MATLAB CODE FOR THE CASE IV.1

```
clear
clc
tic
multiNE = zeros(101,101);
profit_for_m1 = -ones(101,101);
profit_for_m2 = -ones(101,101);
for j1 = 0:100;
for j2 = 0:100;

for i=1:1:101;
    a = [0:1:100];
    n2(i,:) = [a];
end
n1 = n2';
m1 = j1.*ones(101,101)/100;
m2 = j2.*ones(101,101)/100;
%% Each firm's profit calculation
if  j1==1| j2==0| j1==0| j2==1;
    C = zeros(101,101);
    pf1 = zeros(101,101);
    pf2 = zeros(101,101);

else
pf1    =    -(-1-m2+2.*(m1.^2).*m2+m1.*(1+2.*(m2.^2)-2.*n1)+2.*n1-
2.*m2.*(m2+n2)).*(-(-1+m1).*(n1-n2).*(-2+n1+n2)+m2.*(-8+8.*m1+(-2+n1).*n1-(-
2+n2).*n2))./(32.*(-1+m1).*m2.*(1-m1+m2));
pf2    =    -(-1+7.*m2+2.*(m1.^2).*m2+m1.*(1+2.*(-4+m2).*m2-2.*n1)+2.*n1-
2.*m2.*(m2+n2)).*((-1+m1).*(n1-n2).*(-2+n1+n2)+m2.*(8.*m1-(-2+n1).*n1+(-
4+n2).*(2+n2)))./(32.*(-1+m1).*m2.*(1-m1+m2));
```

```matlab
p1      =       -(1-m1+17.*m2-16.*m1.*m2+4.*n1-
4.*m1.*n1+4.*m2.*n1+2.*(n1.^2)-2.*m1.*(n1.^2)+2.*m2.*(n1.^2)-
4.*n2+4.*m1.*n2-4.*m2.*n2+2.*(n2.^2)-2.*m1.*(n2.^2)+2.*m2.*(n2.^2))./(8.*(-
1+m1-m2));
p2      =       -(-1+m1-17.*m2+16.*m1.*m2+4.*n1-4.*m1.*n1+4.*m2.*n1-
2.*(n1.^2)+2.*m1.*(n1.^2)-2.*m2.*(n1.^2)-4.*n2+4.*m1.*n2-4.*m2.*n2-
2.*(n2.^2)+2.*m1.*(n2.^2)-2.*m2.*(n2.^2))./(8.*(-1+m1-m2));
k1      =       -(m2./2-(1./2-n2)./(-2.*m2)+(p1-p2)./(-2.*m2));
k2      =       (m1+1)./2-(n1-1./2)./(2.*(m1-1))+(p1-p2)./(2.*(m1-1))-1;
k3      =       (m2./2-(1./2-n2)./(-2.*m2)+(p1-p2)./(-2.*m2))-((m1+1)./2-(n1-
1./2)./(2.*(m1-1))+(p1-p2)./(2.*(m1-1)));

   if  k1<0 & k2<0 & k3<0 & p1>0 & p2>0;
      C = ones(101,101);
   else C = zeros(101,101);
   end
end
pf1s = pf1.*C-1.*(1-C);
pf2s = pf2.*C-1.*(1-C);


%%Nash Equilibrium of n1, n2 finding
for i = 1:101;
   maxn1(i,:) = max(max(pf1s),0);
   maxn2(:,i) = max(max(pf2s'),0)';
end
checkn1 = (pf1s == maxn1);
checkn2 = (pf2s == maxn2);
equi_for_n = checkn1 .* checkn2;


%%Record profit for m1, m2 that is the N.E. from n1, n2

if sum(sum(equi_for_n))>0
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```
[r,c] = find(equi_for_n>0,1, 'first');
profit_for_m1(j1+1,j2+1) = pf1s(r,c);
profit_for_m2(j1+1,j2+1) = pf2s(r,c);
if sum(sum(equi_for_n))>1
multiNE(j1+1,j2+1) = 1;
end
end
end
end


%% Nash Equilibrium for m1, m2 finding
for i = 1:101;
    maxm1(i,:) = max(max(profit_for_m1),0);
    maxm2(:,i) = max(max(profit_for_m2'),0)';
end


checkm1 = (profit_for_m1 == maxm1);
checkm2 = (profit_for_m2 == maxm2);
equi_for_m = checkm1 .* checkm2;
NEpl_for_m1 = equi_for_m.*profit_for_m1;
NEpl_for_m2 = equi_for_m.*profit_for_m2;

%% To check whether there is any N.E. or not
[NEr,NEc] = find(equi_for_m>0)
toc
```