Dominic Riccoboni Individual Problem Set 7

```
%Function to minimize over [-10 10]
funHandle = @(x)15*sin(2*x).^2 + (x-2).^2;

%Use a large population size for better performance
popsize = 100;

%Upper and lower bound constraints on x
lb = -10;
ub = 10;

%Make sure that the initial range covers all possible x values
init_pop_range = [lb;ub];

%Allow enough iterations to occur for the solution to fall into the correct region
MaxGen = 10000;

%Allow 10% elitism, 60% crossover, and plenty of mutation with relatively rapid shrinking
%of the standard deviation in the gaussian mutation scheme. This shrinking allows a lot of
%spread in the beginninng but once it finds the area around the global minimum, it starts
%to focus in on finding the local minimum
options = optimoptions('ga', 'InitialPopulationRange', init_pop_range,...
   'PopulationSize',popsize,'EliteCount', 10, 'MaxGenerations',MaxGen,...
  'CrossoverFraction',.6, 'MutationFcn', ...
{@mutationgaussian, .5, 100}) %'ConstraintTolerance', 1e-4,
```

```
options =
  ga options:

   Set properties:
               CrossoverFraction: 0.6000
                     EliteCount: 10
          InitialPopulationRange: [2×1 double]
                  MaxGenerations: 10000
                     MutationFcn: {@mutationgaussian  [0.5000]  [100]}
                  PopulationSize: 100

   Default properties:
            ConstraintTolerance: 1.0000e-03
                   CreationFcn: @gacreationuniform
                  CrossoverFcn: @crossoverscattered
                       Display: 'final'
                  FitnessLimit: -Inf
              FitnessScalingFcn: @fitscalingrank
              FunctionTolerance: 1.0000e-06
                      HybridFcn: []
        InitialPopulationMatrix: []
            InitialScoresMatrix: []
            MaxStallGenerations: 50
                  MaxStallTime: Inf
                       MaxTime: Inf
    NonlinearConstraintAlgorithm: 'auglag'
                     OutputFcn: []
                       PlotFcn: []
                PopulationType: 'doubleVector'
                  SelectionFcn: @selectionstochunif
                   UseParallel: 0
```

```
                    UseVectorized: 0
```

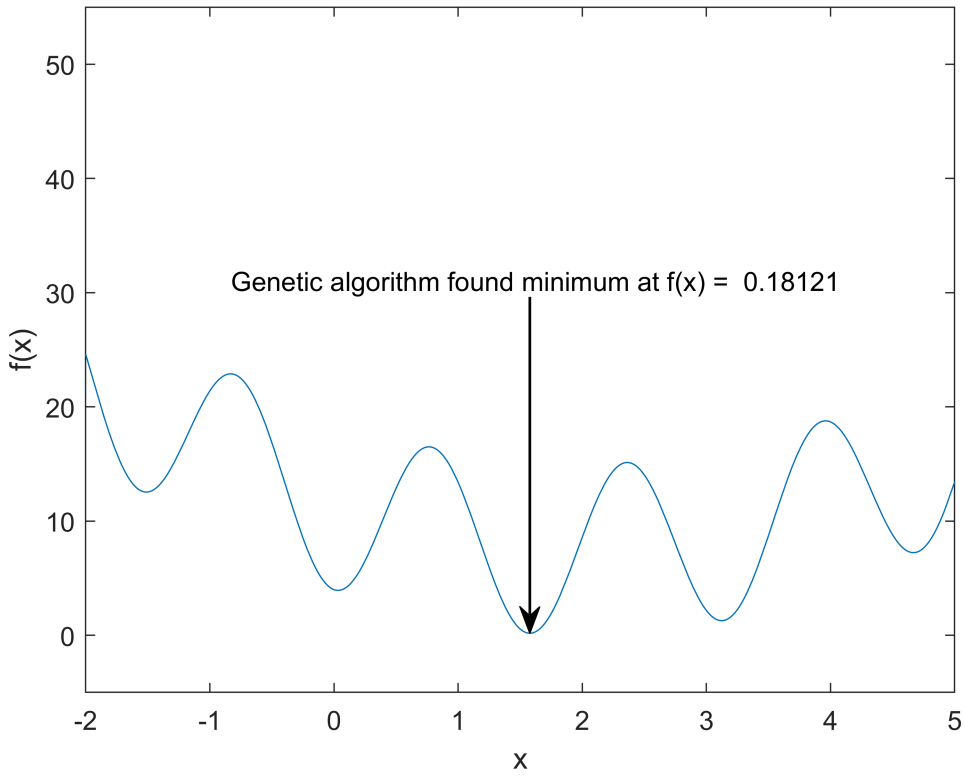
```
warning('off','all')
[x, fval] = ga(funHandle,1,[],[],[],[],lb,ub,[], options)
```

```
Optimization terminated: average change in the fitness value less than options.FunctionTolerance.
x = 1.5783
fval = 0.1812
```

```
figure
fplot(funHandle, [-2 5])
ylim([-5 55])
xlabel('x')
ylabel('f(x)')

%Annotations
ax = gca;

% GA Result, the found minimum
LArr = .4; %Length of Arrow
PhiArr = deg2rad(90);
%Arrow Head
[xh, yh] = ds2nfu(ax,x, fval);
%Arrow Tail
xt = xh + LArr*cos(PhiArr);
yt = yh + LArr*sin(PhiArr);
annotation('textarrow',[xt xh],[yt yh],'String',['Genetic algorithm found minimum at f(x) =  '
```


Genetic algorithm found minimum at f(x) = 0.18121
f(x)
x
50
40
30
20
10
0
-2
-1
0
1
2
3
4
5