**Hands-on Exercise Assignment #4**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Learning objective**: Learn how to use JavaScript instructions to move graphic objects across a canvas, harnessing the basic principles of animation. In this exercise students learn how to keep moving objects from leaving the canvas area, using an if-statement. The concept of acceleration is also explored.

To start, download and save in appropriate locations the resources for this exercise (html and images files) If you need a JavaScript reference, here is one by W3Schools: <https://www.w3schools.com/js/default.asp>

**PART I: Basic animation**

Which instruction starts the animation? Show the instruction here:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_setInterval(drawBall,20)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2) Why does the ball move diagonally, rather than horizontally or vertically like the previous animation (car)?

Hypothesis: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Ways to test a hypothesis:

1. Remove targeted instructions and test program, evaluating results. (comment out)
2. Change key instructions and test program, evaluating the results.
3. Inspect values of selected variables, using “console.log(*variable-name*)”.
4. Assign special values to selected variables and evaluate the results.
5. Make changes and test animation.

How do you test the above hypothesis? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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3) Show the change you would make by showing the modified instructions below to make the ball move to the upper right-hand corner, instead of the lower left-hand corner.

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4) Test your hypothesis and show any corrections needed for the correct solution below:

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5) Modify the animation to **start** the ball along the left edge of the canvas and have it move right, **horizontally only**. Show your modified instructions below, specifying any instructions that you eliminated.

Before you make any changes to the animation, formulate a hypothesis about which instructions are responsible for the symbol’s initial location:

Hypothesis: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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How would you test this hypothesis? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Show your final modifications here: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**PART II: Acceleration and boundaries**

Recall that acceleration is defined as an increase in the rate of speed over time. Have the ball accelerate from its starting point until it leaves the canvas area on the opposite edge.

1. What is your hypothesis for accelerating the ball: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Test your program and identify any changes to your above hypothesis below:

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**Before starting the next section, remove the acceleration.**

To keep the ball in the canvas area, the location of the ball must be checked after each movement. JavaScript provides a *condition* instruction that allows the ability to conduct such a check. For example, in order to prevent the symbol from exiting the bottom of the canvas, this condition is appropriate: if(ball.x >= canvas.width)
 { speedX = -speedX; // reverse sign
 }

Place this instruction after ball.x += speedX; and test your animation.

1. How does your animation change after making the above change? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Formulate a hypothesis about how one would keep the ball from exiting the **left edge** of the canvas.
Hypothesis: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Test and refine your hypothesis, as necessary. Show your final solution below, if different from your original hypothesis:

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1. Change the motion of the ball so that it follows a diagonal path. Develop and test a solution to keep the ball from exiting the **upper edge** of the canvas and show your solution below:

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1. Develop and test a solution to keep the ball from exiting the **bottom edge** of the canvas and show your solution below:

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1. You probably noticed that the symbol partially disappears on certain edges. Run your animation to determine for which edges this occurs and list them below:(right,left,top, bottom).

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1. In order to prevent the ball from partially leaving the canvas, one can subtract the width or height of the symbol (ball.width and ball.height) from the width or height of the canvas in the appropriate conditions. Show the reformulated conditions below:

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**PART III customize the animation**

In this part you may create your own graphic object to bounce around the canvas. Create a non-rectangular image to substitute for the pingpong ball. You can do this by storing your image file in the *images* folder and then substituting your file name for all occurrences of *pingpong.png* in the HTML file.

Finally, what would happen if acceleration were reintroduced? Add acceleration back and describe the resulting animation below:

Demonstrate your animation to the instructor and get her initials: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_