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- FILENAME :
- HW03.m *
- DESCRIPTION :
- Computación Aplicada (Ene 19 Gpo 1)
- Final Exam *
- NOTES :
- In submitting the solution to this final exam, We Bruno González
- Soria and Antonio Osamu Katagiri Tanaka affirm our awareness of the
- standards of the Tecnológico de Monterrey Ethics Code. *
- START DATE :
- 02 May 2019

Contents

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This script should start with the command rng(31416), and should not contain any other call that initializes the state of the random number generator.

```
close all, clear all, clc, format compact
rng(31416)
```

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Problem 1: OPTIMIZATION Consider the following function:

$$f(X) = \sum_{i=1}^{6} \sin(xi)\,\sin\left(\frac{18\ /\ ixi\ \backslash}{|\ ----\ |}\right)$$

where 0 < xi < 5.

Maximize function f () using the Nelder-Mead algorithm (fminsearch) and simulated annealing (simulannealbnd). Modify whatever parameters you deem necessary to produce a good performance of these algorithms, regardless of the state of the random number generator. Use randomly generated initial point in the valid range of x.

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a) Implement f (x) as a MATLAB function.

```
i = 1:6;
f = @(x) -fx(x);
```

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b) Give your best solution found (optimal x and evaluation of x) for each algorithm.

```
% NelderMeade
x0 = rand([1 6])*5;
options = optimset('Display', 'off', 'MaxFunEvals', 10000);
disp("The optimal value of x usning NelderMeade (fminsearch) method is:")
[x,fval,exitflag,output] = fminsearch(f,x0,options)

% Simulated Annealing
disp("The optimal value of x usning Simulated Annealing (simulannealbnd) method is:")
lb = zeros([1 6]);
ub = ones([1 6])*5;
[x,fval,exitflag,output] = simulannealbnd(f,x0,lb,ub,options)
```

```
The optimal value of x usning NelderMeade (fminsearch) method is:
```

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c) Which of these two algorithms has a better expected performance on this problem when varying the initial point(s)? Justify your answer.

```
% From this two algorithms, fminsearch has a better expected performance on
% this problem. The reason is that the fval (objective function value at
% the solution) obtained is larger than the one obtained in simulannealbnd,
% thus closer to a maximum in the function. Additionally, unlike other
% solvers, fminsearch stops when it satisfies both TolFun and TolX.
```

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DEFINED FUNCTIONS:
Problem 1 a)

```
function fcn = fx (x)
suma=0;
    for i = 1:6
        newterm = sin(x(i))*sin((i*x(i))^2/pi)^18;
        suma = suma + newterm;
    end
    fcn = suma;
end
```

```
x =
    4.4463    1.1141    4.6886    0.0604    0.9936    0.0606
fval =
   -1.7347
exitflag =
     1
output =
  struct with fields:

    iterations: 786
     funcCount: 1297
     algorithm: 'Nelder-Mead simplex direct search'
       message: 'Optimization terminated:↵ the current x satisfies the termination criteria using OPTIONS.TolX of 1.000000e-04 ↵ and F(X) satisfies the converg
The optimal value of x usning Simulated Annealing (simulannealbnd) method is:
x =
    0.8269    2.4652    3.4183    1.2366    1.6021    2.7953
fval =
   -2.7718
exitflag =
     1
output =
  struct with fields:

     iterations: 6009
      funccount: 6166
        message: 'Optimization terminated: change in best function value less than options.FunctionTolerance.'
       rngstate: [1×1 struct]
    problemtype: 'boundconstraints'
    temperature: [6×1 double]
      totaltime: 1.6105
```

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