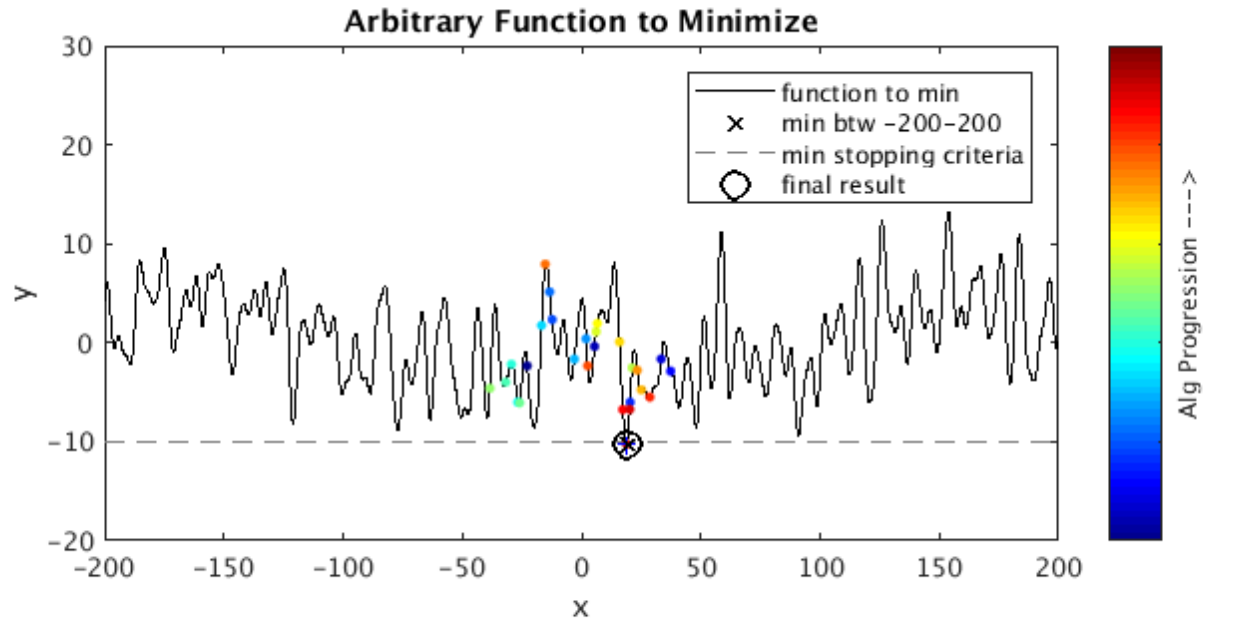
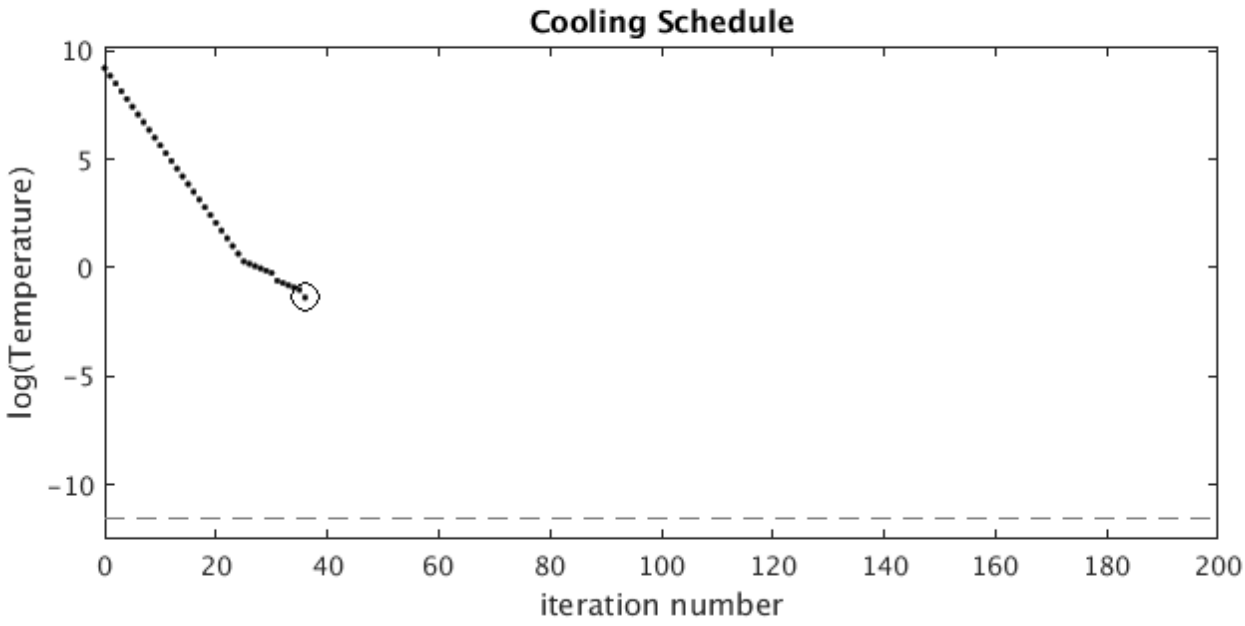
```
% Paula Burgi
% HW 7

close all;
clear;


% make complicated function
x = sym('x');
s = sin(x);
for i = 1:20
    a = rand(1);
    b = randn(1);
    c = randn(1);
    d = rand(1);
    s = s + a.*sin(b*x) + c.*cos(d*x);
end
s = s+(abs(x)./30)-3;
x     = -200:0.1:200;
xa    = x;
ss    = eval(s);
[m,d] = min(ss);

% guess
x = -50;
xo = x;
eo = eval(s);
nT = 1e4;
nits = 200;

% stoping criteria
Tstop = 1e-5;
eStop = -10;

% initiate plot
figure('units', 'normalized', 'outerposition', [.1 .1 .5 .9]); hold on;
hold on;
subplot(2,1,1);
    hold on; box on;
    plot(xa, ss, 'k');
    plot(xa(d),m, 'kx', 'linewidth', 2);
    plot(xa, ones(1, length(xa)).*eStop, '--', 'color', [0.5 0.5 0.5]);
    xlabel('x');
    ylabel('y');
    title('Arbitrary Function to Minimize');
    ylim([-20 30]);
subplot(2,1,2);
    hold on; box on;
    plot(0, log(nT), 'k.');
    xlabel('iteration number');
    ylabel('log(Temperature)');
    title('Cooling Schedule');
    xlim([0 nits]);
    ylim([log(Tstop)-1 log(nT)+1]);
    plot(0:nits, ones(1, nits+1).*log(Tstop), '--', 'color', [0.5 0.5 0.5]);


% intitate matrices
nTa = [];
```

```
eoa = [];
xoa = [];

% Metropolis Alg
for i = 1:nits
    % generate random number & add to last guess
    nr = randn*20;
    x  = xo+nr;
    % evaluate function at new x
    ei = eval(s);
    % generate value for accept/reject new x
    f  = exp(-(ei-eo)./nT);
    % generate rand to compare to f
    rr = rand;
    if f >= rr
        % accept new x
        eo = ei;
        xo = x;
        nT = 0.7*nT;
        eoa = [eoa; eo];
        xoa = [xoa; xo];
    else
        % reject new x
        nT = 0.9*nT;
    end
    nTa = [nTa; nT];

    % stopping criteria
    if nT <= Tstop | eo < eStop
        itStop = i;
        break
    else
        itStop = i;
    end

end

% plot final results
subplot(2,1,1);
    plot(xo, eo, 'ko', 'markersize', 10, 'linewidth', 2);
    ll = length(eoa);
    cm = jet(ll);
    for i=1:ll
        plot(xoa(i), eoa(i), '.', 'color', cm(i,:), 'markersize', 10);
    end
    plot(xo, eo, 'b*');
    plot(xa(d),m, 'kx', 'linewidth', 2, 'linewidth', 2);
    colormap jet
    h = colorbar;
    %title(h,'Alg Progression');
    set(h, 'TickLabels', ['']);
    h.Label.String = 'Alg Progression --->';
    legend('function to min', 'min btw -200-200', 'min stopping criteria', 'final result');

subplot(2,1,2);
    plot(1:itStop, log(nTa), 'k.');
    plot(itStop, log(nT), 'ko', 'markersize', 10);
```





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