```
% Optimization(minimization) of the Booth function with differential
 evalution
function [] = main_func()
clc;
clear;
steps=300; %specify the no.of iterations
best_val=zeros(steps,3);
mse_val=zeros(steps,1);
chromo=init_pop(10);
for itr=1:steps
 donor=mutate(chromo);
 trail=crossover(chromo,donor);
 [chromo, mse_val(itr)]=select(chromo, trail);
 [best_val(itr,1),best_val(itr,2), best_val(itr,3)] =evaluate(chromo);
end
disp("          Optimization of the Booth Function with Differential
 Evalution Algorithm")
disp(strcat("No. of iterations in each run: ", num2str(steps)));
disp("Best fit and corresponding X1 and X2 in each iteration,");
disp("Best fit   X1   X2");
disp(best_val);
disp("Best fit and corresponding X1 and X2 of this run,");
[best,x1,x2]=best_at_run(best_val);
disp(strcat("Best fit: ",num2str(best)));
disp(strcat("X1: ",num2str(x1)));
disp(strcat("X2: ",num2str(x2)));
display(best_val(:,1), mse_val);

function [chromo] = init_pop(n)
for i=1:n
chromo(i,:) = randi([-10,10], 1,2);
end
end

function [donor] = mutate(chromo)
 donor=zeros(10,2);
 for it=1:10
     for i=1:2
       b=randi([1,10], 1,1);
       c=randi([1,10], 1,1);
       while (b==c || it==b || it==c)
        b=randi([1,10], 1,1);
        c=randi([1,10], 1,1);
       end
       donor(it,i)=chromo(it,i)+randn*(chromo(b,i)-chromo(c,i));
     end
 end
 end

function [trial]=crossover(target, don)
 cr=0.5;
 for it=1:10
```

```
         val=randn;
        if(val<=cr)
          trial(it,1)=don(it,1);
          trial(it,2)=don(it,2);
        else
          trial(it,1)=target(it,1);
          trial(it,2)=target(it,2);
        end
 end
end

function [chromo, mse]=select(target, trail)
  for it=1:10
    cal1=(target(it,1) + 2*target(it,2) - 7)^2+(2*target(it,1) +
 target(it,2) - 5)^2;
    cal2=(trail(it,1) + 2*trail(it,2) - 7)^2+(2*trail(it,1) +
 trail(it,2) - 5)^2;
    if(cal1<cal2)
      chromo(it,1)=target(it,1);
      chromo(it,2)=target(it,2);
    else
      chromo(it,1)=trail(it,1);
      chromo(it,2)=trail(it,2);
    end
  end
  out=zeros(10,1);
  for i=1:10
      out(i)=(chromo(i,1) + 2*chromo(i,2) - 7)^2+(2*chromo(i,1) +
 chromo(i,2) - 5)^2;
  end
  mse=0;
  for j=1:10
      mse=mse+(out(j)-mean(out))^2;
  end
  mse=mse/9;
end

function [op_val, x1, x2]=evaluate(ch)
 op_val=(ch(1,1) + 2*ch(1,2) - 7)^2+(2*ch(1,1) + ch(1,2) - 5)^2;
 x1=ch(1,1);
 x2=ch(1,2);
 for it=2:10
   if(((ch(it,1) + 2*ch(it,2) - 7)^2+(2*ch(it,1) + ch(it,2) -
 5)^2)<=op_val)
   op_val=(ch(it,1) + 2*ch(it,2) - 7)^2+(2*ch(it,1) + ch(it,2) - 5)^2;
   x1=ch(it,1);
   x2=ch(it,2);
   end
 end
end

function []=display(op1, op2)
 runs=(1:steps);%specify the no.of iterations
 subplot(1,2,1);
```

```
 scatter(runs,op1);
 title('iterations vs best fit');
 xlabel('iteration');
 ylabel('best fit');
 hold on
 line(runs,op1);
 xlim([0 steps]);
 ylim([0 50]);
 hold off
 subplot(1,2,2);
 scatter(runs,op2);
 title('iterations vs mse');
 xlabel('iteration');
 ylabel('mse');
 hold on
 line(runs,op2);
 xlim([0 steps]);
 ylim([0 50]);
 hold off
end

function [op_val, x1, x2]=best_at_run(ch)
 op_val=ch(1,1);
 x1=ch(1,2);
 x2=ch(1,3);
 for it=2:steps
   if(ch(it,1)<=op_val)
   op_val=ch(it,1);
   x1=ch(it,2);
   x2=ch(it,3);
   end
 end
end
end
```

```
          Optimization of the Booth Function with Differential
 Evalution Algorithm
No. of iterations in each run: 300
Best fit and corresponding X1 and X2 in each iteration,
Best fit   X1   X2
   81.0000   -2.0000    9.0000
   81.0000   -2.0000    9.0000
   57.3265   -4.6414    7.4236
    7.8749   -1.0539    4.8804
    7.8749   -1.0539    4.8804
    7.8749   -1.0539    4.8804
    7.8749   -1.0539    4.8804
    7.8749   -1.0539    4.8804
    7.8749   -1.0539    4.8804
    7.8749   -1.0539    4.8804
    7.8749   -1.0539    4.8804
    7.8749   -1.0539    4.8804
    7.8749   -1.0539    4.8804
    7.8749   -1.0539    4.8804
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7.8749   -1.0539    4.8804
7.8749   -1.0539    4.8804
7.8749   -1.0539    4.8804
7.8749   -1.0539    4.8804
7.8749   -1.0539    4.8804
7.8749   -1.0539    4.8804
7.8749   -1.0539    4.8804
1.0177    0.2875    3.4259
1.0177    0.2875    3.4259
1.0177    0.2875    3.4259
1.0177    0.2875    3.4259
1.0177    0.2875    3.4259
1.0177    0.2875    3.4259
1.0177    0.2875    3.4259
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1.0177    0.2875    3.4259
1.0177    0.2875    3.4259
1.0177    0.2875    3.4259
1.0177    0.2875    3.4259
0.9683    0.9828    3.4537
0.9683    0.9828    3.4537
0.9683    0.9828    3.4537
0.9683    0.9828    3.4537
0.9683    0.9828    3.4537
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0.9683    0.9828    3.4537
0.9683    0.9828    3.4537
0.9683    0.9828    3.4537
0.5057    0.5977    3.1148
0.5057    0.5977    3.1148
0.5057    0.5977    3.1148
0.5057    0.5977    3.1148
0.5057    0.5977    3.1148
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0.5057    0.5977    3.1148
0.5057    0.5977    3.1148
0.0717    0.8896    3.1881
0.0717    0.8896    3.1881
0.0717    0.8896    3.1881
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0.0717    0.8896    3.1881
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0.0717    0.8896    3.1881
0.0717    0.8896    3.1881
0.0717    0.8896    3.1881
0.0717    0.8896    3.1881
0.0717    0.8896    3.1881
0.0306    0.9163    3.0069
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0.0035    1.0430    2.9714
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0.0035    1.0430    2.9714
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0.0035	1.0430	2.9714
0.0035	1.0430	2.9714
0.0035	1.0430	2.9714
0.0035	1.0430	2.9714
0.0035	1.0430	2.9714
0.0029	1.0335	2.9601

```
0.0029    1.0335    2.9601
0.0029    1.0335    2.9601
0.0029    1.0335    2.9601
0.0029    1.0335    2.9601
0.0029    1.0335    2.9601
0.0029    1.0335    2.9601
0.0029    1.0335    2.9601
0.0029    1.0335    2.9601
0.0029    1.0335    2.9601
0.0016    1.0273    2.9715
0.0016    1.0273    2.9715
0.0016    1.0273    2.9715
0.0016    1.0273    2.9715
0.0016    1.0273    2.9715
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0.0016    1.0273    2.9715
0.0016    1.0273    2.9715
0.0016    1.0273    2.9715
0.0016    1.0273    2.9715
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0.0004    1.0138    2.9872
0.0004    1.0138    2.9872
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0.0004    1.0138    2.9872
0.0004    1.0138    2.9872
0.0004    1.0138    2.9872
0.0004    0.9965    3.0110
0.0004    0.9965    3.0110
0.0004    0.9965    3.0110
0.0004    0.9965    3.0110
0.0004    0.9965    3.0110
0.0004    0.9965    3.0110
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0.0004    0.9965    3.0110
0.0004    0.9965    3.0110
0.0004    0.9965    3.0110
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0.0004	0.9965	3.0110
0.0004	0.9965	3.0110
0.0004	0.9965	3.0110
0.0004	0.9965	3.0110
0.0002	1.0060	3.0001
0.0002	1.0060	3.0001
0.0002	1.0060	3.0001
0.0002	1.0060	3.0001
0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
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0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
0.0001	1.0022	3.0020
0.0000	1.0004	3.0007
0.0000	1.0004	3.0007
0.0000	1.0004	3.0007
0.0000	1.0004	3.0007
0.0000	1.0004	3.0007
0.0000	1.0004	3.0007
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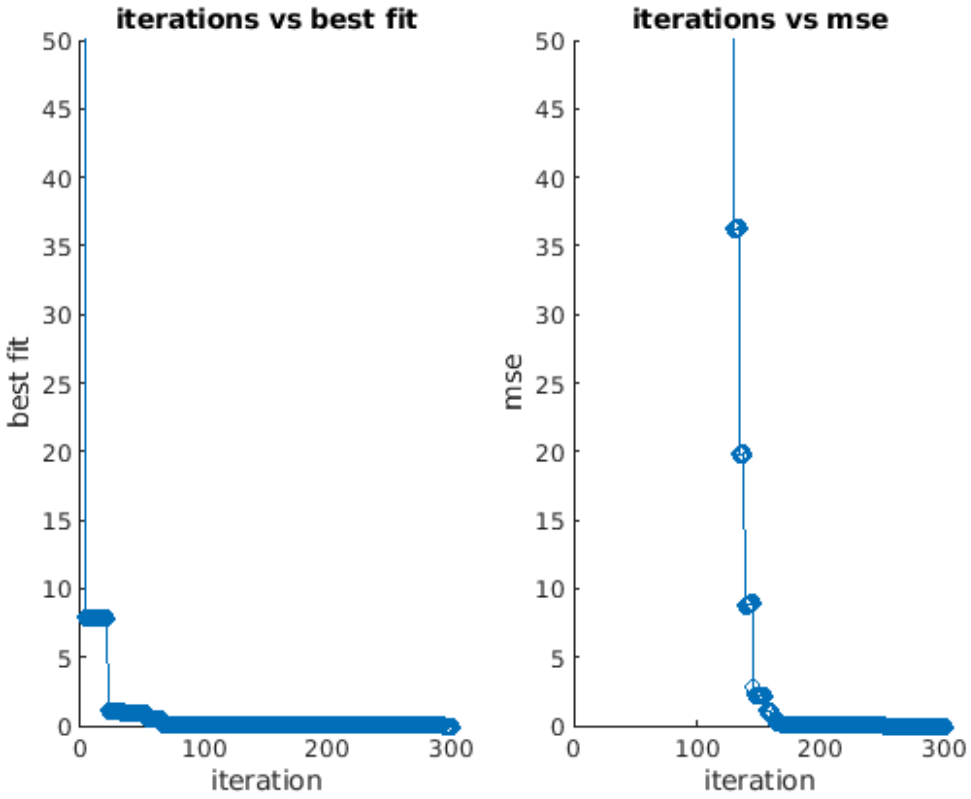
0.0000	1.0004	3.0007
0.0000	1.0004	3.0007
0.0000	1.0004	3.0007
0.0000	1.0004	3.0007
0.0000	1.0004	3.0007
0.0000	1.0004	3.0007
0.0000	1.0004	3.0007
0.0000	1.0004	3.0007

```
    0.0000    0.9987    3.0005
    0.0000    0.9987    3.0005
    0.0000    0.9987    3.0005
    0.0000    0.9987    3.0005
    0.0000    0.9987    3.0005
    0.0000    0.9987    3.0005
    0.0000    0.9987    3.0005
    0.0000    0.9987    3.0005
    0.0000    0.9987    3.0005
    0.0000    0.9998    3.0000
    0.0000    0.9998    3.0000
    0.0000    0.9998    3.0000
    0.0000    0.9998    3.0000
    0.0000    0.9998    3.0000
    0.0000    0.9998    3.0000
    0.0000    0.9998    3.0000
```

```
Best fit and corresponding X1 and X2 of this run,
Best fit: 2.4168e-07
X1: 0.99979
X2: 3
```



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