Non Linear Optimisation I Assignment 6

Exercise 6.1

(I)

```
function [x,iter] = coordinate_minimisation(H,type)

n= size(H,1);
x0 = 0.001*rand(n,1);
%x0 = ones(n,1);

alpha = 1/normest(H,2);
for iter = 0:999

    if (iter == 0)
       x = x0;
    end

    fprintf(' Iteration %d || Function Value: %f \n',iter+1,(0.5*x'*H*x))
    ik = mod(iter,n)+1;
    grad_quad = H*x;

    if(type == 0)
        alpha = x(ik)- (H(ik,:)*x - H(ik,ik)*x(ik)/(2*H(ik,ik)));
    elseif(type == 2)
      ik = randi(n);
    elseif(type == 3)
      ik = find(abs(grad_quad) == max(abs(grad_quad)));
    end

    vect = zeros(n,1);
    vect(ik) =1;


    if(type==0)
       x = x- vect*alpha;
    else
       x = x- vect*alpha*grad_quad(ik);

    end
    if(norm(H*x,2)<= 10e-06*max(1,norm(H*x0,2)))
        break;
    end
end
end
```

(II)

```
for  n = [10,100,1000]

   a = 1;
   for rc = [1/10,1/100,1/1000,1/10000]

      R = sprandsym(n,0.1,rc,1);
      [x,iter(a)] = coordinate_minimisation(R,3);
```

```matlab
        func_mag(a) = x'*R*x;
        a = a+1;
    end

    figure;subplot(1,2,1)

    plot([1/10,1/100,1/1000,1/10000],func_mag,'r');
    title(strcat('Performance of algorithm 4 for dimsension: ',num2str(n)))
    xlabel('condition number')
    ylabel('Magnitude of function')

    subplot(1,2,2)
    plot([1/10,1/100,1/1000,1/10000],iter+1,'g')
    title(strcat('Performance of algorithm 4 for dimsension: ',num2str(n)))
    xlabel('condition number')
    ylabel('number of iterations')

end
```

Performance of algorithm3 for dimsension:10

Magnitude of function / condition number

Performance of algorithm3 for dimsension:10

number of iterations / condition number

Performance of algorithm4 for dimsension:10

Magnitude of function / condition number

Performance of algorithm4 for dimsension:10

number of iterations / condition number

Performance of algorithm 1 for dimsension:100 (top left, Magnitude of function vs condition number, ×10⁻¹¹)

Performance of algorithm 1 for dimsension:100 (top right, number of iterations vs condition number)

Performance of algorithm2 for dimsension:100 (bottom left, Magnitude of function vs condition number, ×10⁻⁶)

Performance of algorithm2 for dimsension:100 (bottom right, number of iterations vs condition number)

Performance of algorithm3 for dimsension:100

Performance of algorithm3 for dimsension:100

Performance of algorithm4 for dimsension:100

Performance of algorithm4 for dimsension:100

Performance of algorithm3 for dimsension:1000

Performance of algorithm3 for dimsension:1000

Performance of algorithm4 for dimsension:1000

Performance of algorithm4 for dimsension:1000