**حل مسئله ۳۰ وزیر با الگوریتم هارمونی hs در متلب**

**صورت مسئله:**

در یک صفحه شطرنجی ۳۰x۳۰، می خواهیم به نحوی ۳۰ وزیر را در صفحه قرار دهیم که در هر ستون تنها یک وزیر باشد و هیچ دو وزیری یکدیگر را گارد نکنند.

**شرح کد:**

این سورس کد شامل 3 فایل می باشد که عبارتند از:

این الگوریتم ماکزیمم یاب است و ما بعد از محاسبه هزینه و کم کردن آن از تعداد وزیرها برازندگی را حساب می کنیم.

**MyCost:** تابعی که گارد بودن وزیرها را بررسی می کند و هزینه آن را محاسبه می کند.

```
function [z sol]=MyCost(s)

    n=numel(s);

    [~, X]=sort(s);
    Y=1:n;

    Hit=zeros(n,n);برخورد ها

    z=0;
    for i=1:n-1
        for j=i+1:n
            if abs(X(i)-X(j))==abs(Y(i)-Y(j)) بررسی برخورد
                Hit(i,j)=1;
                Hit(j,i)=1;
                z=z+1; تعداد برخورد
            end
        end
    end

                                        دادن مقادیر به مدل
    sol.X=X;
    sol.Y=Y;
    sol.Hit=Hit;
    sol.z=z;
```

```
end
```

**PlotSolution(sol):** کشیدن بهترین راه حل

```
function PlotSolution(sol)

    X=sol.X-0.5;
    Y=sol.Y-0.5;
    Hit=sol.Hit;
    z=sol.z;

    n=numel(X);

    for i=1:n-1
        for j=i+1:n
            if Hit(i,j)==1
               plot([X(i) X(j)],[Y(i)
Y(j)],'b:','LineWidth',2);
               hold on;
            end
        end
    end

    plot(X,Y,'ko','MarkerSize',12,'MarkerFaceColor','y');

    strTitle=[num2str(n) '-Queens: '];
    if z==0
        title([strTitle 'No Hits!']);
    elseif z==1
        title([strTitle 'Just one Hit']);
    else
        title([strTitle num2str(z) ' Hit(s)']);
    end

    grid on;
    axis square;

    set(gca,'XTick',0:n);
    set(gca,'YTick',0:n);
```

```
    xlim([0 n]);
    xlim([0 n]);

    hold off;

end
```

**پیاده سازی هارمونی:hs.m**

```
clc;
clear;
close all;

تعریف مسئله
nQueen=30;

CostFunction=@(s) MyCost(s);          محاسبه هزینه(برای
                                    برازندگی)
nVar=nQueen;          تعداد متغیرهای تصمیم

VarSize=[1 nVar];    اندازه ماتریس متغیرهای تصمیم

VarMin=0;           حد پایین متغیرهای تصمیم
VarMax=1;           حد بالا متغیرهای تصمیم

پارامترهای سرچ هارمونی

MaxIt = 500;      تعداد تکرار ماکزیمم

HMS = 50;           اندازه حافظه هارمونی

nNew = 60;          تعداد هارمونی جدید

HMCR = 0.9;         میزان توجه به حافظه هارمونی

PAR = 0.1;          میزان تنظیم پیچ

FW = 0.02*(VarMax-VarMin);     عرض پهنای باند (پهنای باند)

FW_damp = 0.995;                نسبت کم کم عرض

مقدار دهی اولیه

ساختار هماهنگی خالی
empty_harmony.Position = [];
empty_harmony.Cost = [];
```

```
empty_harmony.Sol = [];
حافظه هارمونی را آغاز کنید
HM = repmat(empty_harmony, HMS, 1);

هماهنگی های اولیه ایجاد کنید
for i = 1:HMS
    HM(i).Position = unifrnd(VarMin, VarMax, VarSize);
    [HM(i).Cost, HM(i).Sol]= CostFunction(HM(i).Position);
end

مرتب سازی حافظه هارمونی
[~, SortOrder] = sort([HM.Cost]);
HM = HM(SortOrder);

به روز رسانی بهترین راه حل که تاکنون پیدا شده است
BestSol = HM(1);

آرایه برای نگه داشتن بهترین مقادیر هزینه
BestCost = zeros(MaxIt, 1);

حلقه اصلی Harmony Search
for it = 1:MaxIt

                    آرایه را برای هارمونی جدید مقداردهی کنید
    NEW = repmat(empty_harmony, nNew, 1);

ایجاد هارمونی جدید
    for k = 1:nNew

                                ایجاد موقعیت هارمونی جدید
        NEW(k).Position = unifrnd(VarMin, VarMax, VarSize);
        for j = 1:nVar
            if rand <= HMCR
                            از حافظه هارمونی استفاده کنید
                i = randi([1 HMS]);
                NEW(k).Position(j) = HM(i).Position(j);
            end

                                                تنظیم پیچ
            if rand <= PAR
                %DELTA = FW*unifrnd(-1, +1);    % Uniform
                DELTA = FW*randn();             نرمال گوسی
```

```
                NEW(k).Position(j) =
NEW(k).Position(j)+DELTA;
            end

        end

        افزودن حدود متغیر
        NEW(k).Position = max(NEW(k).Position, VarMin);
        NEW(k).Position = min(NEW(k).Position, VarMax);

                                                    ارزیابی
        [NEW(k).Cost, NEW(k).Sol]=
CostFunction(NEW(k).Position);

    end

                        ادغام هارمونی حافظه و هارمونی جدید
    HM = [HM
        NEW]; خوبه

                                        ذخیره هارمونی حافظه
    [~, SortOrder] = sort([HM.Cost]);
    HM = HM(SortOrder);

                                    هارمونی های اضافی را خارج کنید
    HM = HM(1:HMS);

       به روز رسانی بهترین راه حل که تاکنون پیدا شده است
    BestSol = HM(1);

     کم ترین هزینه ای(بیشترین برازندگی) را که تاکنون پیدا
کرده اید ذخیره کنید
                                    برازندگی = nQueen-BestCost
    BestCost(it) = BestSol.Cost;

                                    نمایش برازندگی در هر تکرار
    disp(['Iteration ' num2str(it) ': Best Fit = '
num2str(nQueen-BestCost(it))]);

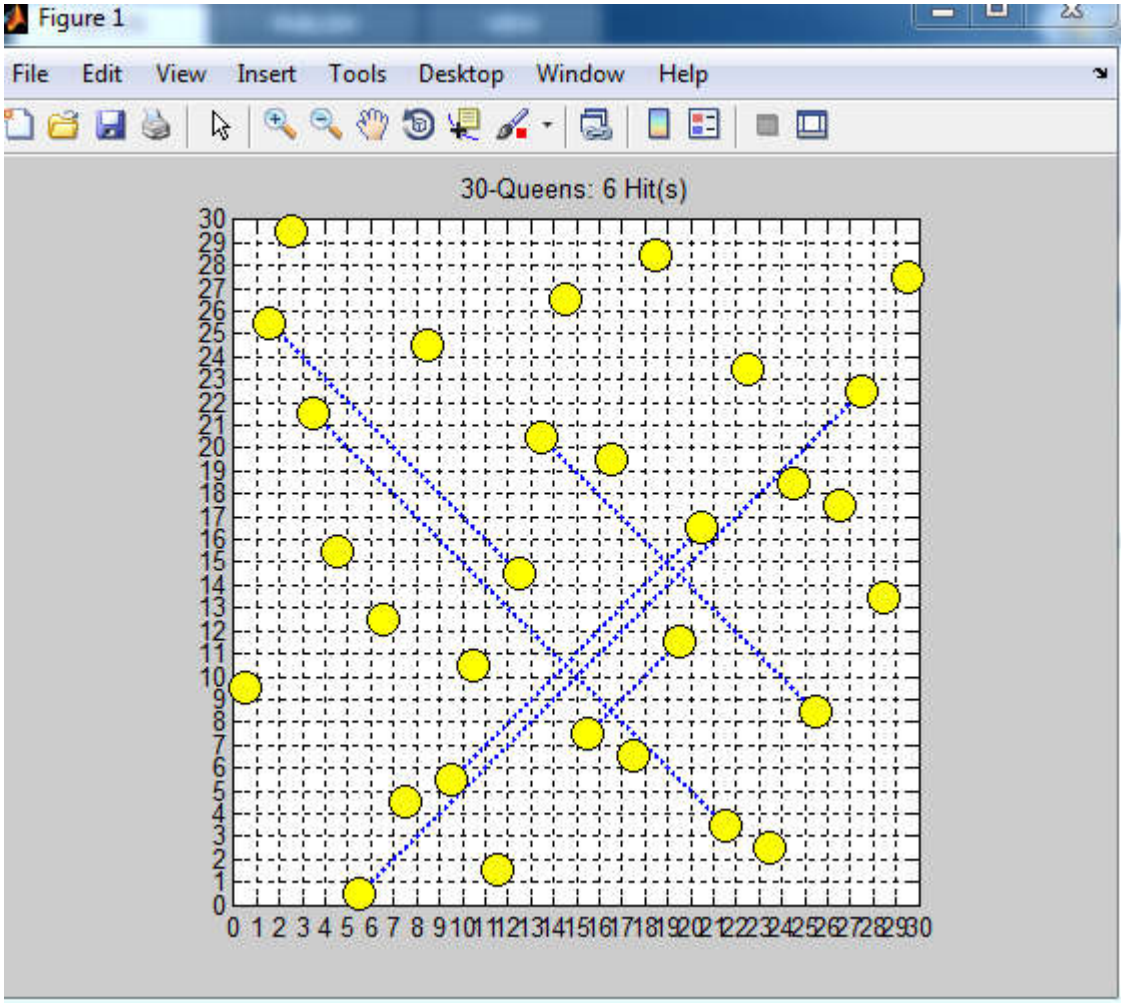

   عرض صدای ضعیف
    FW = FW*FW_damp;
    نمایش بهترین راه حل
    figure(1);
```

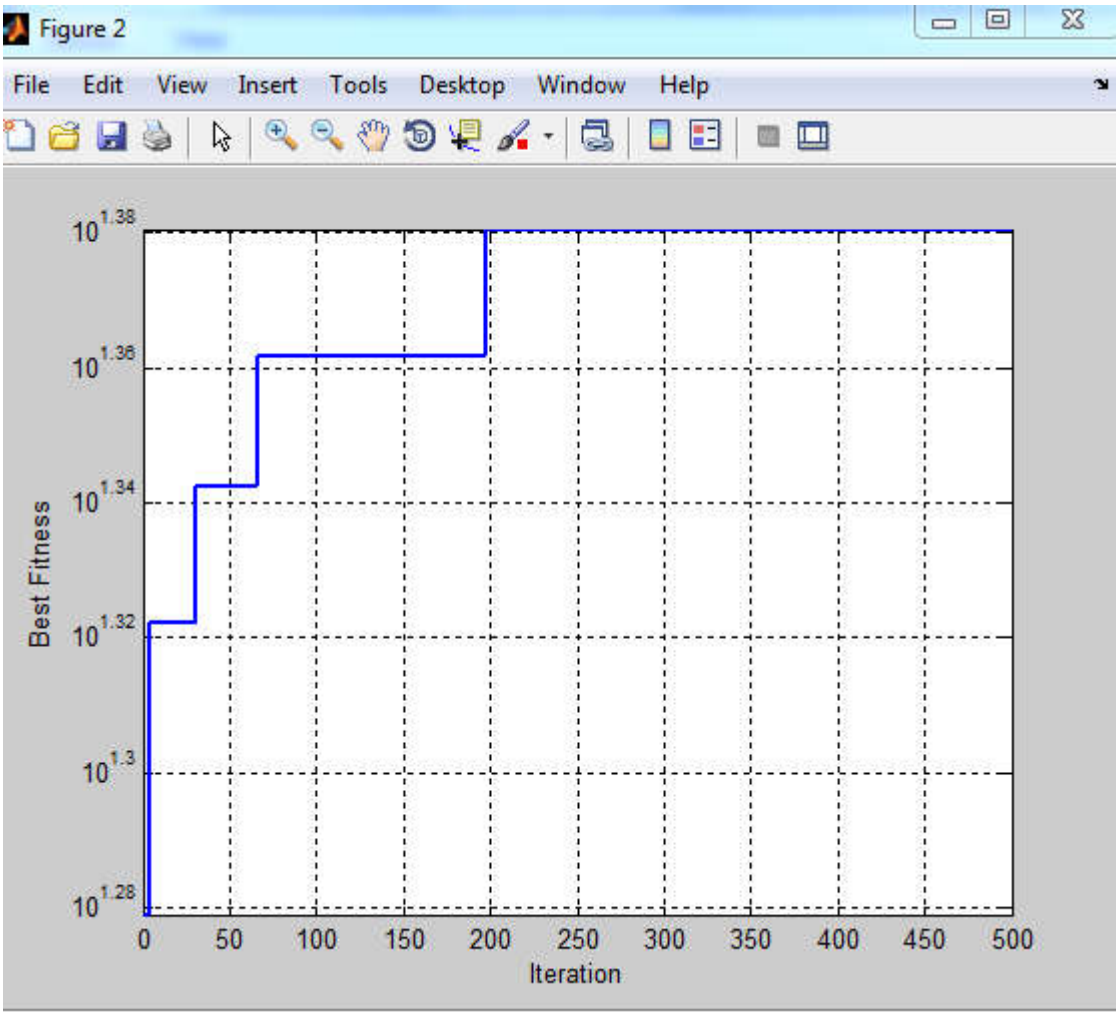
```
    PlotSolution(BestSol.Sol);

    if BestCost(it)==0
        break;
    end
end
BestCost=BestCost(1:it);
نتایج

figure;
semilogy(nQueen-BestCost, 'LineWidth', 2);
xlabel('Iteration');
ylabel('Best Fitness');
grid on;
```

**نتایج:**



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Iteration 500: Best Fit = 24
>> BestSol

BestSol =

    Position: [1x30 double]
        Cost: 6
         Sol: [1x1 struct]

>> BestSol.Position

ans =

  Columns 1 through 10

    0.1658    0.7527    0.9970    0.6274    0.4906
0.0208    0.3259    0.0761    0.7139    0.0902

  Columns 11 through 20

    0.2296    0.0413    0.4098    0.5733    0.7727
0.1077    0.5579    0.1069    0.9517    0.2827

  Columns 21 through 30

    0.4946    0.0646    0.6662    0.0570    0.5322
0.1184    0.5099    0.6306    0.4061    0.9326

>>
```