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% To implement the gradient descent algorithm.
% Example: [xs,fs,k] = grad_desc('f_rosen','g_rosen',[0; 2],1e-9);
function [xs,fs,k] = grad_desc(fname,gname,x0,epsi)
format compact
format long
k = 1;
xk = x0;
gk = feval(gname,xk);
dk = -gk;
ak = bt_lsearch(xk,dk,fname,gname);
adk = ak*dk;
er = norm(adk);
xs = [xk];
while er >= epsi,

    % prevent runaway to infinite asymptote
    if k >= 2000
        disp('RUNAWAY condition occurred!!!');
        break;
    end
    xk = xk + adk;
    gk = feval(gname,xk);
    dk = -gk;
    ak = bt_lsearch(xk,dk,fname,gname);
    adk = ak*dk;
    er = norm(adk);
    k = k + 1;
    xs = [xs xk];
end
disp('solution:')
xs = [xs (xk + adk)];
xs(:,end)
disp('objective function at solution point:')
fs = feval(fname,xs(:,end))
format short
disp('number of iterations performed:')
k
```

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