1. Vector and matrix operations in MATLAB
Vector and matrix operations (External resource)

(1.0 points possible)

Array operations

- In general, MATLAB is quite intuitive when it comes to operating on matrices and vectors. For example, we can add two vectors or matrices $\mathbf{A}$ and $\mathbf{B}$ to form a third matrix $\mathbf{C}$ using the following command:

```
C = A+B
```

- If $\mathbf{A}$ is an $m \times n$ matrix and $\mathbf{B}$ is an $n \times p$ matrix, then we can calculate the product of $\mathbf{A}$ and $\mathbf{B}$, i.e. $\mathbf{D} = \mathbf{AB}$, using the following command:

```
D = A*B
```

- If $\mathbf{v}_1$ and $\mathbf{v}_2$ are two vectors of the same length, we can calculate the dot product $a = \mathbf{v}_1 \cdot \mathbf{v}_2$ using:

```
a = dot(v1,v2)
```

- The transpose of an matrix/vector $\mathbf{A}$ is a new matrix, $\mathbf{B} = \mathbf{A}^T$, such that the ith column of $\mathbf{A}^T$ is the ith row of $\mathbf{A}$. It is calculated using an apostrophe:

```
B = A'
```

- The final MATLAB operation we will look at in this section is "element-wise" multiplication. Suppose we have two matrices $\mathbf{A}$ and $\mathbf{B}$ of the same size. Then the element-wize product takes each entry in $\mathbf{A}$ and multiplies it by the corresponding entry in $\mathbf{B}$

e.g. if

$$\mathbf{A} = \begin{bmatrix} 1 & 1 \\ 2 & 3 \end{bmatrix}, \qquad \mathbf{B} = \begin{bmatrix} 2 & 0 \\ 3 & 1 \end{bmatrix}$$

Then the element-wise product is

$$\mathbf{C} = \mathbf{A} \circ \mathbf{B} = \begin{bmatrix} 2 & 0 \\ 6 & 3 \end{bmatrix}$$

The matlab command for this operation is

```
C = A.*B
```

Define the following matrices and vectors:

$$\mathbf{X} = \begin{bmatrix} 2 & 1 \\ 0 & 4 \end{bmatrix}, \qquad \mathbf{Y} = \begin{bmatrix} 3 & 4 \\ 1 & 1 \end{bmatrix}$$

$$\mathbf{u} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}, \mathbf{v} = \begin{bmatrix} 4 \\ -3 \end{bmatrix}$$

Use MATLAB's built-in functions to define the following new arrays:

1. $\mathbf{A} = \mathbf{XY}$
2. $\mathbf{B} = \mathbf{YX}$
3. $\mathbf{C} = \frac{1}{2}[\mathbf{X} - \mathbf{Y}^T]$
4. $\mathbf{D} = \mathbf{X} \circ \mathbf{Y}$
5. $a = \mathbf{u} \cdot \mathbf{v}$
6. $b = \mathbf{v}^T\mathbf{Xu}$

Your Script

Save Reset MATLAB Documentation (https://www.mathworks.com/help/)

```
% We provide definitions of X, Y, u and v for you
X = [2 1; 0 4];
Y = [3 4; 1 1];
u = [-1;1];
v = [4;-3];

A = X*Y;
B = Y*X;
C = (X-Y')/2;
D = X.*Y;
a = dot(u,v);
b = v'*X*u;
```

▶ Run Script ()

Assessment: Correct

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- **Value of A**
- **Value of B**
- **Value of C**

Value of D

Value of a

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