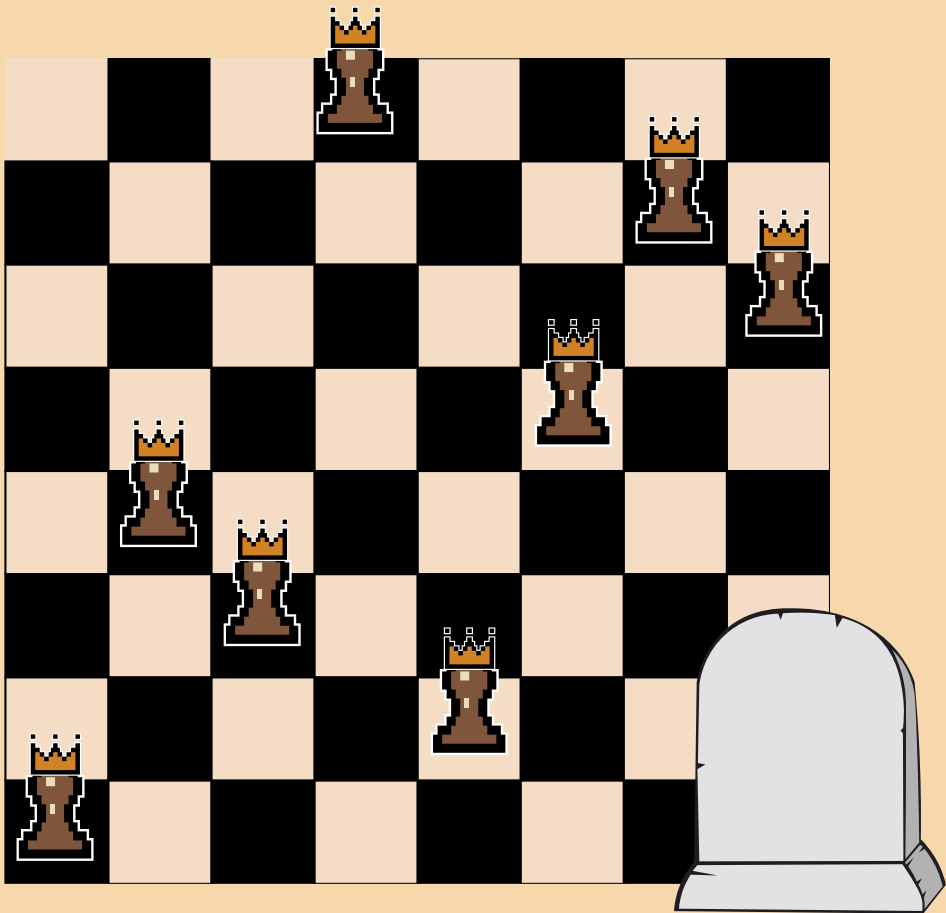
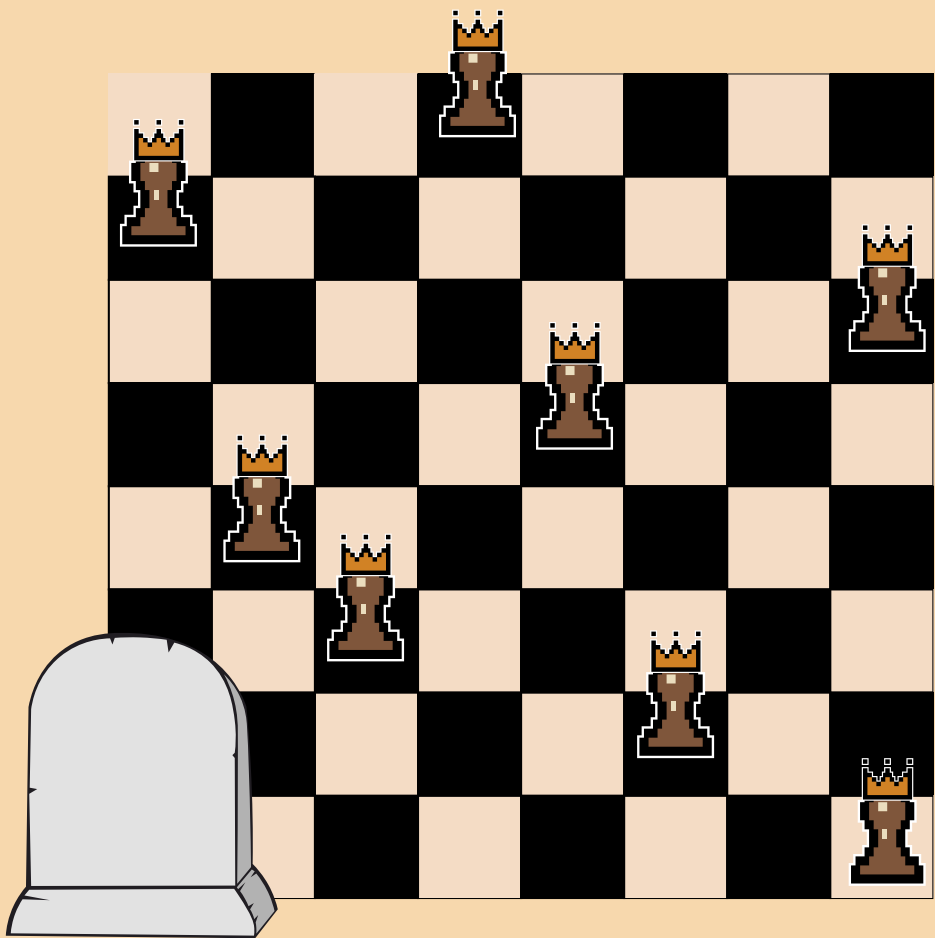
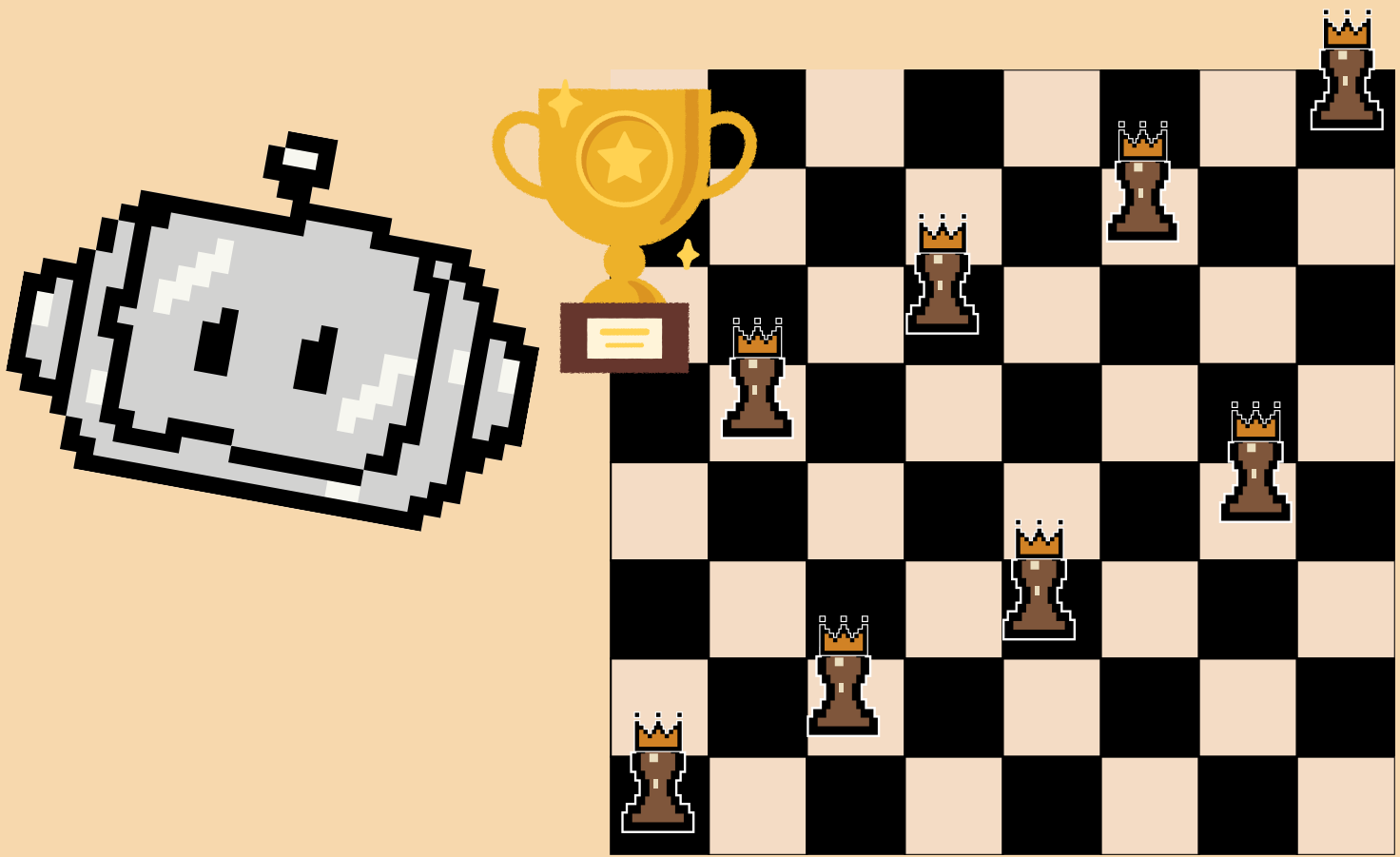
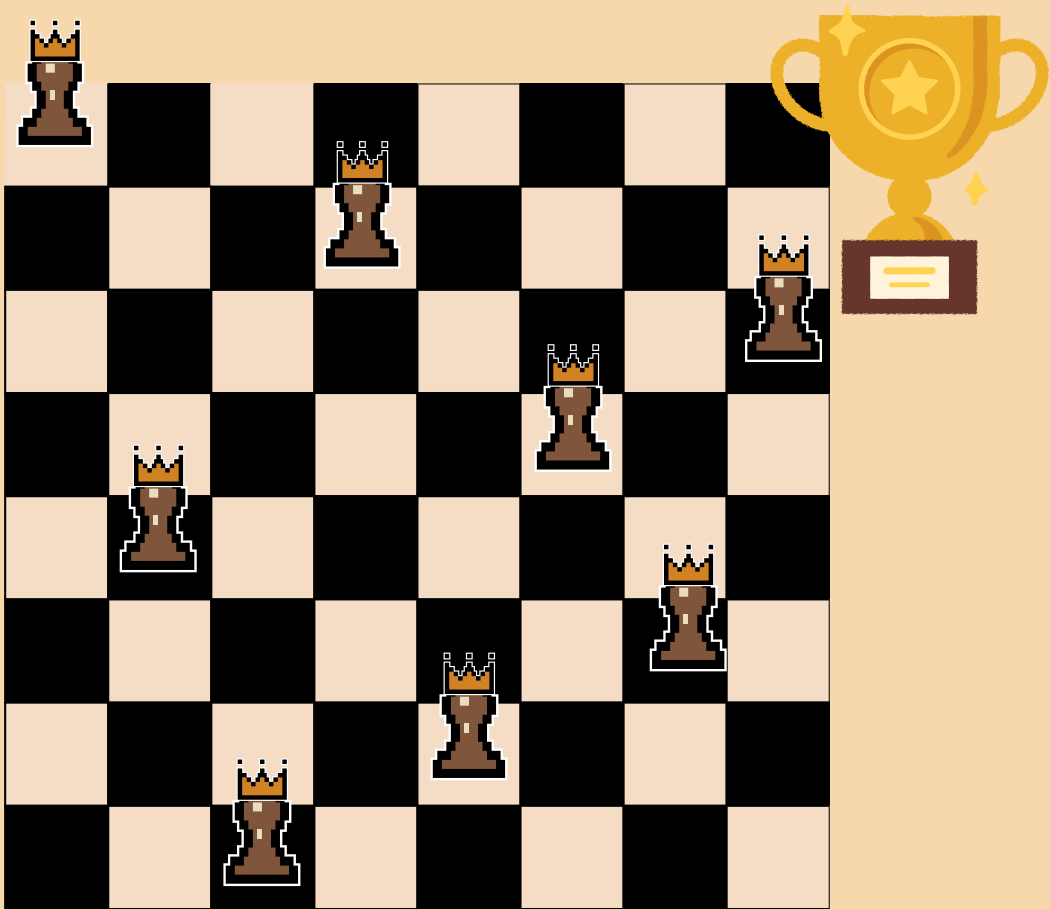
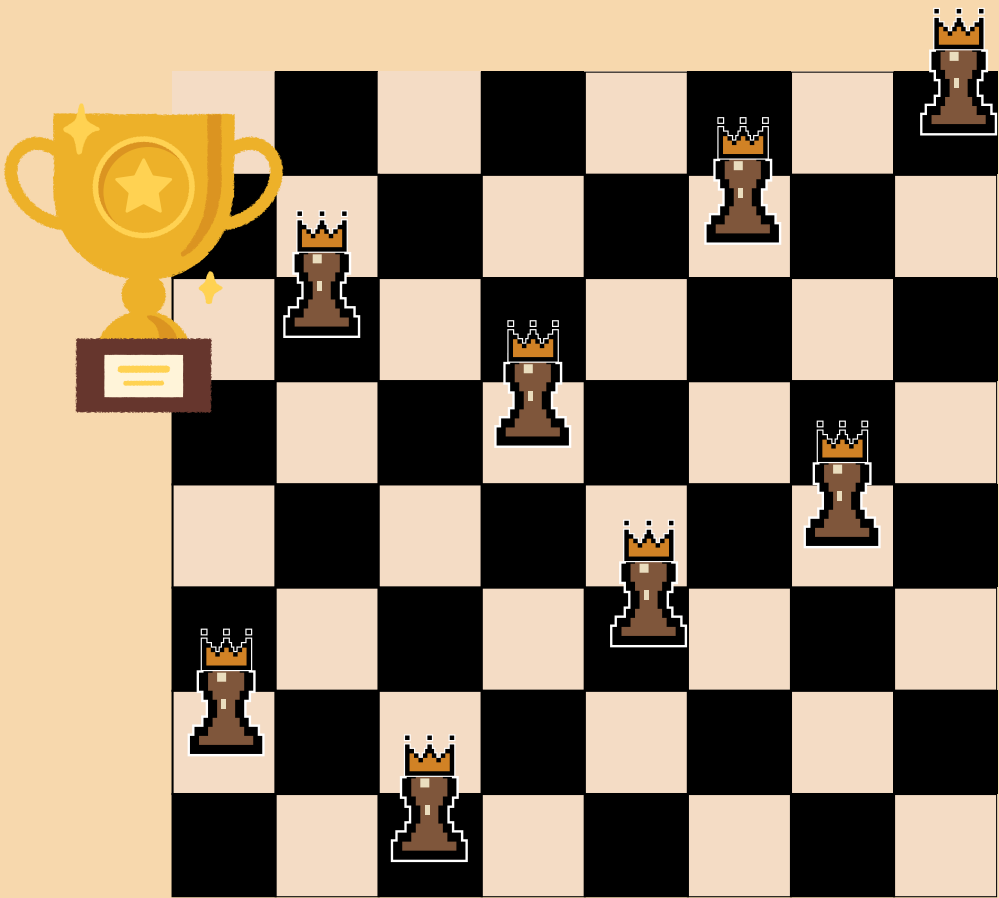
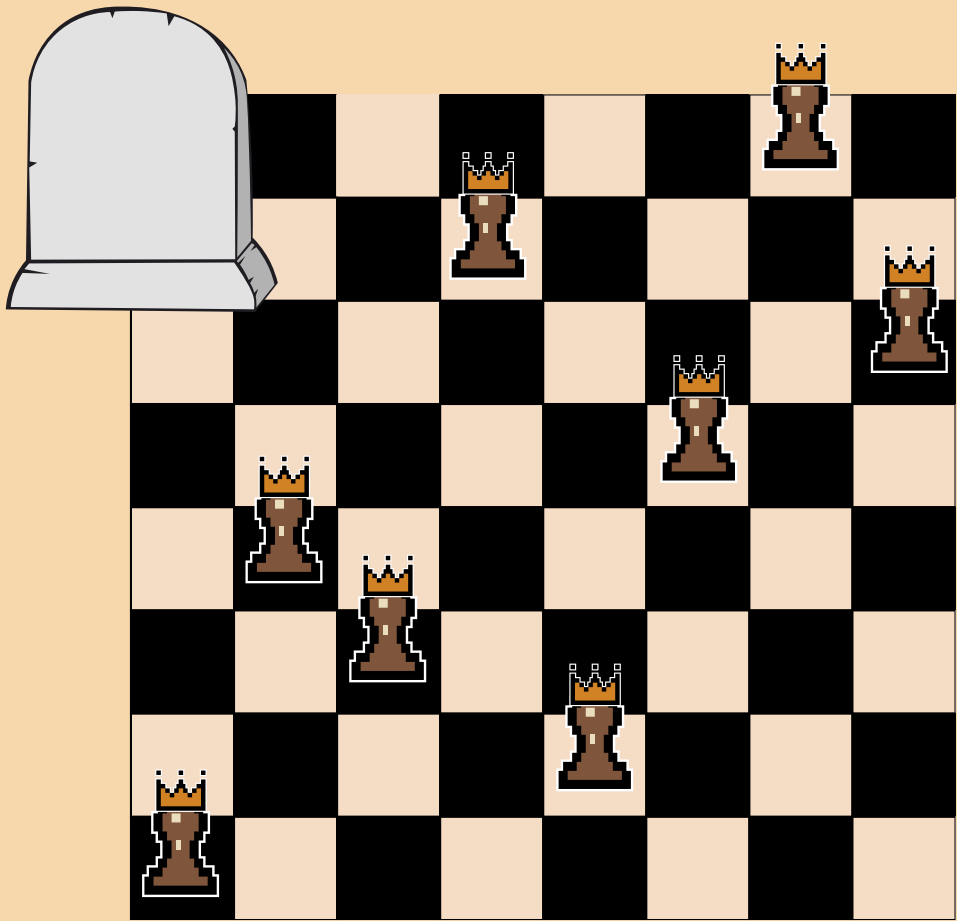
#### Selectia parintilor:

- se aleg cei mai buni parinti bazati pe cele mai inalte scoruri
  - ex: avem scorurile 8, 4, 2, 1, 3, 6, 5, 7
  - vor fi parintii: (8,7) (6,5) (4,3) (2,1)

3) SELECTIA TABLELOR CELE MAI FIT: TURNIR



3) SELECTIA TABLELOR CELE MAI FIT: TURNIR



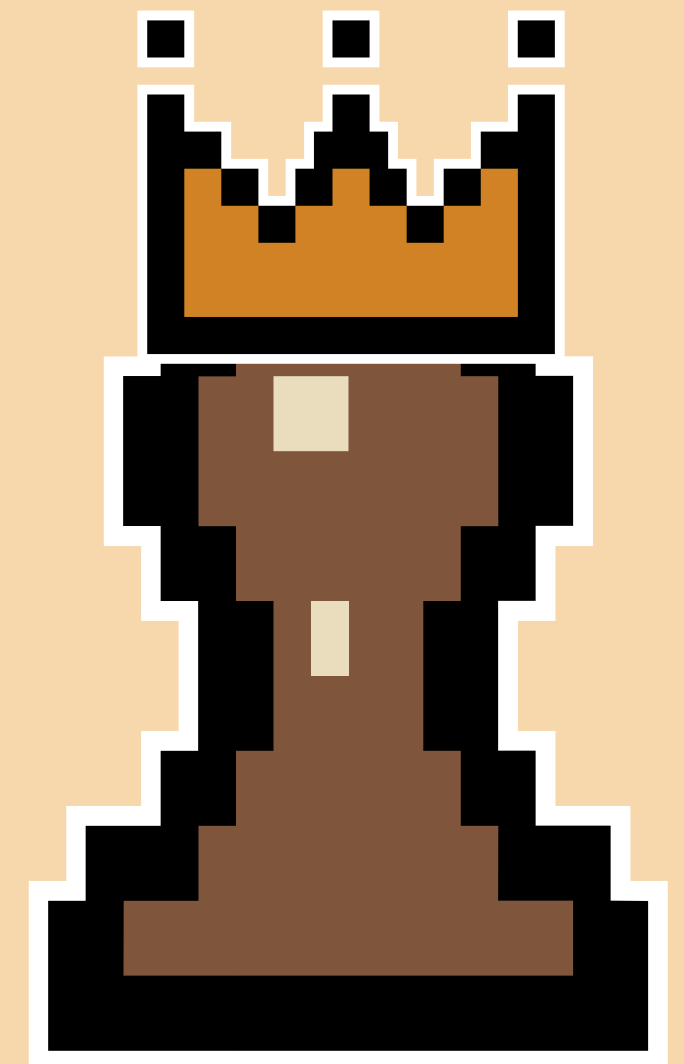
## 4) GENE, PARINTI SI MUTATII

### 1) Definim o functie de incrucisare a cromozomilor

• ex:

- parintele 1:                   5 2 3 1 6 4 8 7
- parintele 2:                   1 8 6 4 7 5 3 2
- copilul:                        3 1 6 4           (parintele 1)
- 8 7               5 2   (parintele 2)

### 2) Cream populatie noua intre perechile de parinti aranjate anterior



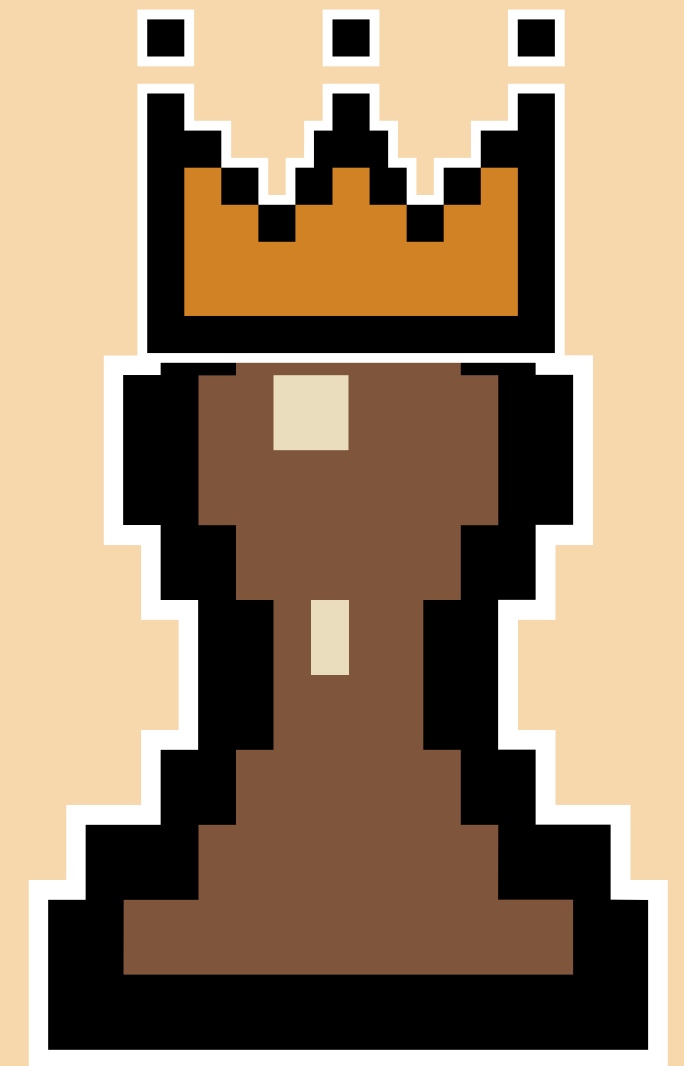
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## 4) GENE, PARINTI SI MUTATII

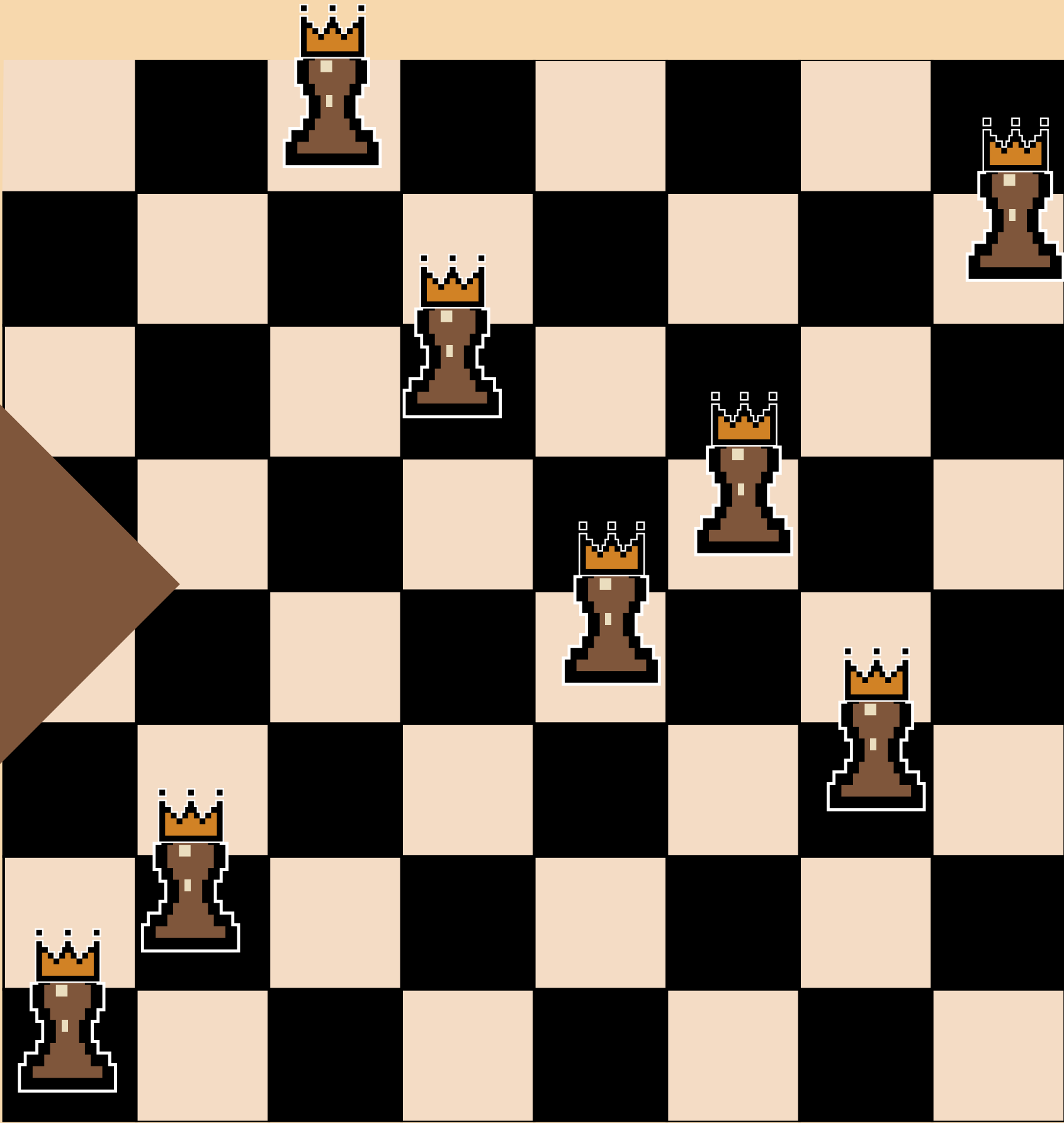
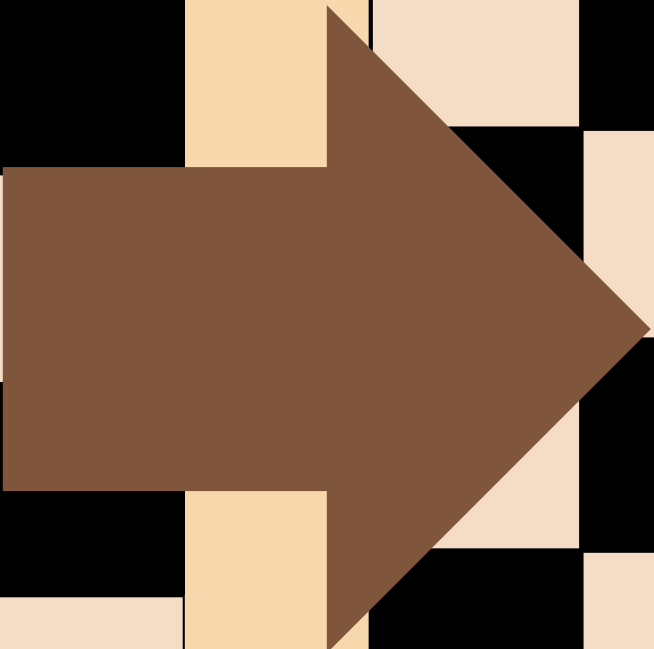
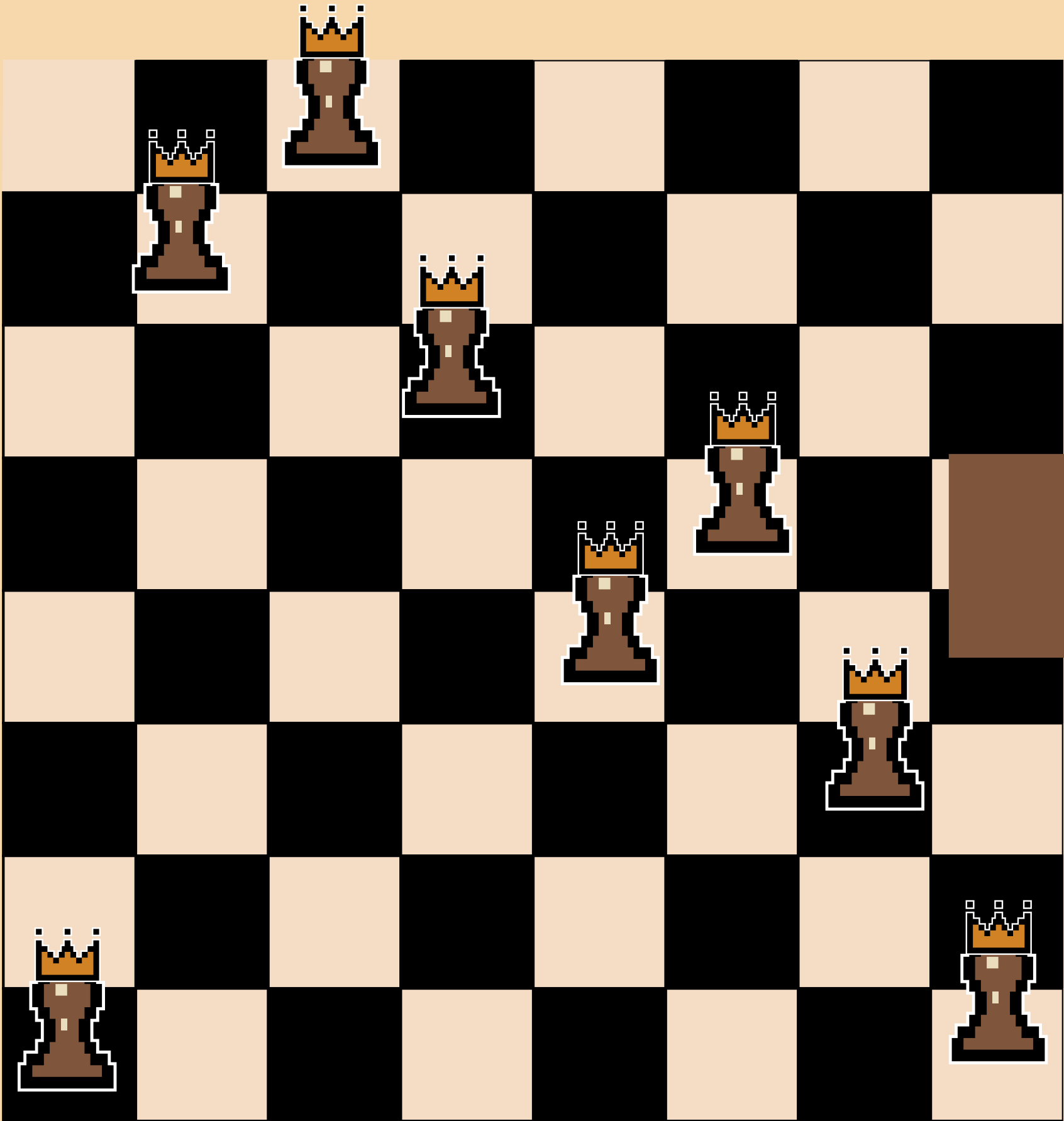
### 3) Mutam acele gene ale copilului (noua tabla)

- definim o probabilitate de mutatie (ex: 10%)
- calculam o valoare aleatorie intre 0 si 100
- daca probabilitatea e mai mare decat valoarea, se interschimba doi cromozomi (doua regine)
- cele doua regine sunt positionate: prima in prima jumătate, a doua in a doua jumătate si iau aleatoriu
- ex:
  - tabla: 7 1 0 2 4 3 5 6
  - probabilitate de mutatie: 0.2 (20%)
  - valoarea aleatorie: 3
  - tabla\_mutata: 7 **6** 0 2 4 3 5 **1**

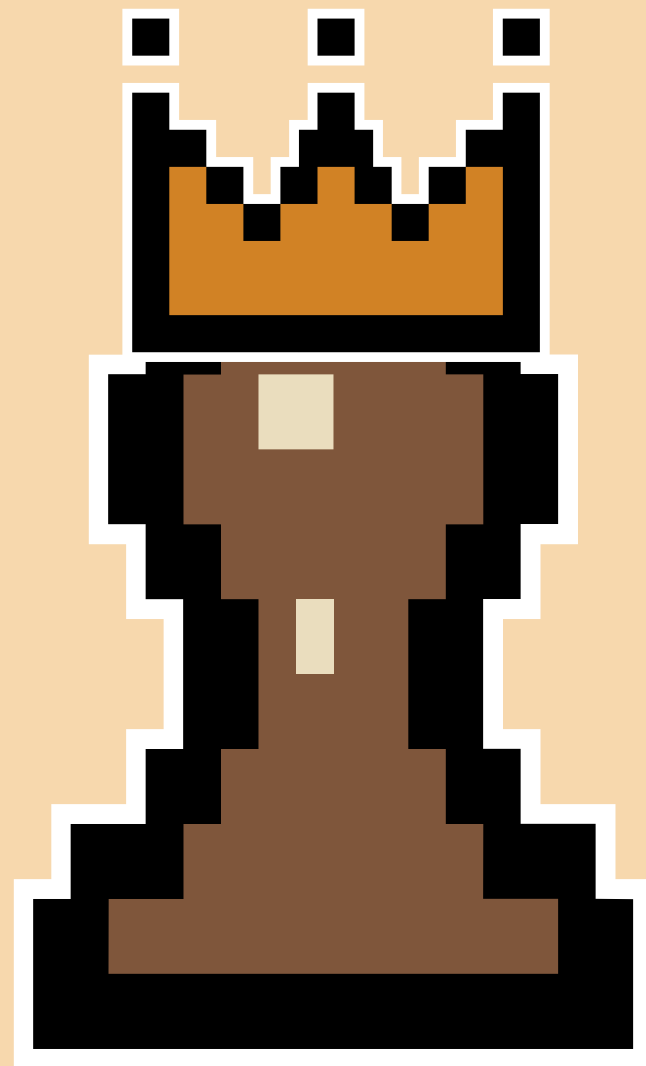


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4) GENE, PARINTI SI MUTATII



## **5) SELECTIE NATURALA**



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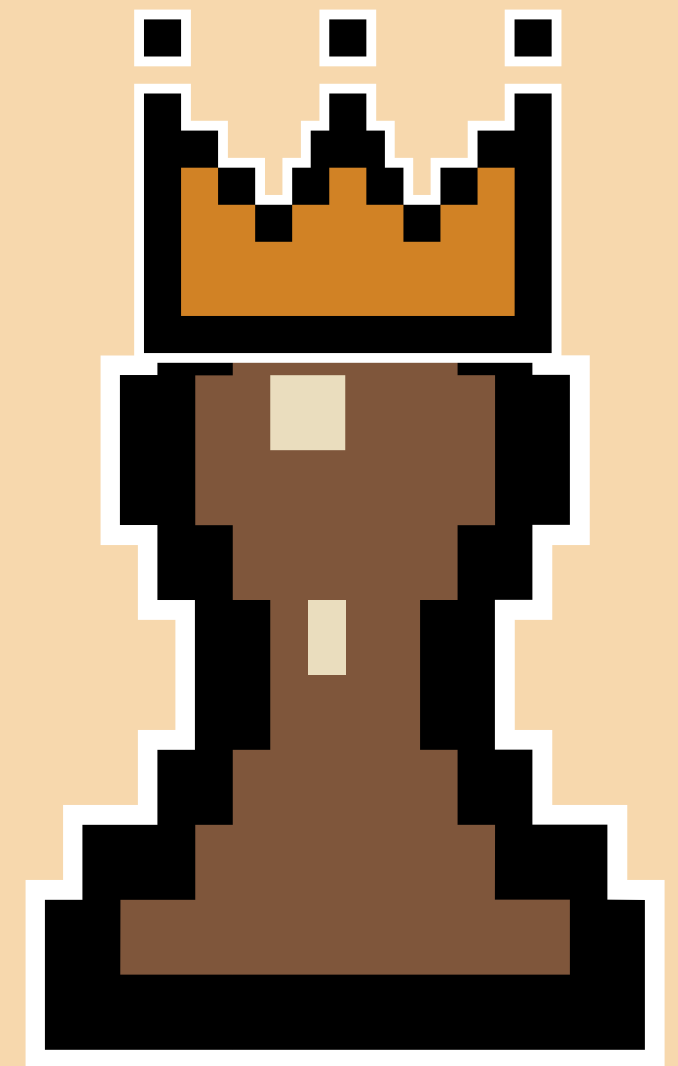
**1) Calculam din nou scorurile de potrivire a noii populatii de table**

**2) Selectia tablelor care supravietuiesc:**

- se aleg aleatoriu in functie de scorul de potrivire**

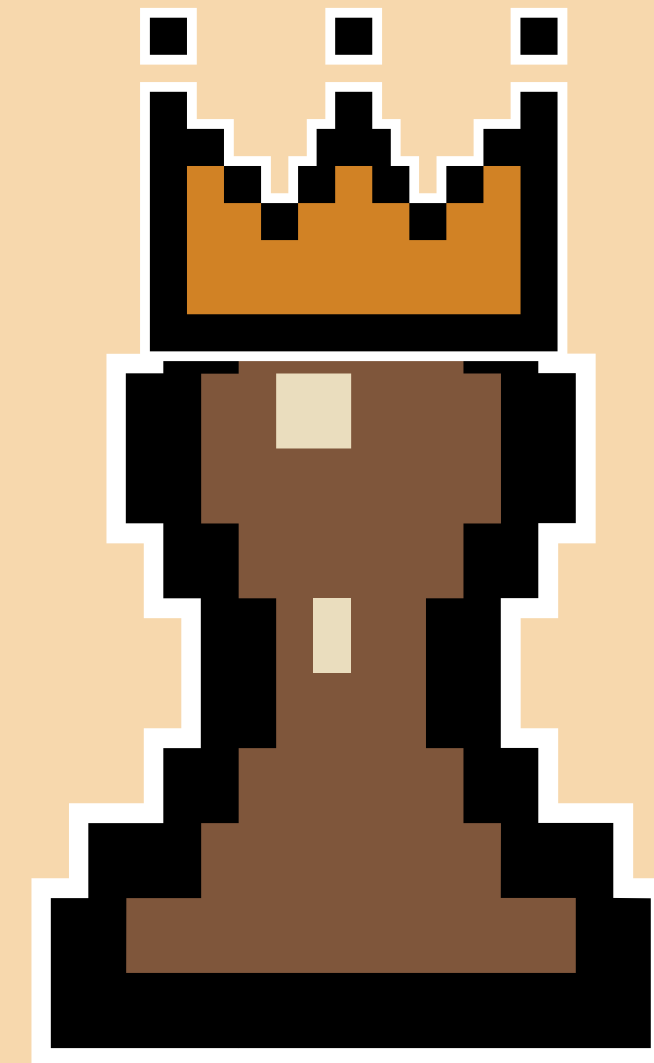
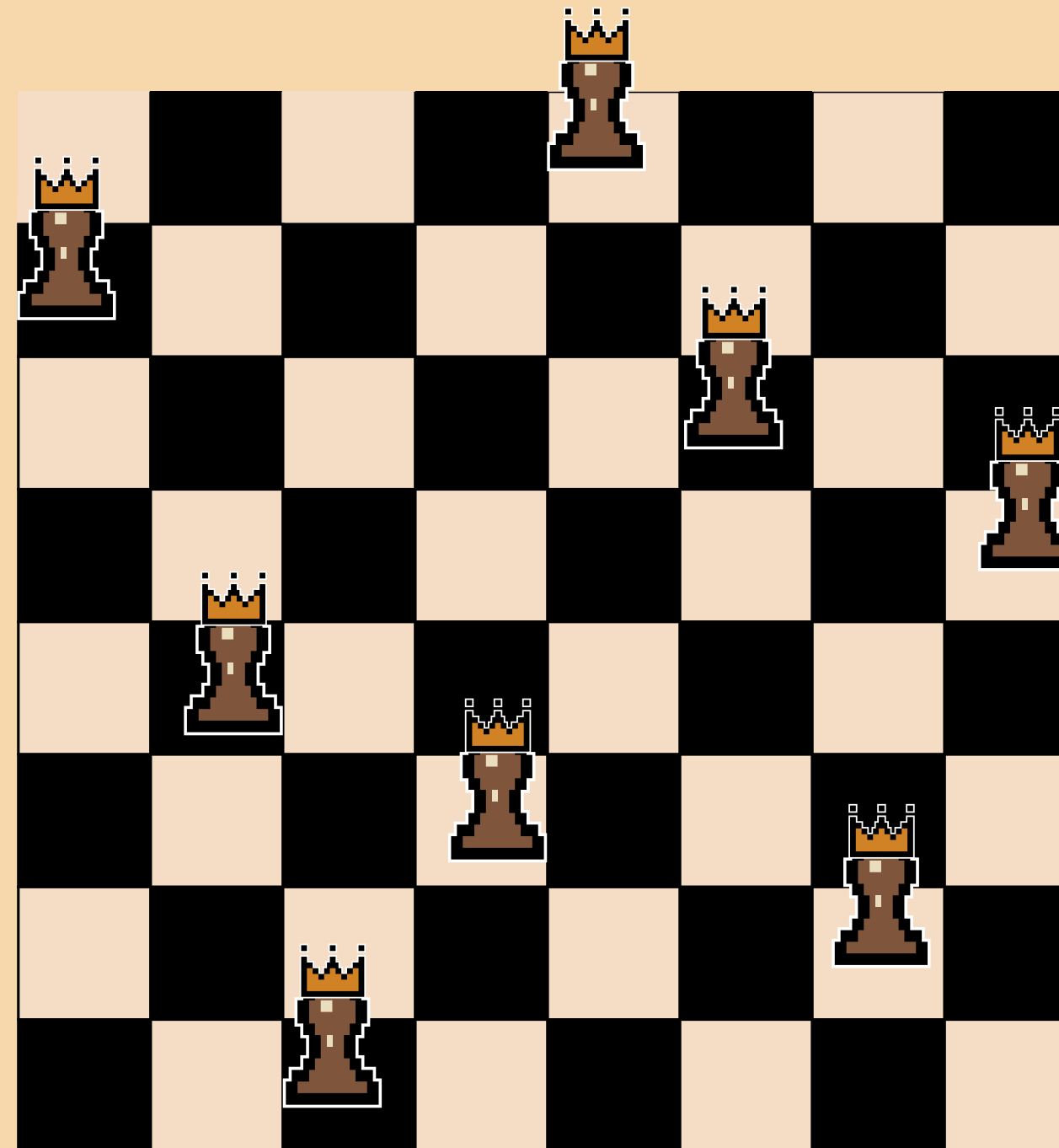
## **6) GENERATII PANA LA GASIREA TABLE PERFECTE**

- 1) Decidem un numar de generatii pe care dorim sa il avem**
- 2) Calculam scorurile supravietuitorilor**
- 3) Formam noi perechi de parinti**
- 4) Intersectam cromozomii**
- 5) Mutam genele**
- 6) Vedem supravietuitorii**
- 7) Selectam cel mai bun individ dintre toti**



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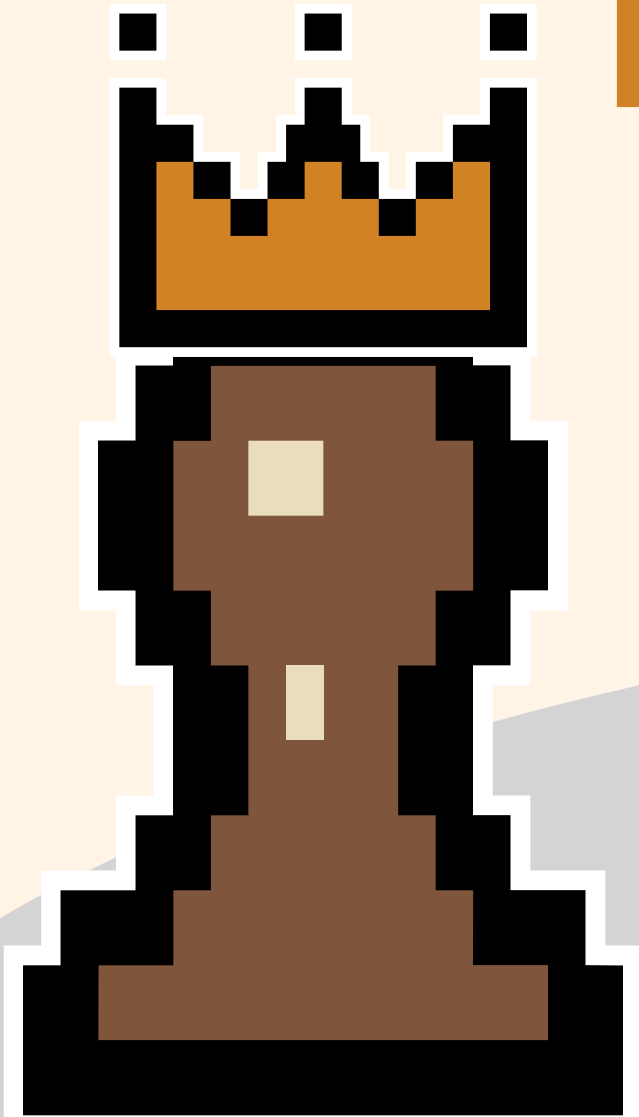
# 7) SUPRAVIETUITOAREA NOASTRA ESTE TABLA:



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## **PROBLEMA CELOR N REGINE**

# **HAIDETI SA FACEM UN DEMO**



**JACLINA-IANA BULAT  
STUDENTA ANUL 3**