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8.5.1.1

```
function [nzA, ir, ic] = create_poisson_matrix(N)
    nzA = zeros(5*N^2,1);
    ic = zeros(5*N^2,1);
    ir = zeros(N^2+1,1);
    nz_counter = 1;
    for i = 1:N^2
        ir(i) = nz_counter;
        [n, r, c] = compute_row_update(i, N);
        nzA(nz_counter:nz_counter + r - 1) = n;
        ic(nz_counter:nz_counter + r - 1) = c;
        nz_counter = nz_counter + r;
    end
    ir(end,1) = nz_counter;
    nzA = nzA(1:ir(end,1)-1);
    ic = ic(1:ir(end,1)-1);
end

function [...
    nzA_update, ir_increment, ic_update ...
] = compute_row_update(i, N)
    R = mod(i, N);
    dummy = [-1; -1; 4; -1; -1];
    diags_ic = [i-N; i-1; i; i+1; i+N];
    if R == 1
        dummy = [-1; 4; -1; -1];
        diags_ic = [i-N; i; i+1; i+N];
    elseif R == 0
        dummy = [-1; -1; 4; -1];
        diags_ic = [i-N; i-1; i; i+N];
    end
    idx = find(diags_ic>0 & diags_ic<=N^2);
    ir_increment = size(idx,1);
    ic_update = diags_ic(idx);
    nzA_update = dummy(idx);
end
```

8.5.1.2

```
function y = SparseMvMult(nzA, ir, ic, x)
    m = size(ir,1) - 1;
    y = zeros(m,1);
    for i = 1:m
        for j = ir(i):ir(i+1)-1
            k = ic(j);
            y(i) = y(i) + x(k)*nzA(j);
        end
    end
end
```