```matlab
% To implement BFGS algorithm.
% Example:
% [xs,fs,k] = bfgs('f200','g200',[zeros(100,1);-ones(100,1)],1e-7);
function [xs,fs,k] = bfgs(fname,gname,x0,epsi)
format compact
format long
n = length(x0);
I = eye(n);
k = 1;
xk = x0;
Sk = I;
fk = feval(fname,xk);
gk = feval(gname,xk);
dk = -Sk*gk;
ak = bt_lsearch(xk,dk,fname,gname);
dtk = ak*dk;
xk_new = xk + dtk;
fk_new = feval(fname,xk_new);
dfk = abs(fk - fk_new);
er = max(dfk,norm(dtk));
xs = [xk];
while er >= epsi,

        if k >= 2000
            disp('RUNAWAY condition occurred!!!');
            break;
        end
        gk_new = feval(gname,xk_new);
        gmk = gk_new - gk;
        D = dtk'*gmk;
        if D <= 0,
            Sk = I;
        else
            sg = Sk*gmk;
            sw0 = (1+(gmk'*sg)/D)/D;
            sw1 = dtk*dtk';
            sw2 = sg*dtk';
            Sk = Sk + sw0*sw1 - (sw2'+sw2)/D;
        end
        fk = fk_new;
        gk = gk_new;
        xk = xk_new;
        dk = -Sk*gk;
        ak = bt_lsearch(xk,dk,fname,gname);
        dtk = ak*dk;
        xk_new = xk + dtk;
        fk_new = feval(fname,xk_new);
        dfk = abs(fk - fk_new);
        er = max(dfk,norm(dtk));
        k = k + 1;
        xs = [xs xk];
end
```

```
disp('solution:')
xs(:,end)
disp('objective function at solution point:')
fs = feval(fname,xs(:,end))
format short
disp('number of iterations at convergence:')
k
```

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