Midterm Programming Assignment

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Link for the complete code in this assignment :
https://github.com/gary1346aa/Scientific-Computing-Exam1

1) **Write two programs implementing matrix multiplication** $C = AB$, **where** A **is** $m \times n$ **and** B **is** $n \times k$, **in two different ways: (i) compute the** mk **inner products of rows of** A **with columns of** B, **and (ii) form each column of** C **as a linear combination of columns of** A. **Name the two programs :** `sdot` **and** `saxpy`**. Please include your source code in your report.**

```
function C = sdot(A,B)

    [m,~] = size(A);
    [~,k] = size(B);
    C = zeros(m,k);

    for i = 1 : m
        for j = 1 : k
            C(i,j) = C(i,j) + A(i,:) * B(:,j);
        end
    end

end


function C = saxpy(A,B)

    [m,~] = size(A);
    [n,k] = size(B);
    C = zeros(m,k);

    for j = 1 : k
        for i = 1 : n
            C(:,j) = C(:,j) + A(:,i) * B(i,j);
        end
    end

end
```
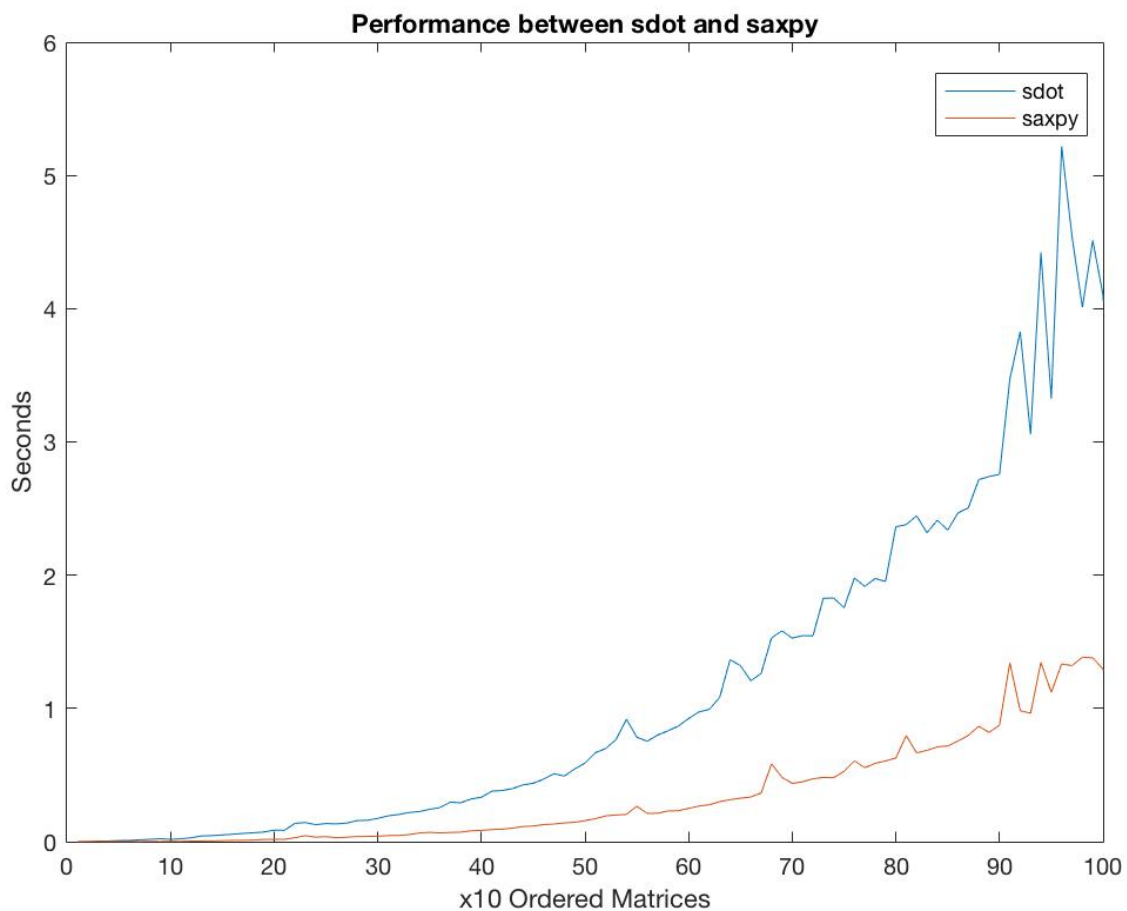
The algorithm of these two matrix multiplication is similar, the only difference is the read/storage order, `sdot` is row ordered and `saxpy` is column orded.

2) **Compare the performance of these two implementations on your computer. You may need to try very large matrices before the differences in performance become significant.**

We can observe that as orders of the input matrices goes high, `saxpy` outperforms `sdot,` but in fact they're still in the same time complexity.

3) **Present the specifications (such as cache size and cache management policy) of your computer system, and use the information to explain the results you observe.**

CPU : Intel Core i7-8700K, Cache = 12MB
Operating System : Windows 10 64bit
IDE : Matlab (Column-Oriented)

Column- or row-major is defined by the language, on the Matlab platform it's column oriented, so the column ordered `saxpy` has a significant faster processing speed than doing `sdot.`