

```

import numpy as np
import random as rn

def creat_ch(n):
    ch = [rn.randint(1, n) for i in range(n)]
    return ch

def fitness(ch):
    n = len(ch)
    f = 0
    for i in range(n):
        for j in range(i+1, n):
            if ch[i] == ch[j] or abs(i-j) == abs(ch[i]-ch[j]):
                f += 1
    ch.insert(0, f)
    return ch

def cross_over(p1, p2):
    n = len(p1)
    r = rn.randint(1, n-1)
    ch1 = p1.copy()
    ch2 = p2.copy()
    ch1[r:] = p2[r:]
    ch2[r:] = p1[r:]
    return ch1, ch2

def mutution(ch):
    n = len(ch)
    r = rn.randint(0, n-1)
    ch[r] = rn.randint(1, n)
    return ch

def creat_pop(npop, n):
    pop = [creat_ch(n) for i in range(npop)]

```

```

        return pop
n=4
npop=10
pop=creat_pop(npop,n)
pop
for i in range(npop):
    pop[i]=fitness(pop[i])
pop.sort()
best = pop[0]
iter = 0
while best[0] != 0:
    print(iter)
    iter += 1
    newpop = []
    for i in range(0, npop, 2):
        ch1, ch2 = cross_over(pop[i][1:], pop[i+1][1:])
        ch1 = mution(ch1)
        ch2 = mution(ch2)
        ch1 = fitness(ch1)
        ch2 = fitness(ch2)
        newpop.append(ch1)
        newpop.append(ch2)
    pop += newpop
    pop.sort()
    pop = pop[:npop]
    best = pop[0]
best

```