

CPSC 314, Written Homework 1: Transformations

Out: Wed 20 Jan 2016

Due: Wed 27 Jan 2016 2pm (hand in at start of lecture)

Value: 4% of final grade

Total Points: 100

Name: _____

Student Number: _____

<i>Q1</i>	/15
<i>Q2</i>	/3
<i>Q3</i>	/4
<i>Q4</i>	/16
<i>Q5</i>	/8
<i>Q6</i>	/54
<i>Total</i>	/100

Please check one of the following:

- I did not collaborate with anyone in the completion of this homework.
- I collaborated with people named below in the completion of this problem set:

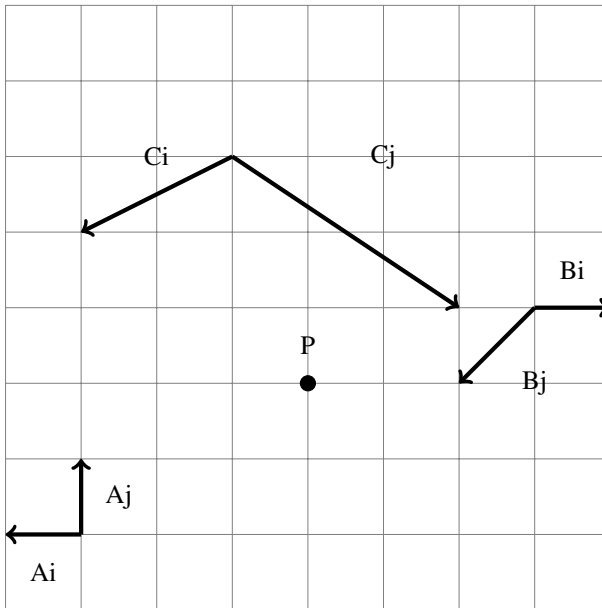
Name: _____ Student Number: _____

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Name: _____ Student Number: _____

1. (15 pts) The point coordinate P can be expressed as (4,3): that is, $P = 4*i + 3*j$, where i and j are basis vectors of unit length along the x and y axes, respectively, with an origin at the lower left of the grid. Describe the point P in terms of the three other coordinate systems given below (A, B, C).

Update Jan 22: origin of C coordinate frame moved.



2. (3 pts) Write down the 4x4 matrix for scale an object by 1 in y, 3 in x, and 2 in z.

$$\begin{bmatrix} & & & \\ & & & \\ & & & \\ & & & \end{bmatrix}$$

3. (4 pts) Homogenize the point (6,3,0,3).

()

4. (16 pts) Give the 4x4 modelview matrix at the four lines A, B, C, and D in the pseudocode below. Assume the matrix stack has been initialized with LoadIdentity(). The transformation direction goes left to right.

```
LoadIdentity();
translation(1, 0, 0);
A
rotation(90, 0, 0, 1);
B
scale(2, 1, 3);
C
translation(0, 1, 2);
D
```

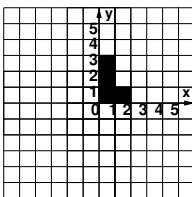
5. (8 pts) Give the pseudocode required to encode M with left-to-right direction. You may assume the matrix stack has been initialized with `LoadIdentity()`.

$$M = \begin{bmatrix} 2 & 0 & 0 & 3 \\ 0 & 2 & 0 & 1 \\ 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

6. (54 pts) For each equation below, sketch the new location L' of the L shape on the grid and provide the pseudocode sequence needed to carry out those operations. You may assume the matrix mode is `mvMatrix` and that the stack has been initialized with `LoadIdentity()`.

For reference, the pseudocode transformation is `scale(x, y, z), rotation(theta, x, y, z), translation(x, y, z)`. Show your partial work, with the position that the L would be drawn after each transformation.

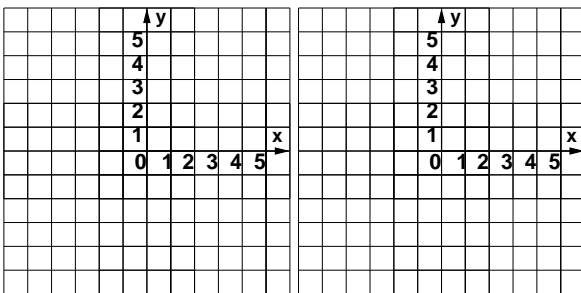
Do these computations in both directions: from left to right (moving coordinate frame), and also from right to left (moving object). You will get different intermediate answers, but the final position of the L should be the same each way; it's a good way to cross-check your work! You don't need to rewrite the pseudocode from right to left, once is enough.



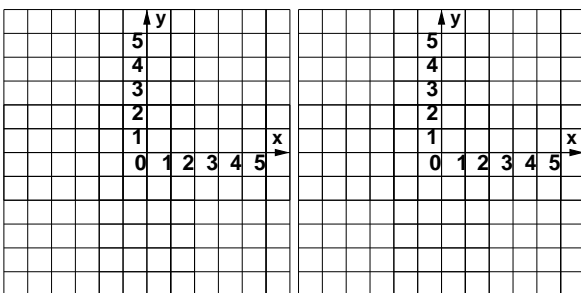
$$A = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}, B = \begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}, C = \begin{bmatrix} 1 & 0 & 0 & -1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}, D = \begin{bmatrix} 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

a) $L' = BC L$

Left to Right:

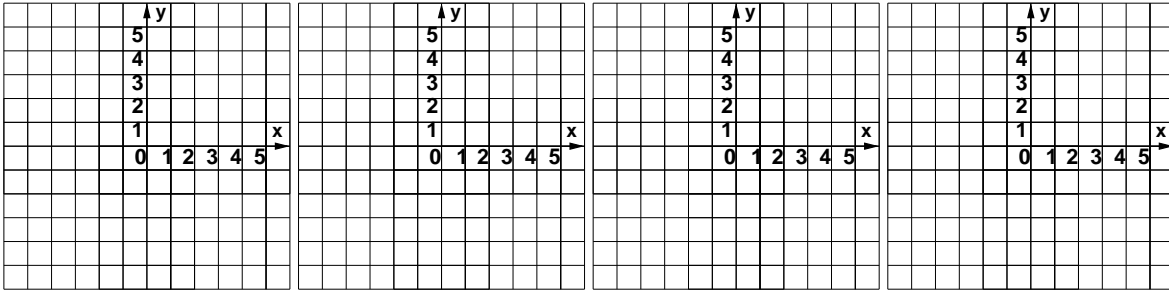


Right to Left:

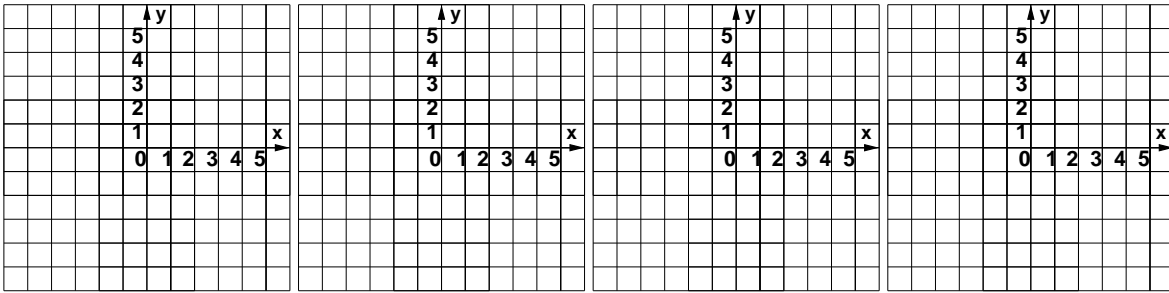


b) $L' = CDAC L$

Left to Right:

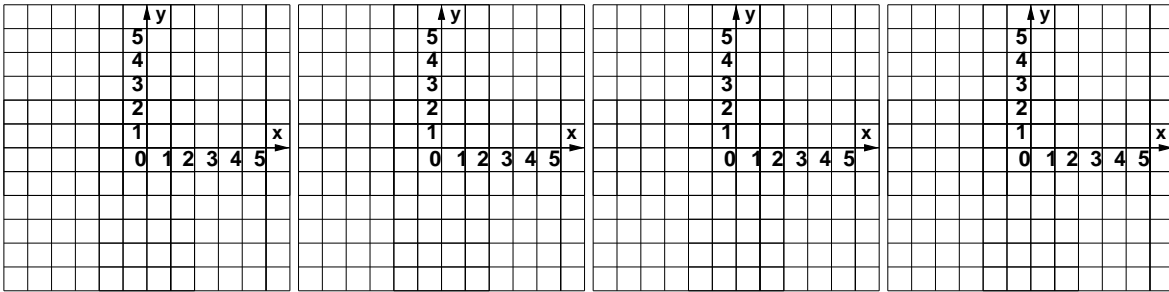


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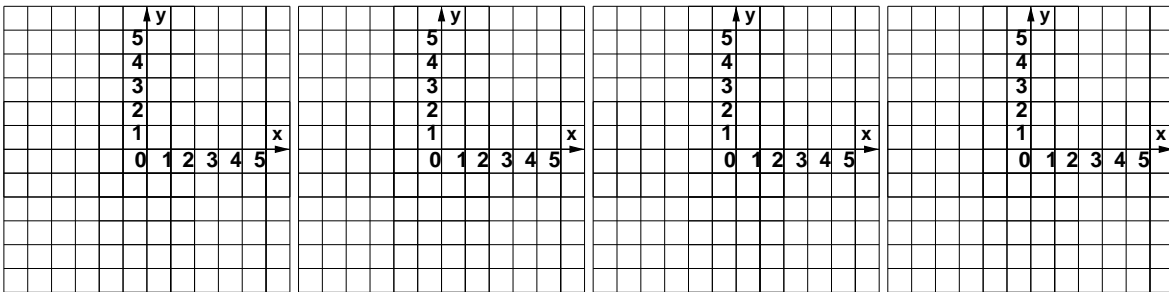


c) $L' = ADCC L$

Left to Right:

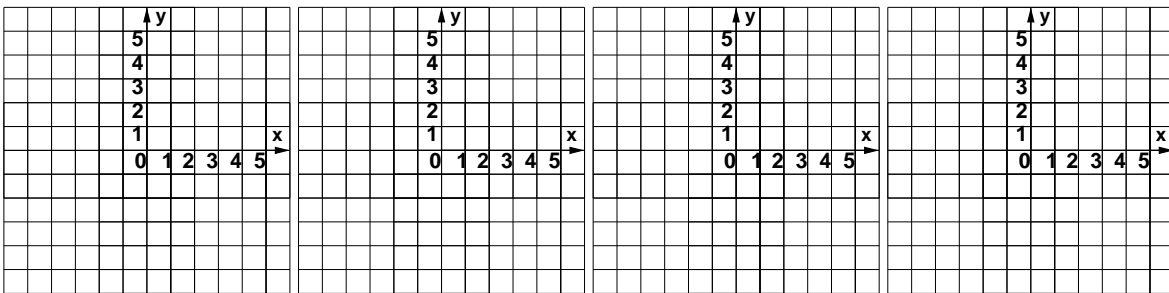


Right to Left:

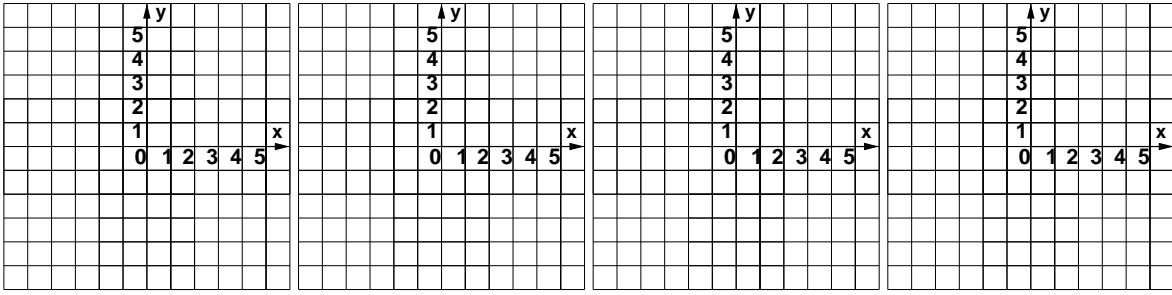


d) $L' = ACBD L$

Left to Right:

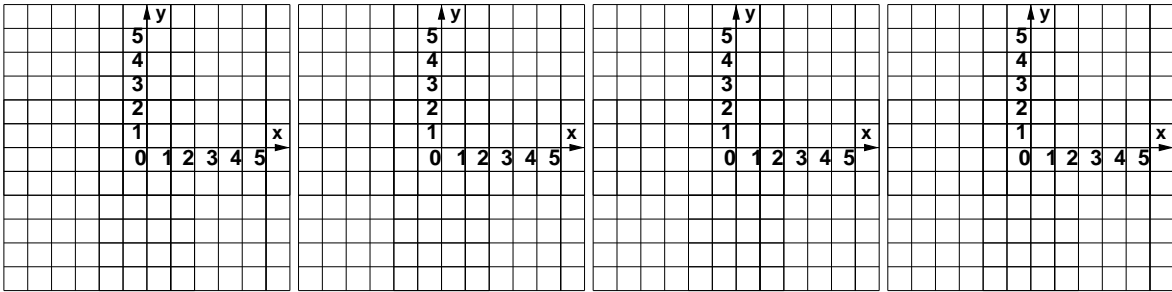


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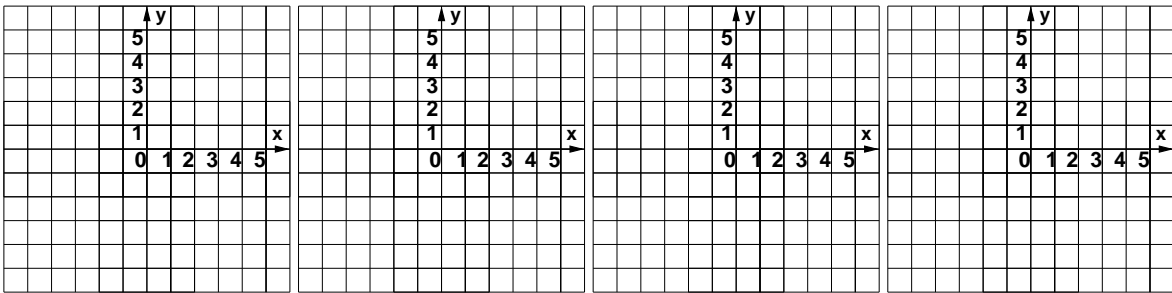


e) $L' = ACDB L$

Left to Right:

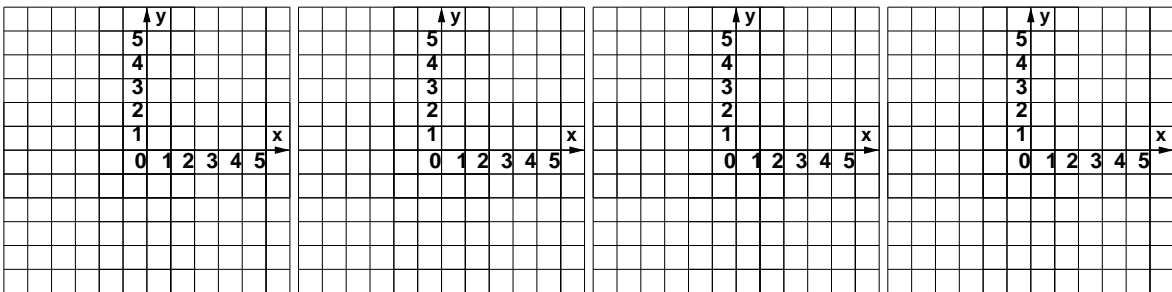


Right to Left:



f) $L' = CCBC L$

Left to Right:



Right to Left:

