Introduction to Web Technology

# HTML5: Graphic Canvas, Drag and Drop

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## HTML 5

### Canvas

- First introduced in WebKit by Apple for the OS X Dashboard, Graphic Canvas has since been implemented in other major browsers.

- Canvas is used to draw graphics, such as paths, boxes, circles, text, and images, on the fly, via JavaScript.

## HTML 5

### Drag and Drop

- Drag and Drop enable applications to use drag and drop features in browsers.

- The user can select draggable elements with a mouse, drag the elements to a droppable element, and drop those elements by releasing the mouse button.

## Canvas

The `<canvas>` element is used to draw graphics on a web page.

```
<canvas id="mycanvas" width="1000" height="500"
style="border:1px solid black;">
Your browser does not support canvas.
</canvas>
```

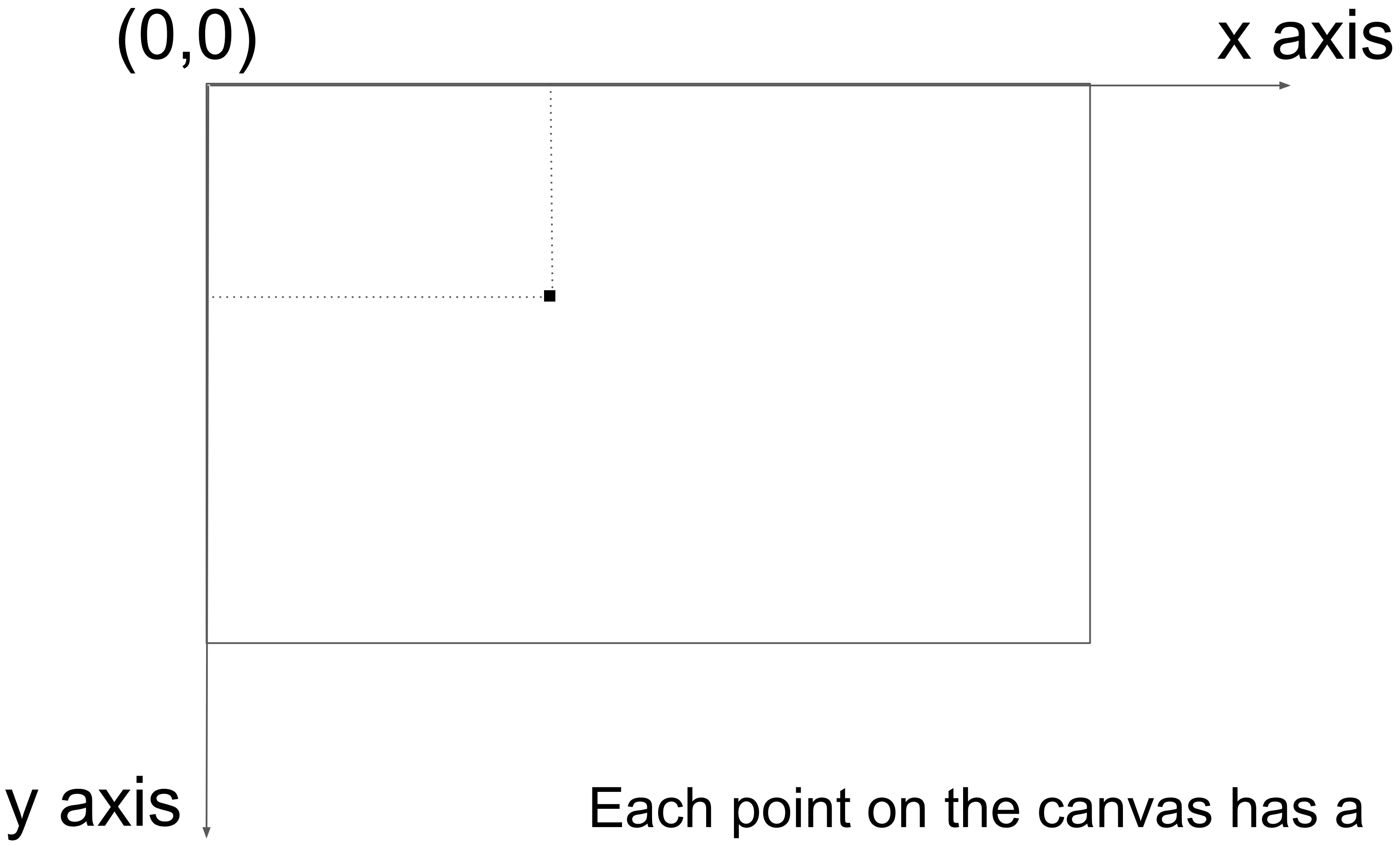
## Canvas

The `<canvas>` element is used to draw graphics on a web page.

```
<canvas id="mycanvas" width="1000" height="500"
style="border:1px solid black;">
Your browser does not support canvas.
</canvas>
```

The `<canvas>` element is only a container for the graphics. We must use JavaScript to actually draw the graphics content.

## Canvas



Each point on the canvas has a coordinate (x,y)

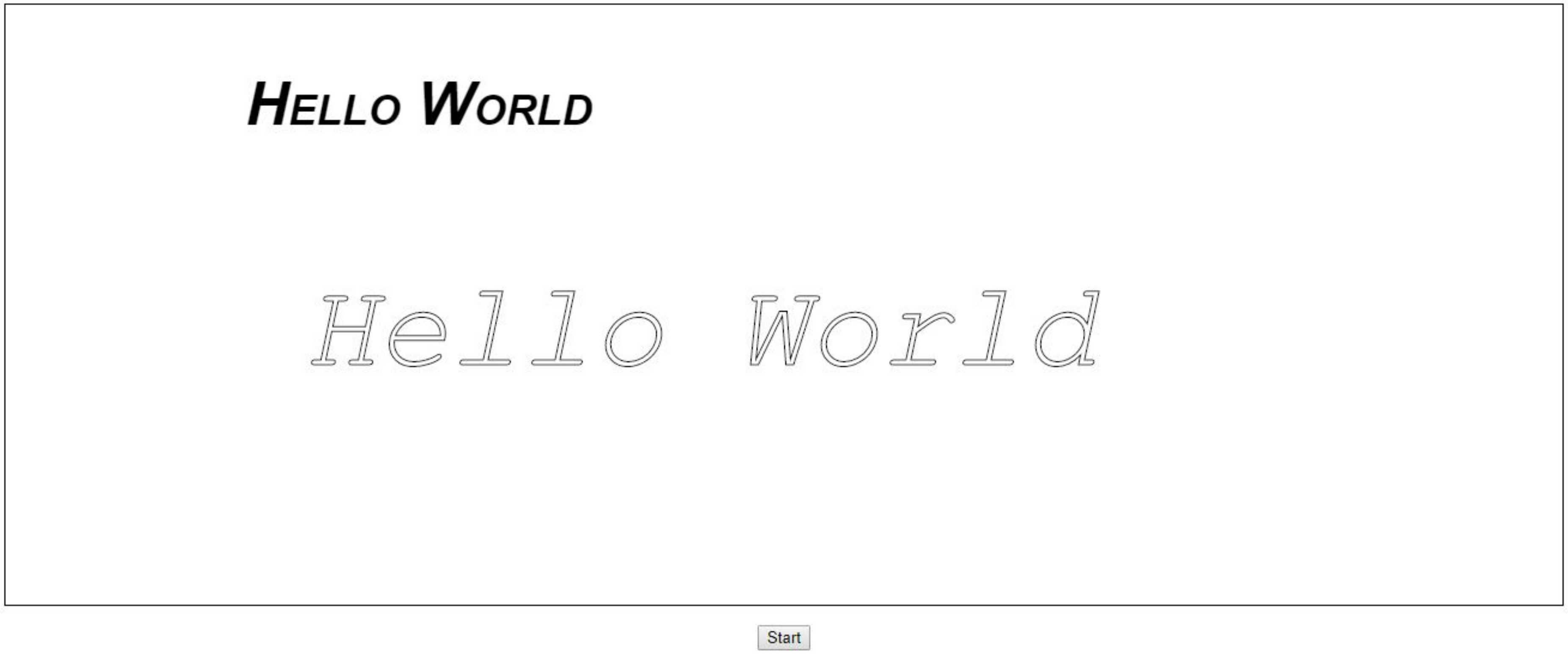
## Canvas

**CanvasRenderingContext2D** is used for drawing text, images, shapes and other objects onto the canvas element. It provides the 2D rendering context for the drawing surface of a canvas element.

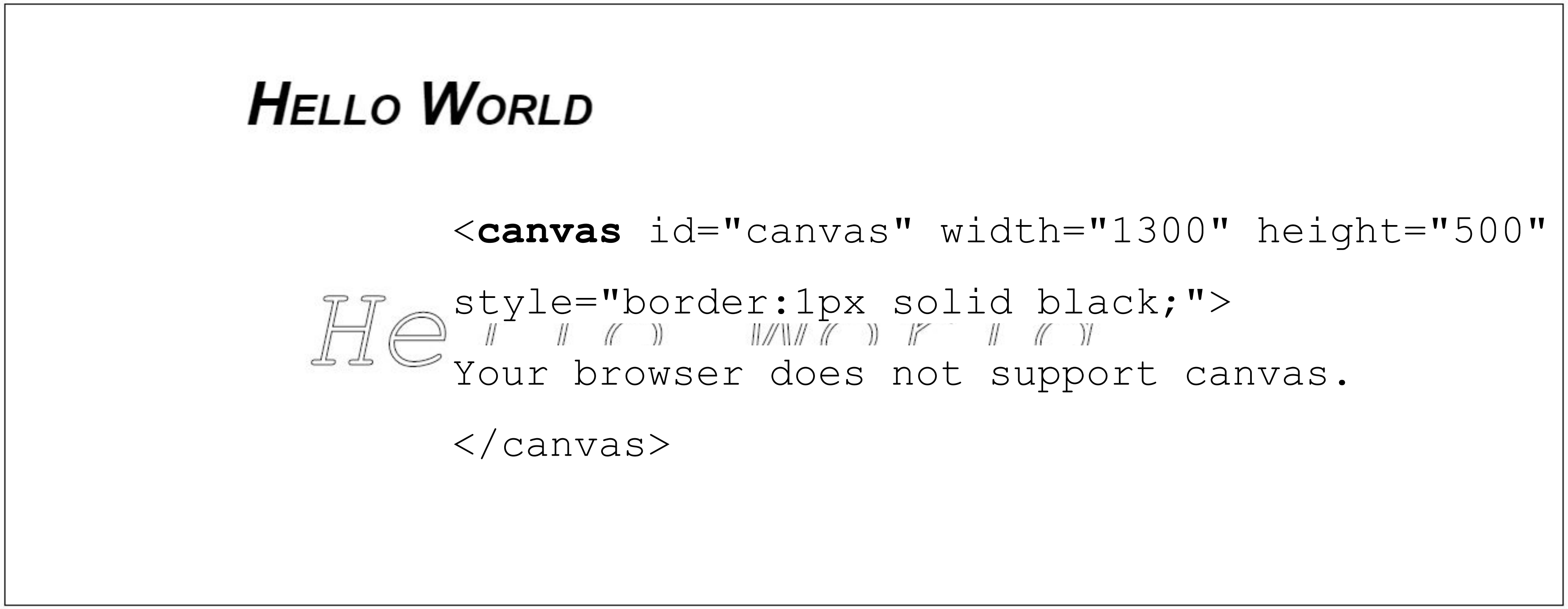
```
// get the canvas's 2d context
var canvas = document.getElementById("the-canvas-id");
var context = canvas.getContext("2d");
```

There are other rendering contexts for canvas that are not covered in this subject:
**WebGLRenderingContext**,
**WebGL2RenderingContext**

## Hello World

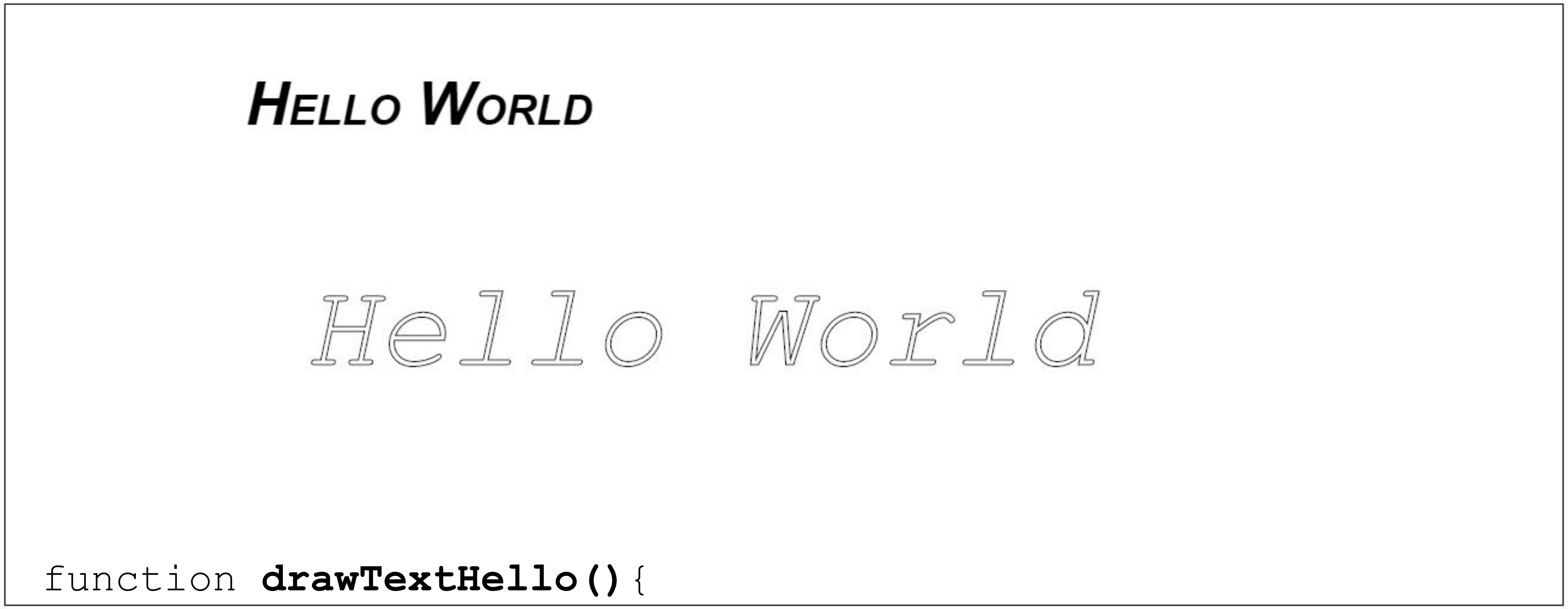


## Hello World



```
<canvas id="canvas" width="1300" height="500"
style="border:1px solid black;">
Your browser does not support canvas.
</canvas>

<br /><br />

<button onClick="drawTextHello()">
Start
</button>
```

# Hello World

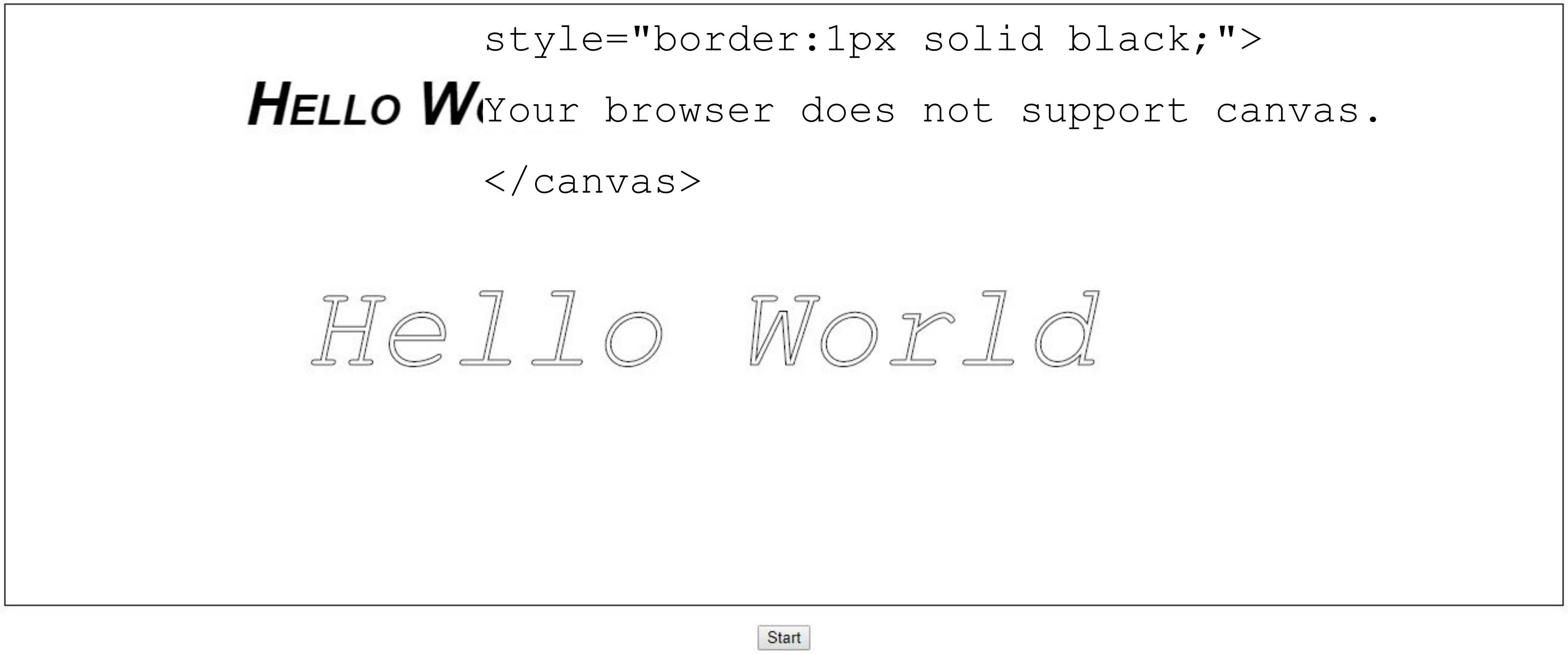

HELLO WORLD

Hello World

```
function drawTextHello(){
  // get the canvas's 2d context

  // fillText


  // strokeText
}
```

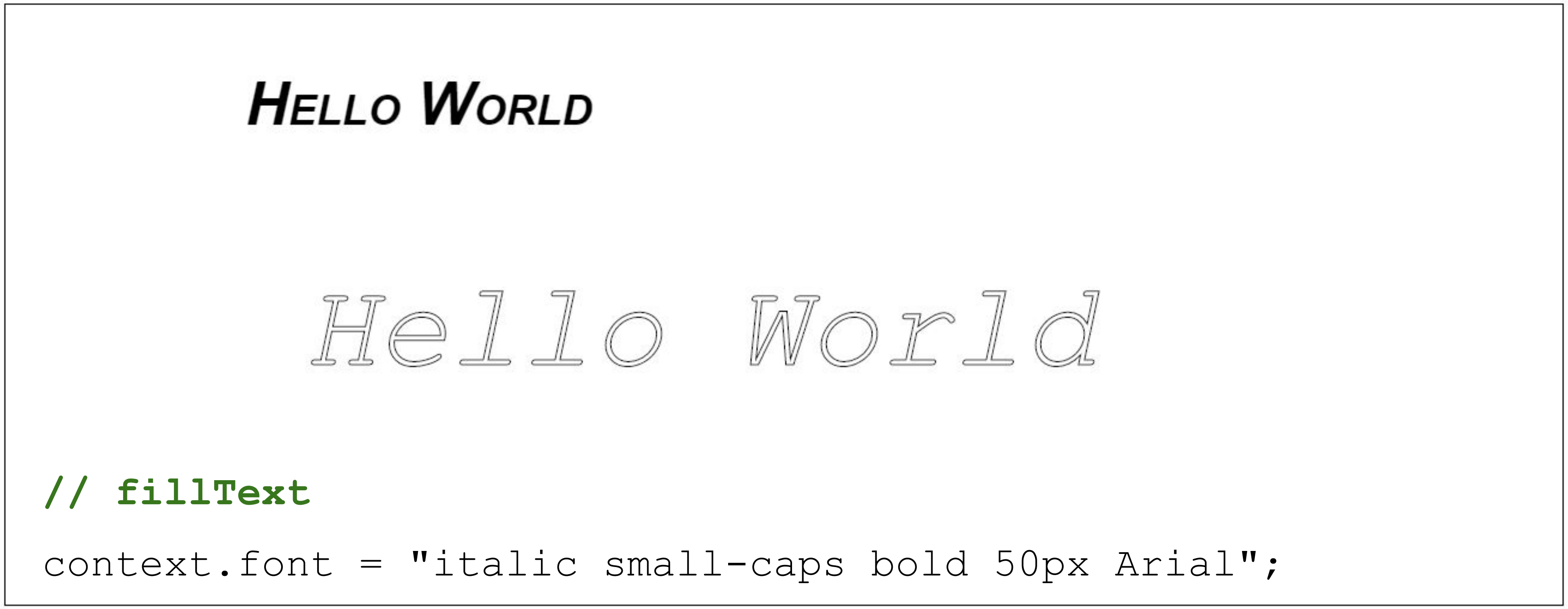
## Hello World

```
<canvas id="canvas" width="1300" height="500"
style="border:1px solid black;">
Your browser does not support canvas.
</canvas>
```



```
// get the canvas's 2d context
var canvas = document.getElementById("canvas");
var context = canvas.getContext("2d");
```

## Hello World



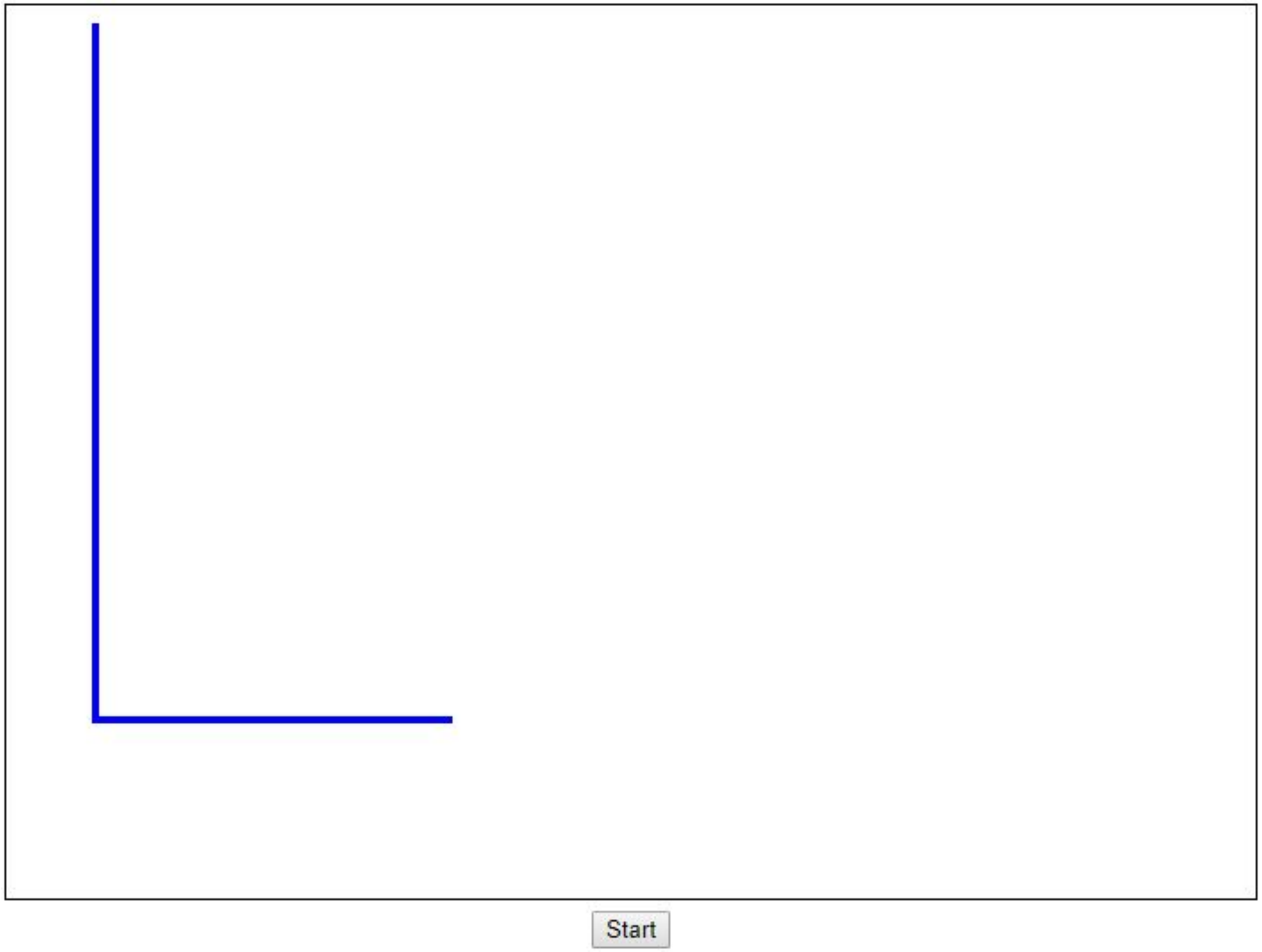
```
// fillText
context.font = "italic small-caps bold 50px Arial";
context.fillText("Hello World", 200, 100);

// strokeText
context.font = "oblique 100px Courier New";
context.strokeText("Hello World", 250, 300);
```

## Clear canvas

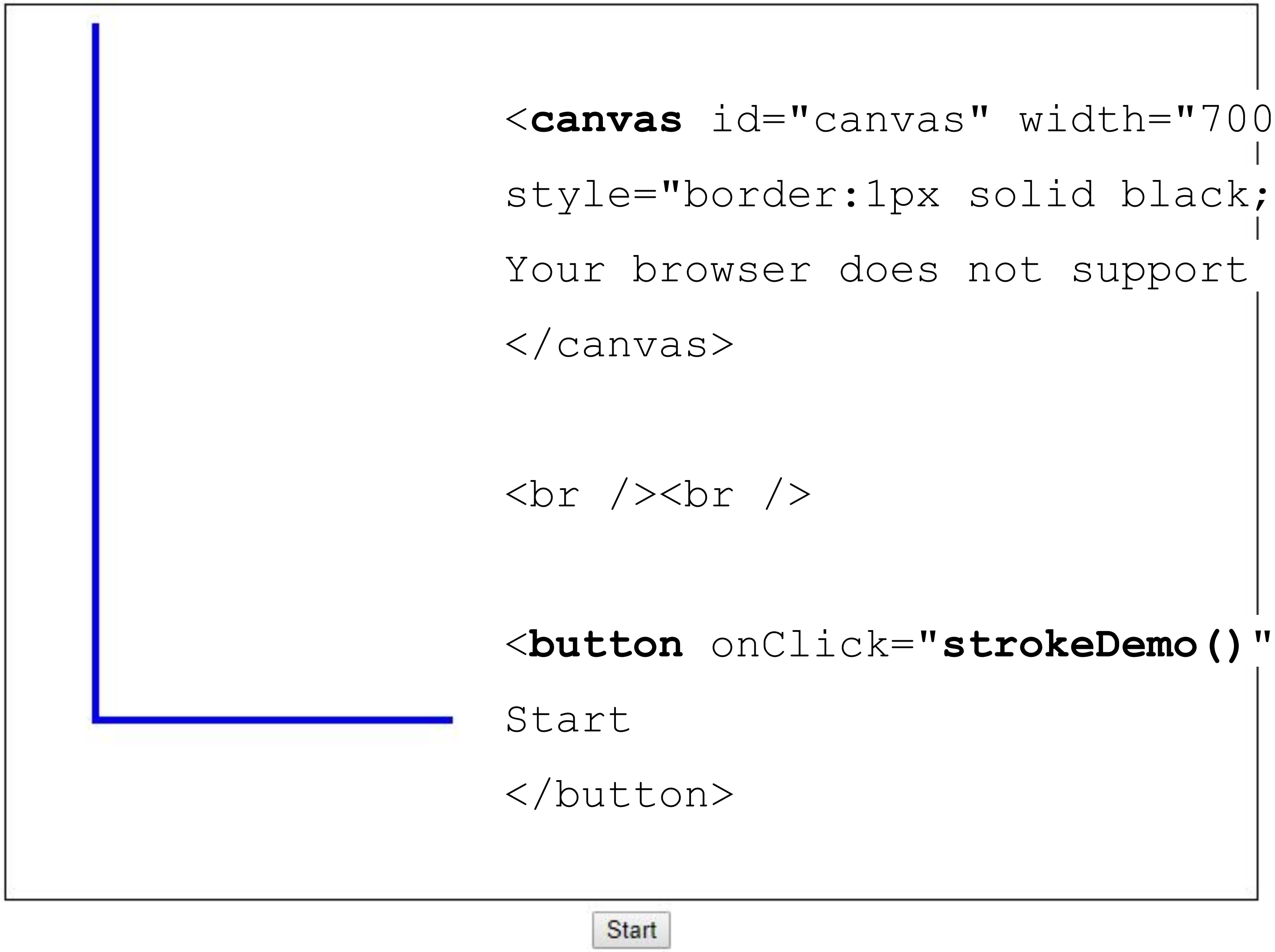
```
<button onClick="clearCanvas()">
  Clear canvas
</button>


// clear canvas area
function clearCanvas(){
  // get the canvas's 2d context
  var canvas = document.getElementById("canvas");
  var context = canvas.getContext("2d");
  // clear the canvas
  context.clearRect(0, 0, canvas.width, canvas.height);
}
```

Clear rectangle: `clearRect(x1, y1, x2, y2)`

## Stroke Demo 1

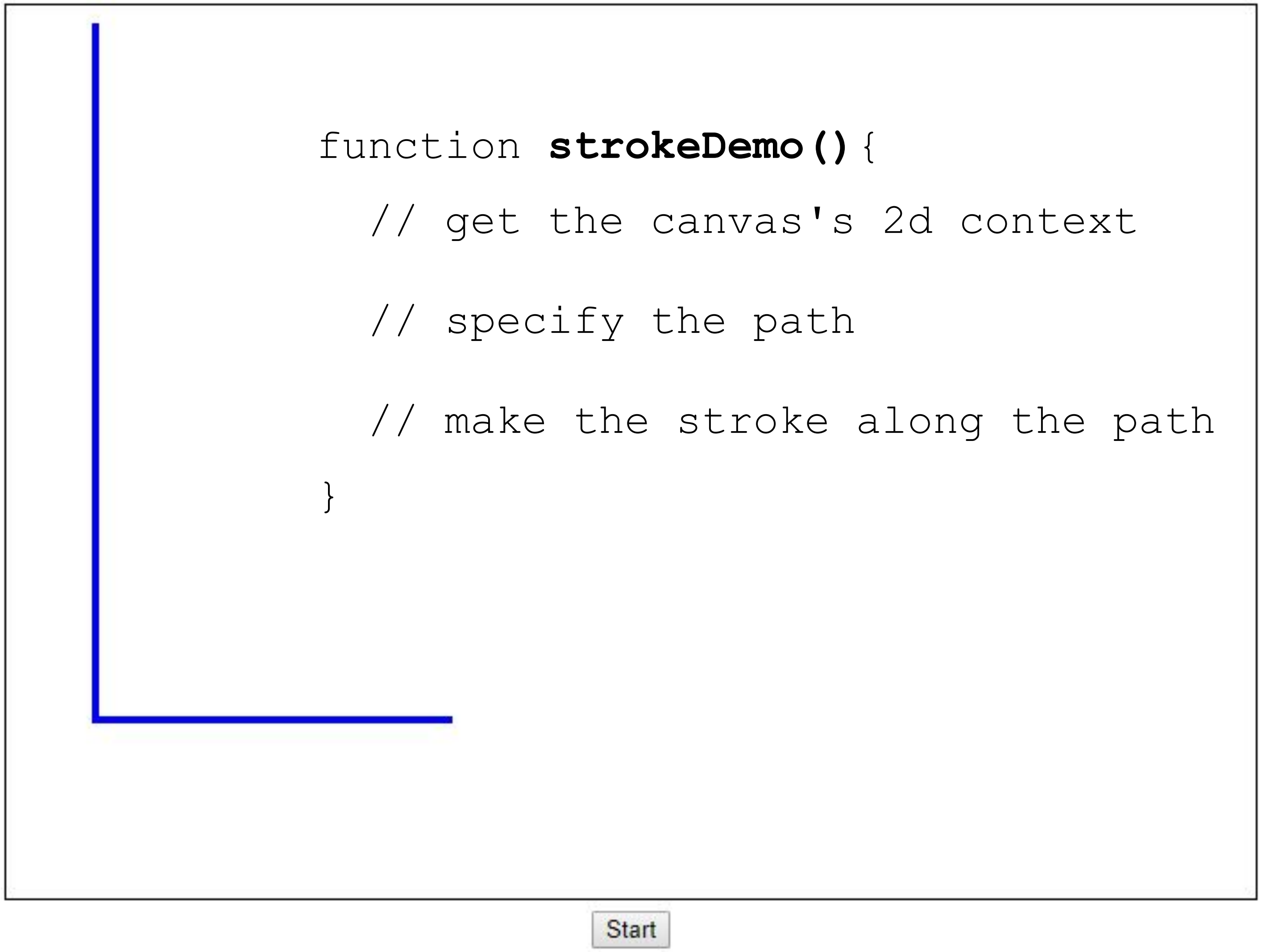


## Stroke Demo 1



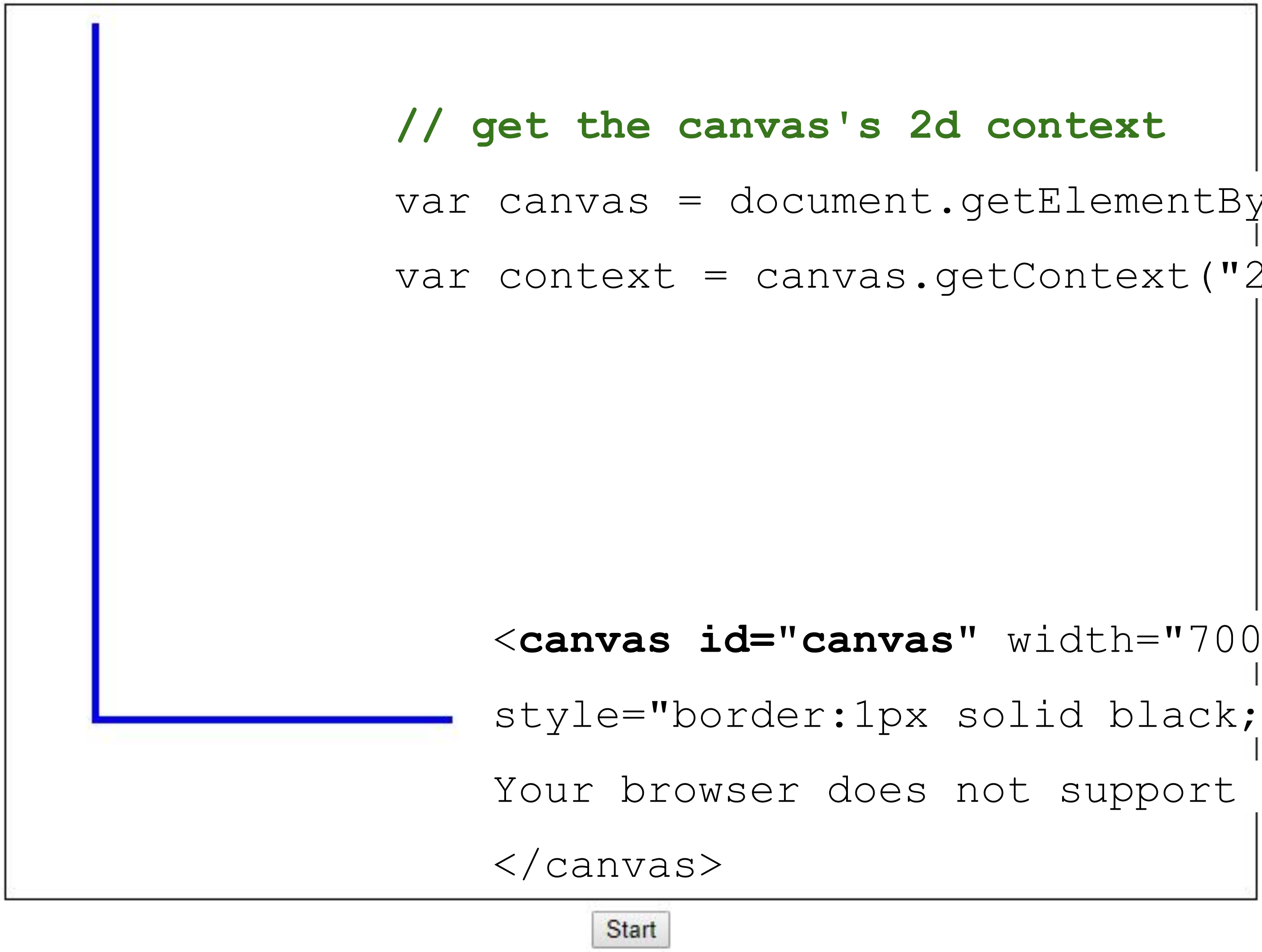
```
<canvas id="canvas" width="700" height="500"
style="border:1px solid black;">
Your browser does not support canvas.
</canvas>

<br /><br />

<button onClick="strokeDemo()">
Start
</button>
```

## Stroke Demo 1



```
function strokeDemo(){
  // get the canvas's 2d context

  // specify the path

  // make the stroke along the path
}
```

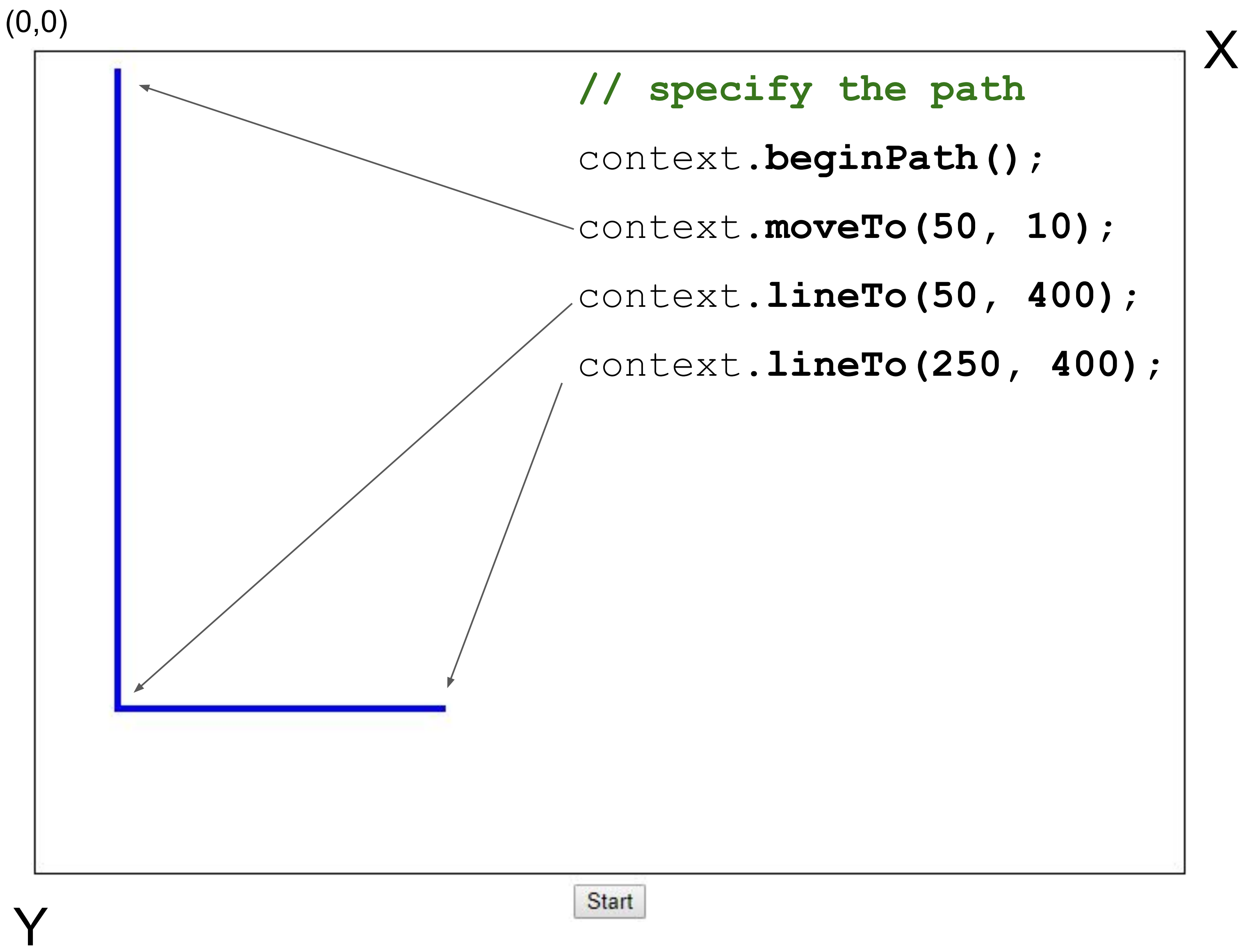
## Stroke Demo 1



```
// get the canvas's 2d context
var canvas = document.getElementById("canvas");
var context = canvas.getContext("2d");
```

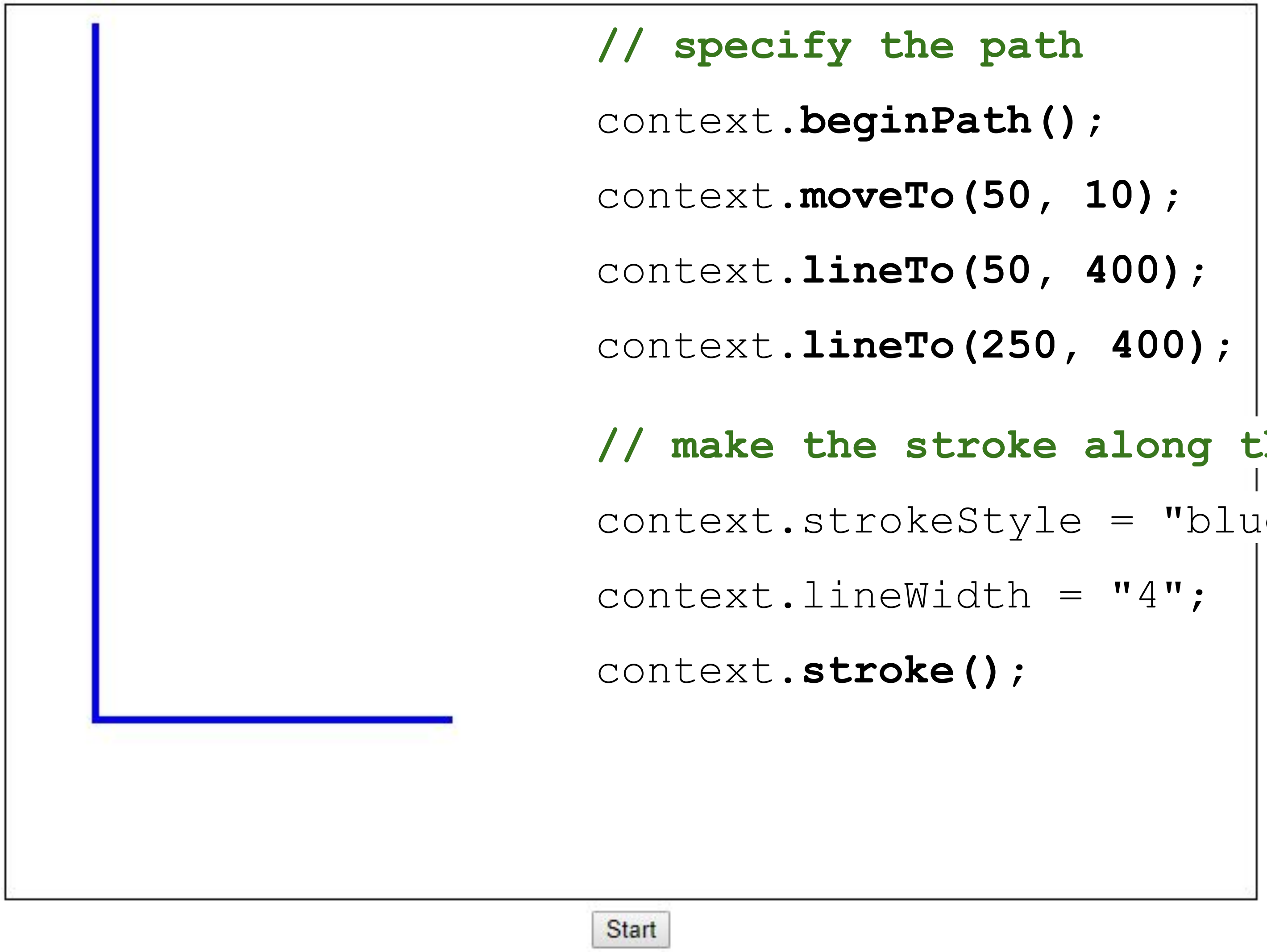
```
<canvas id="canvas" width="700" height="500"
style="border:1px solid black;">
Your browser does not support canvas.
</canvas>
```

# Stroke Demo 1



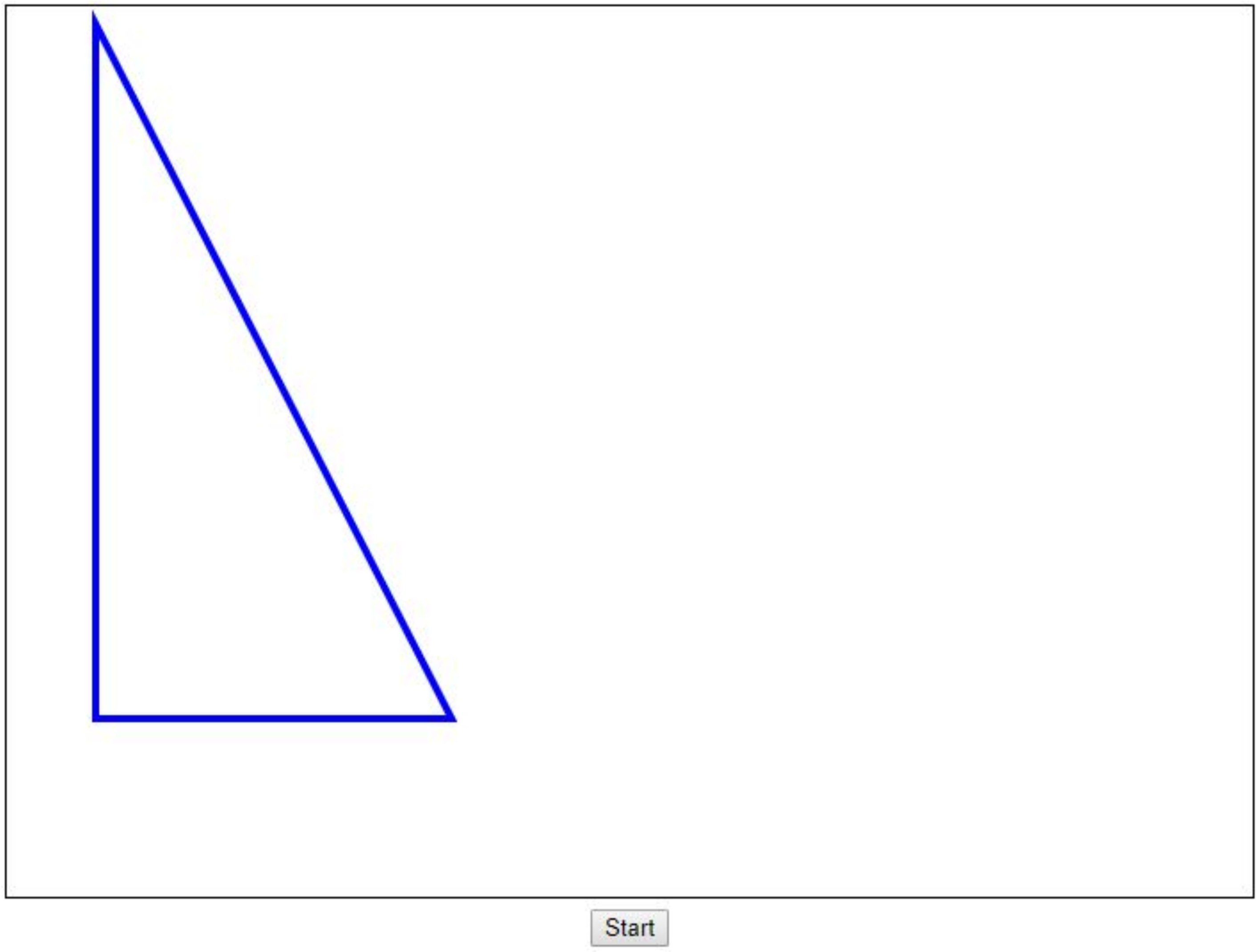
```
// specify the path
context.beginPath();
context.moveTo(50, 10);
context.lineTo(50, 400);
context.lineTo(250, 400);
```

## Stroke Demo 1

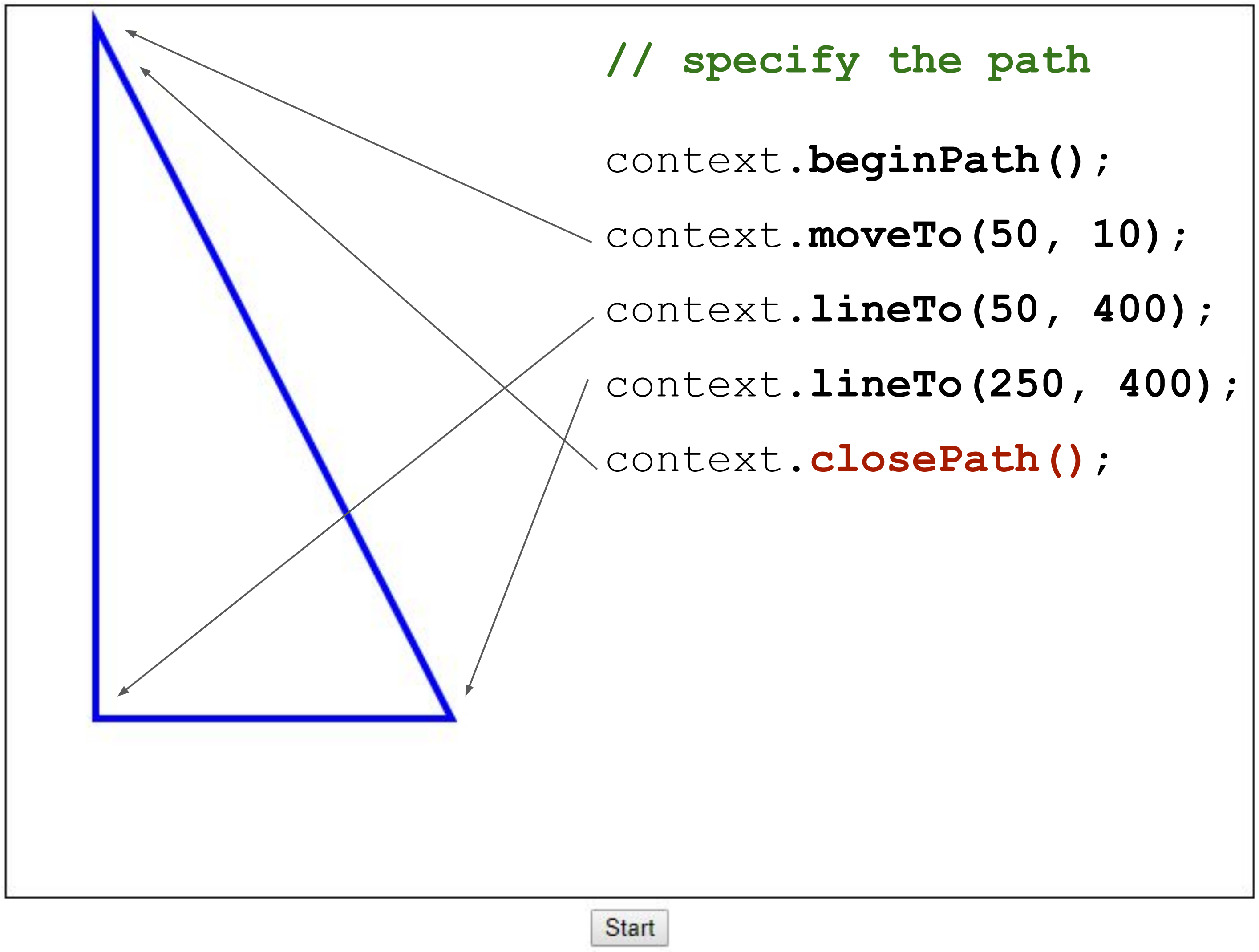


```
// specify the path
context.beginPath();
context.moveTo(50, 10);
context.lineTo(50, 400);
context.lineTo(250, 400);

// make the stroke along the path
context.strokeStyle = "blue";
context.lineWidth = "4";
context.stroke();
```

## Stroke Demo 2

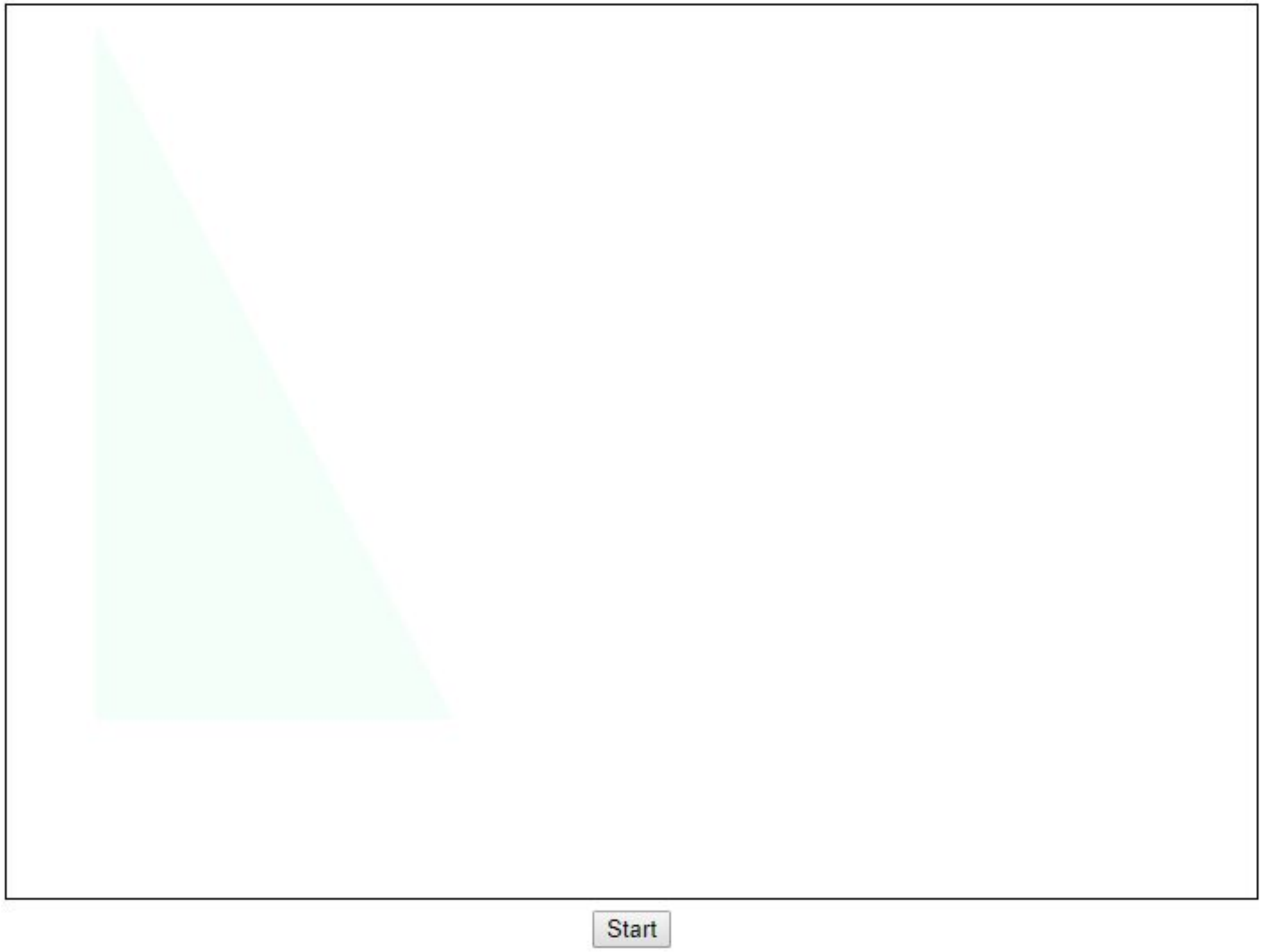


## Stroke Demo 2



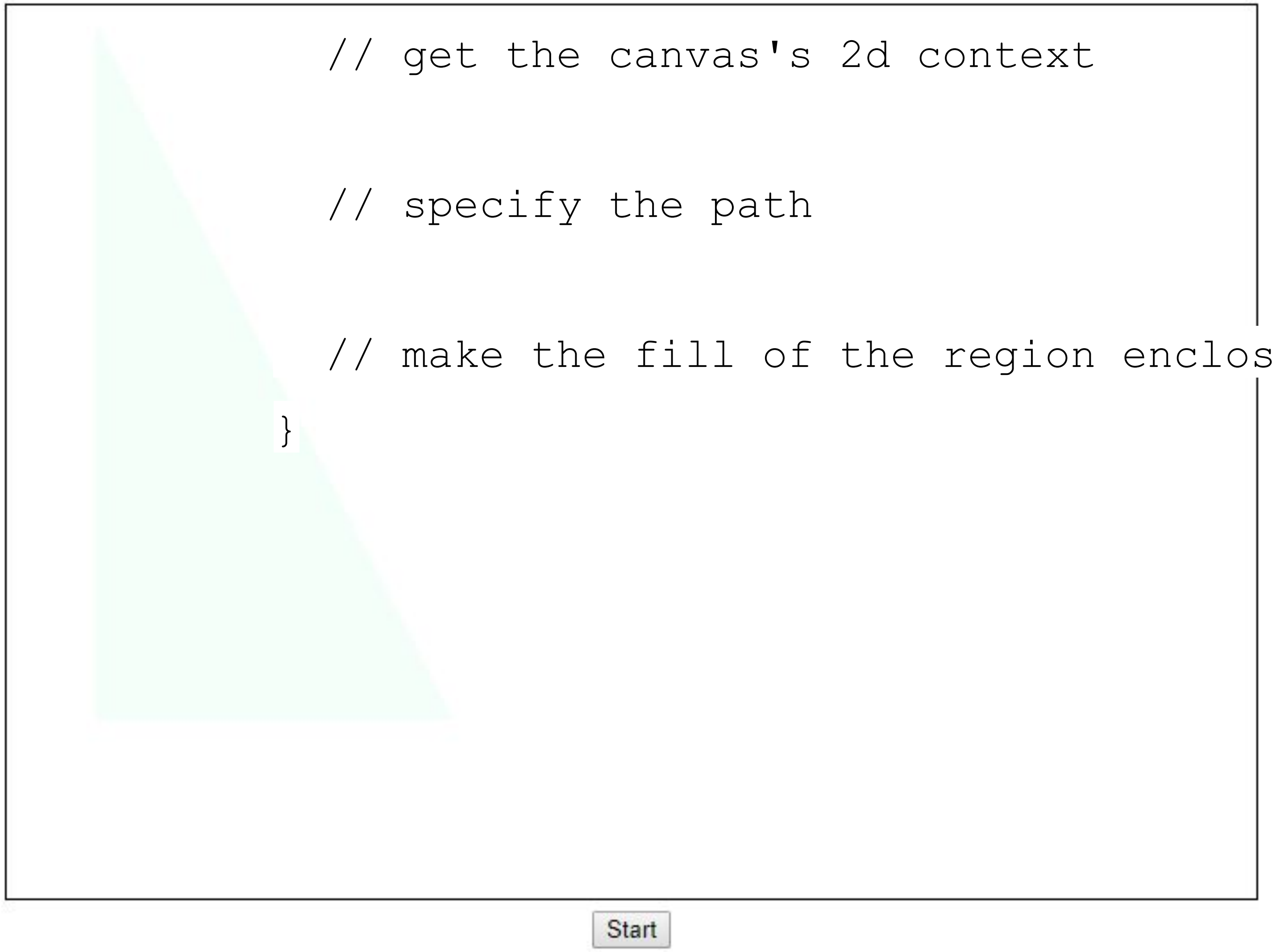
```
// specify the path

context.beginPath();
context.moveTo(50, 10);
context.lineTo(50, 400);
context.lineTo(250, 400);
context.closePath();
```

## Fill Demo 1

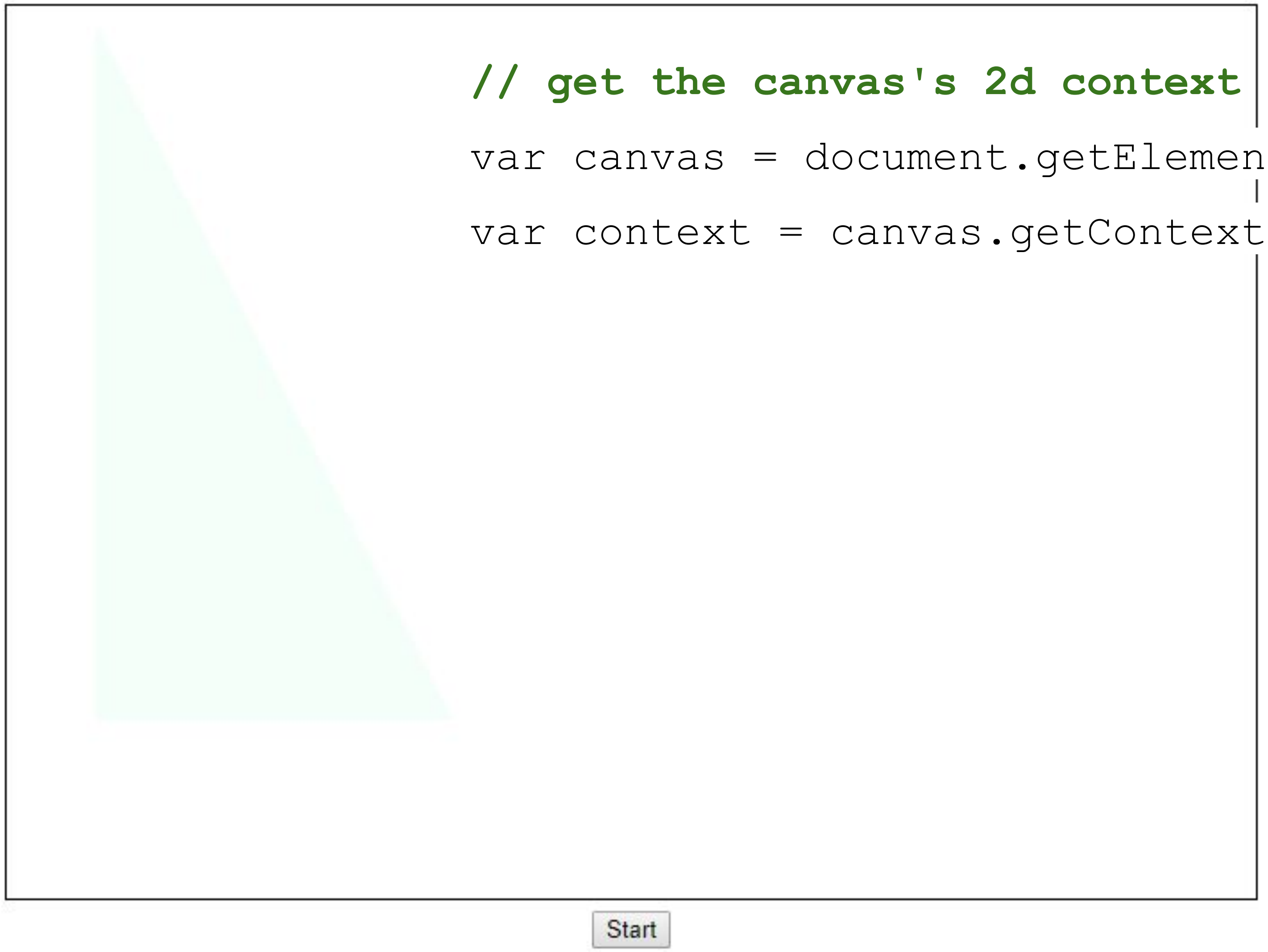


# Fill Demo 1

```
function fillDemo(){
  // get the canvas's 2d context

  // specify the path

  // make the fill of the region enclosed by the path
}
```

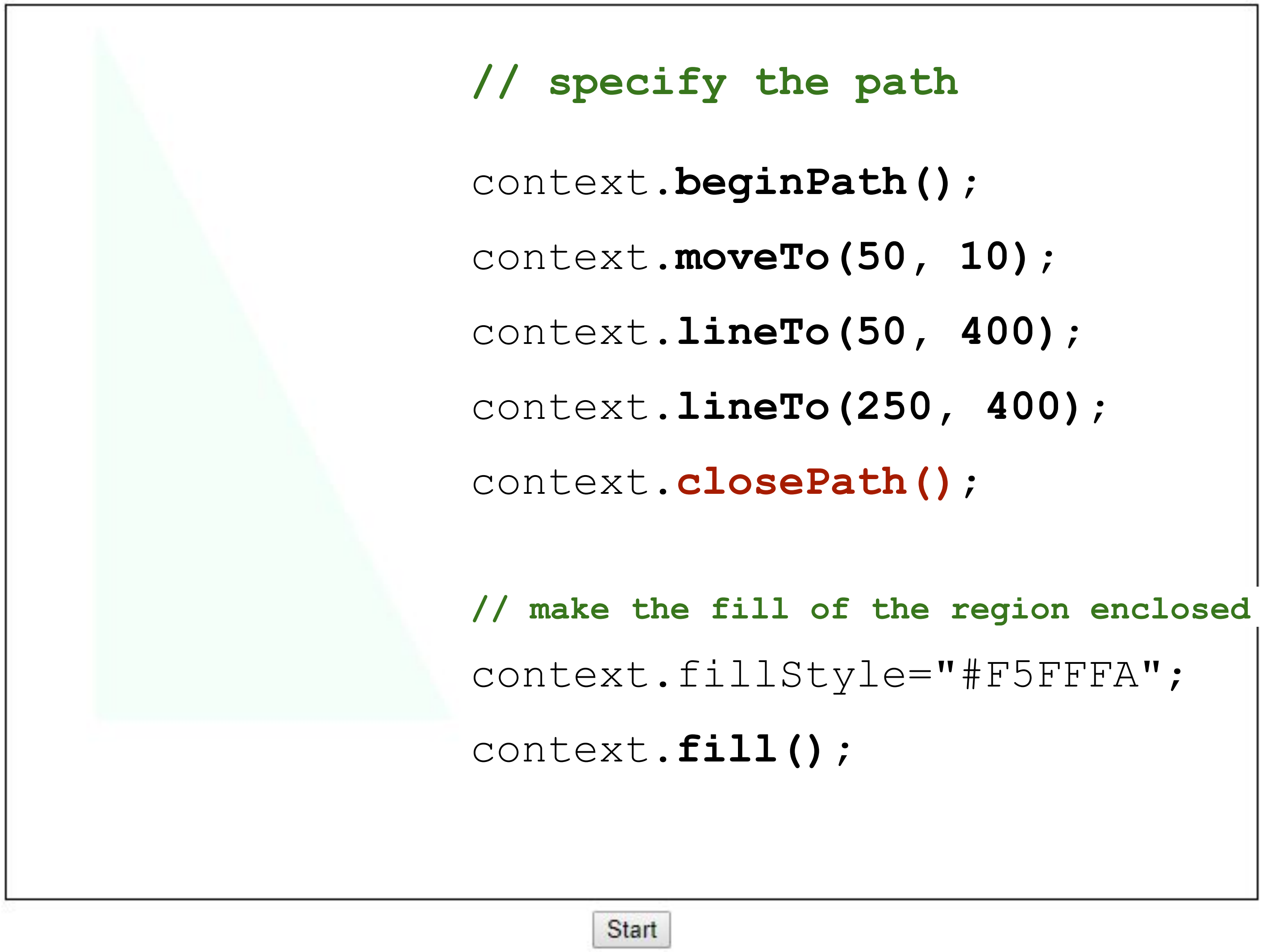


## Fill Demo 1



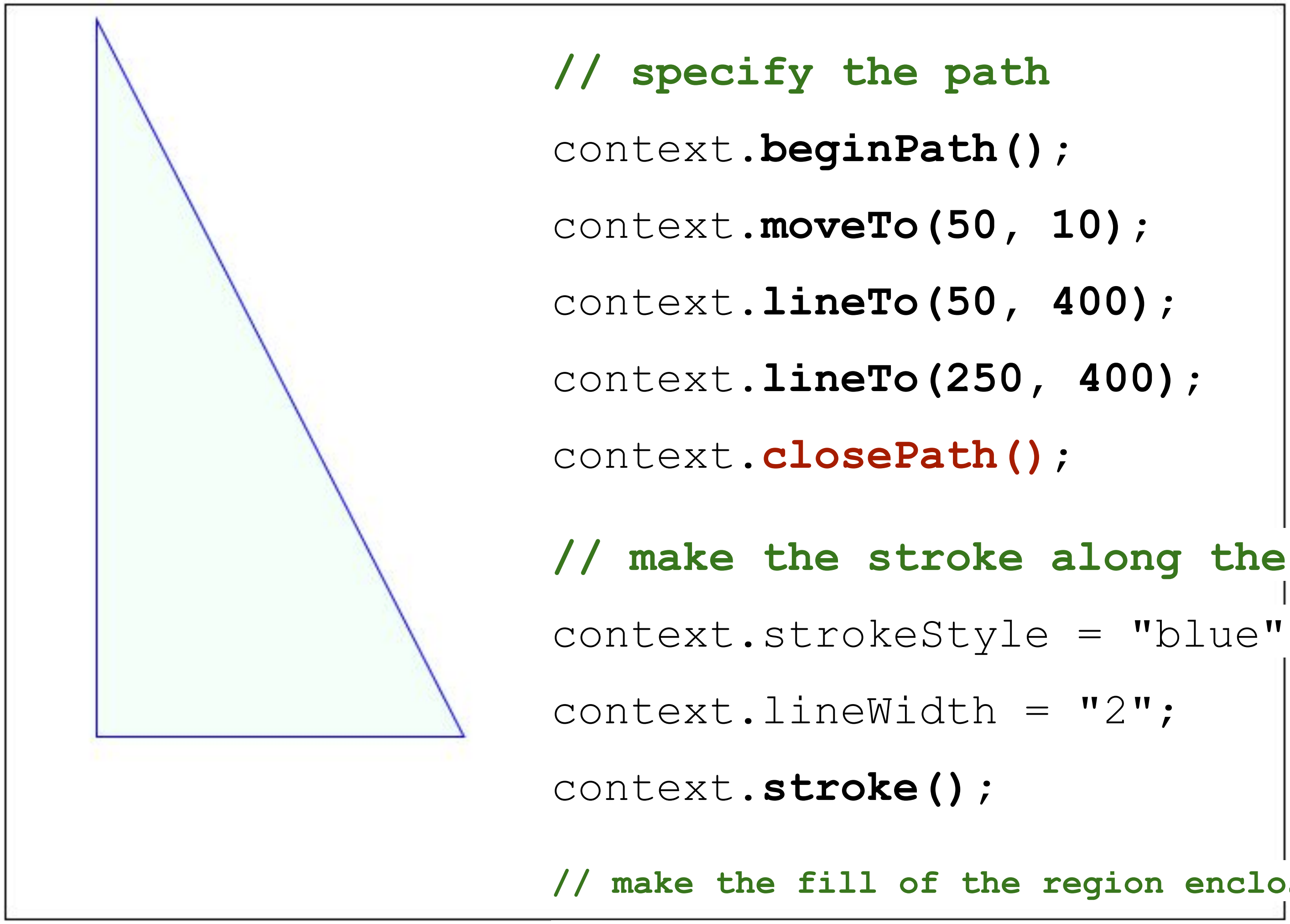
```
// get the canvas's 2d context
var canvas = document.getElementById("canvas");
var context = canvas.getContext("2d");
```

# Fill Demo 1



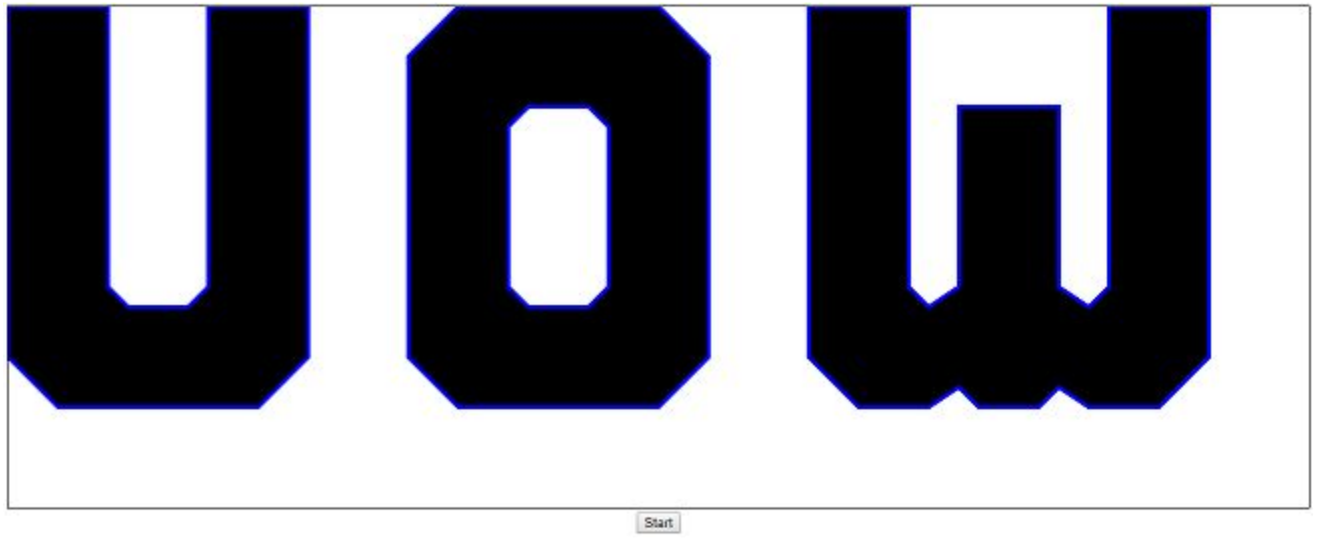
```
// specify the path

context.beginPath();

context.moveTo(50, 10);

context.lineTo(50, 400);

context.lineTo(250, 400);

context.closePath();


// make the fill of the region enclosed by the path

context.fillStyle="#F5FFFA";

context.fill();
```

# Fill Demo 2

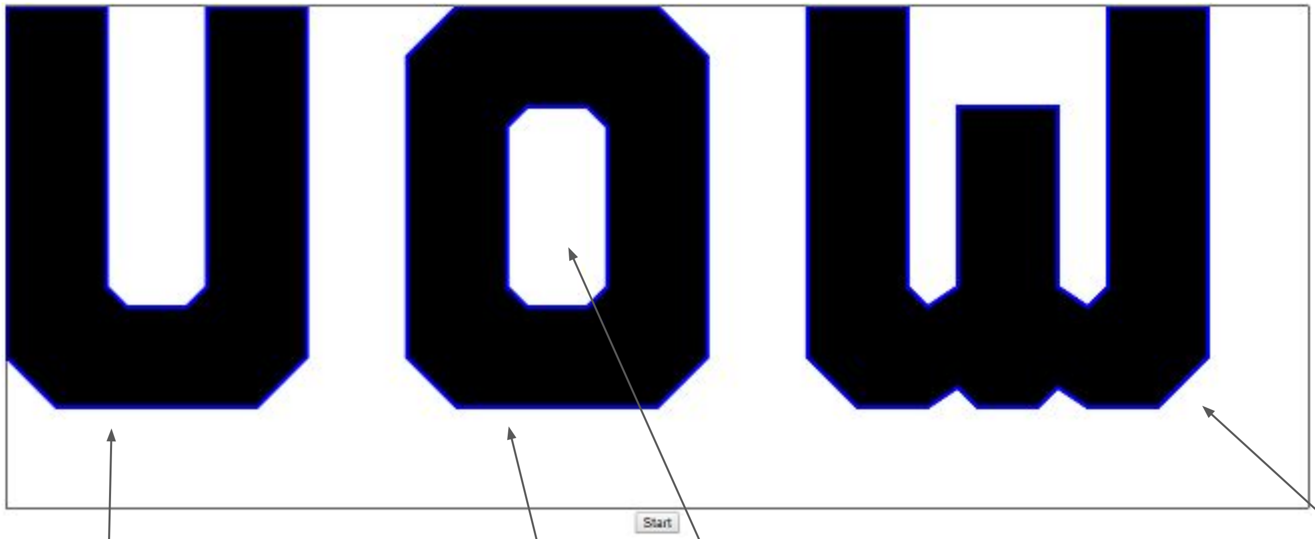


```
// specify the path
context.beginPath();
context.moveTo(50, 10);
context.lineTo(50, 400);
context.lineTo(250, 400);
context.closePath();

// make the stroke along the path
context.strokeStyle = "blue";
context.lineWidth = "2";
context.stroke();

// make the fill of the region enclosed by the path
context.fillStyle="#F5FFFA";
context.fill();
```

## UOW



## UOW



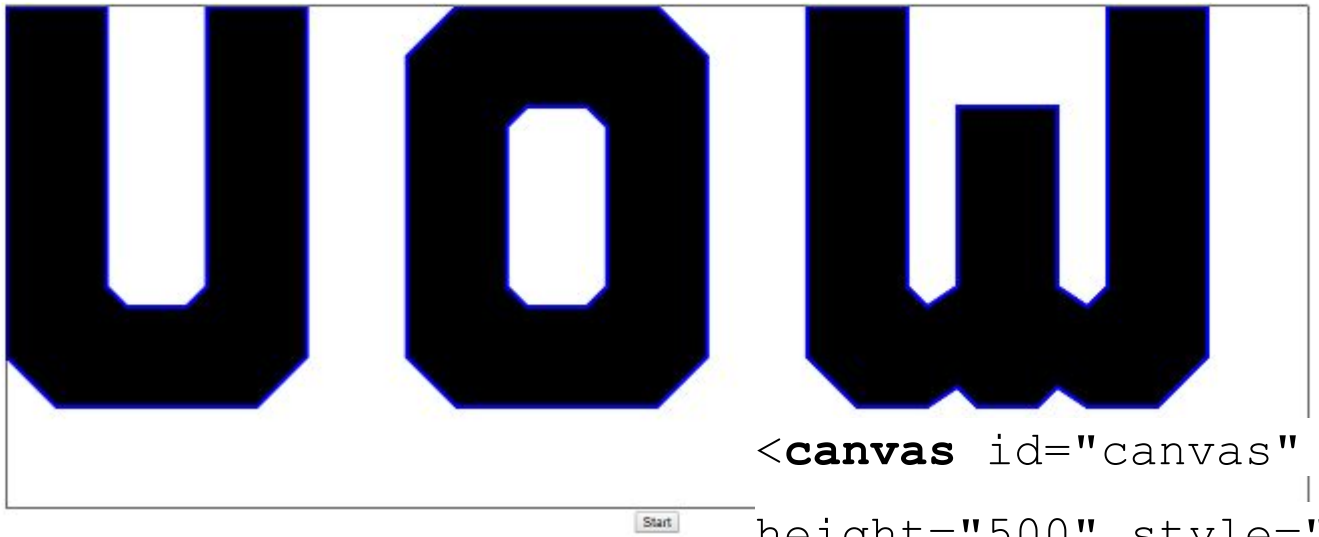
1. letter U filled with black

2. letter O (**outer**) filled with black

3. letter O (**inner**) filled with white

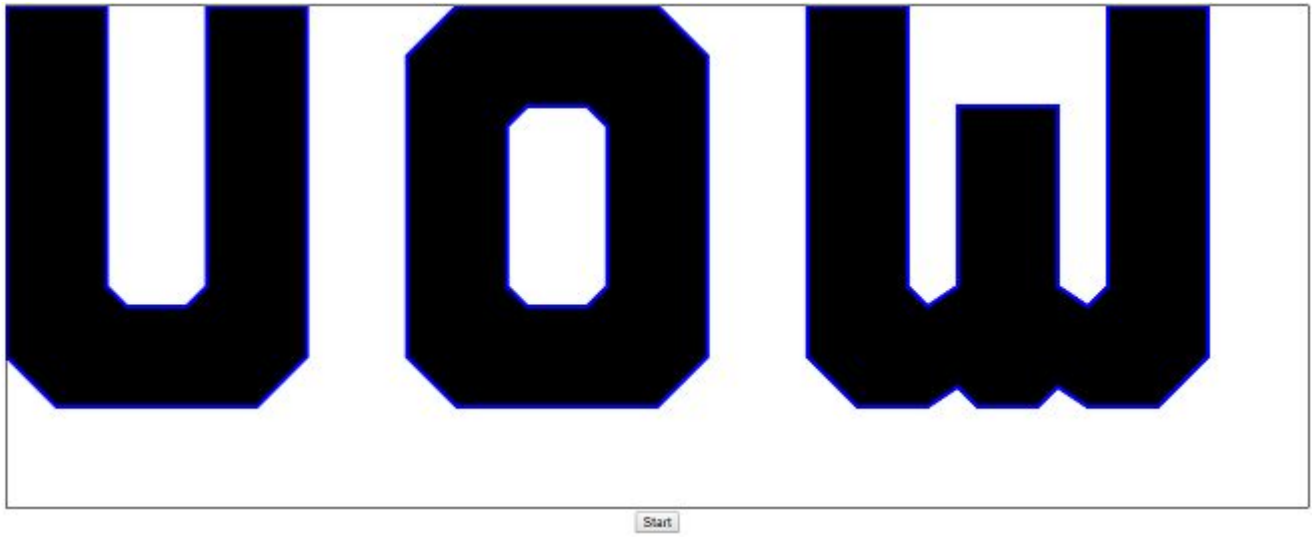
4. letter W filled with black

## UOW



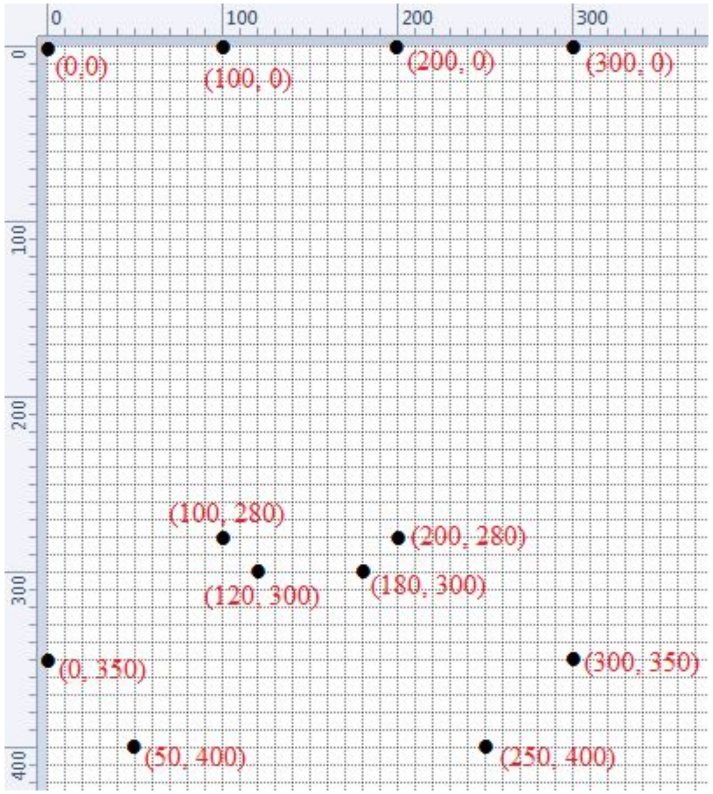
```
<canvas id="canvas" width="1300"
height="500" style="border:1px solid
black;">
Your browser does not support canvas.
</canvas>

<br /><br />

<button onClick="drawUOW()">
Start
</button>
```

## UOW



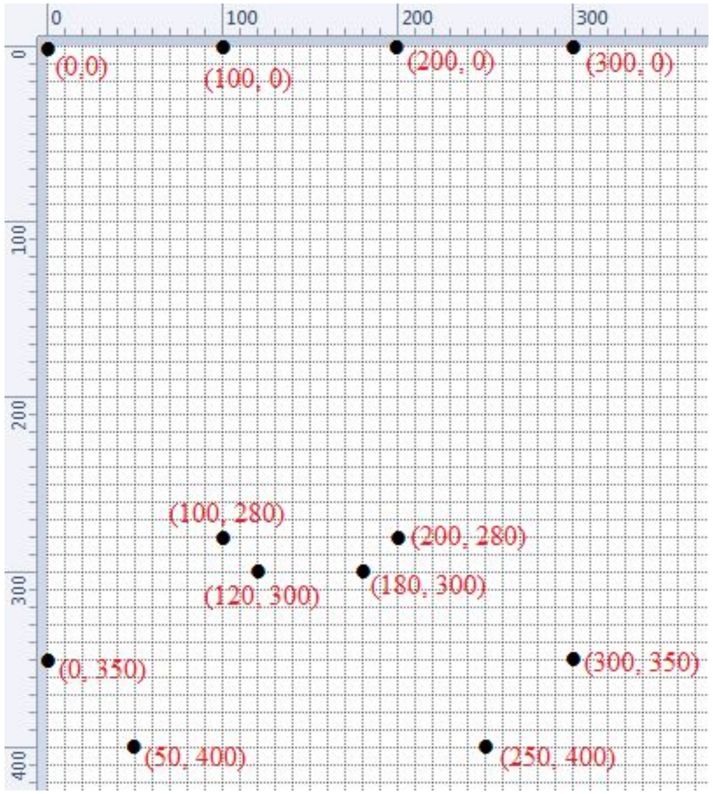
```
function drawUOW(){
  // get the canvas's 2d context
  // letter U
  // letter O (outer)
  // letter O (inner)
  // letter W
}
```

## UOW



```
// letter U
context.beginPath();
context.moveTo(0, 0);
context.lineTo(0, 350);
context.lineTo(50, 400);
context.lineTo(250, 400);
context.lineTo(300, 350);
context.lineTo(300, 0);
context.lineTo(200, 0);
context.lineTo(200, 280);
context.lineTo(180, 300);
context.lineTo(120, 300);
context.lineTo(100, 280);
context.lineTo(100, 0);
context.closePath();
```

## UOW



```
// letter U
context.beginPath();
context.moveTo(0, 0);
...
context.lineTo(100, 0);
context.closePath();


context.fillStyle="black";
context.fill();


context.strokeStyle="blue";
context.lineWidth = "4";
context.stroke();
```

## Drag and Drop

Need to specify 2 types of elements:

- ***Draggable elements****: elements that we can be dragged*
- ***Droppable elements****: elements that can be dropped on*

The user can select **draggable elements** with a mouse, drag the elements to a **droppable element**, and drop those elements by releasing the mouse button.

## Drag and Drop

Need to specify 2 types of elements:

- ***Draggable elements****: elements that we can be dragged*
- ***Droppable elements****: elements that can be dropped on*

```
<element id="drag-id" draggable="true"
onDragStart="dragStart(event)" >draggable
element</element>


<element id="drop-id" onDrop="drop(event)"
onDragOver="dragOver(event)">droppable element</element>
```

## Drag and Drop

***Draggable elements**: elements that we can be dragged*

```
<element id="drag-id" draggable="true"
onDragStart="dragStart(event)" >draggable
element</element>
```

dragStart event is fired when the user starts dragging an element

```
function dragStart(event){
  // get the dragged element ID
  var dragId = event.target.id;

  // store the dragged element ID into the
  //dataTransfer object
  event.dataTransfer.setData("dragId", dragId);
}
```

## Drag and Drop

***Draggable elements**: elements that we can be dragged*

```
<element id="drag-id" draggable="true"
onDragStart="dragStart(event)" >draggable
element</element>
```

*We need to know what object we are dragging*

```
function dragStart(event){
  // get the dragged element ID
  var dragId = event.target.id;

  // store the dragged element ID into the dataTransfer object
  event.dataTransfer.setData("dragId", dragId);
}
```

*The DataTransfer object is used to hold the data that is being dragged during a drag and drop operation.*

## Drag and Drop

***Droppable elements**: elements that can be dropped on*

```
<element id="drop-id" onDrop="drop(event)"
onDragOver="dragOver(event)">droppable element</element>
```

*The **drop** event is fired when an element is dropped on a valid drop target.*

```
function drop(event){

  // get the drop element ID

  var dropId = event.target.id;

  // retrieve the dragged element ID from the dataTransfer object

  var dragId = event.dataTransfer.getData("dragId");

  // do the dropping logic

}
```

## Drag and Drop

***Droppable elements**: elements that can be dropped on*

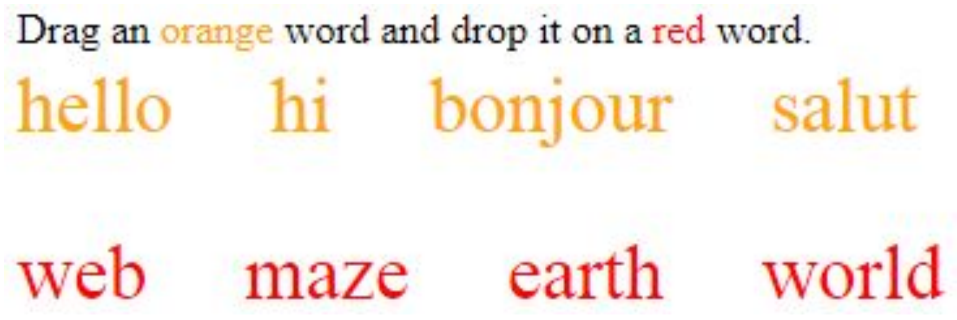
```
<element id="drop-id" onDrop="drop(event)"
onDragOver="dragOver(event)">droppable element</element>
```

*What is the **dragOver** event for?*

*Calling the preventDefault() method during a **dragOver** event will indicate that a drop is allowed at that location.*

```
function dragOver(event){

  event.preventDefault();

}
```

# Drag and Drop: Hello World

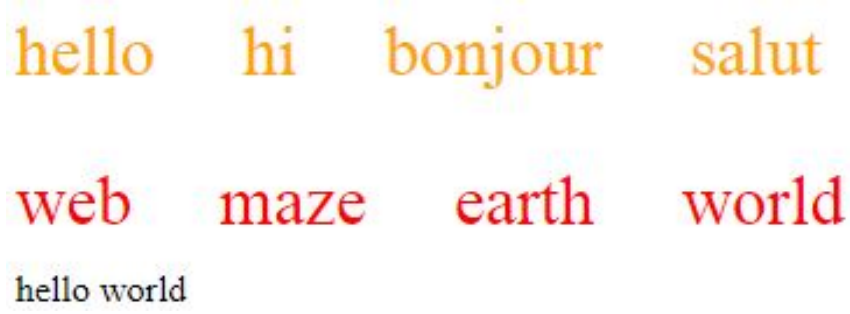


Drag an orange word and drop it on a red word.

hello hi bonjour salut

web maze earth world

*When "hello" is dropped on "world", the page displays "hello world".*

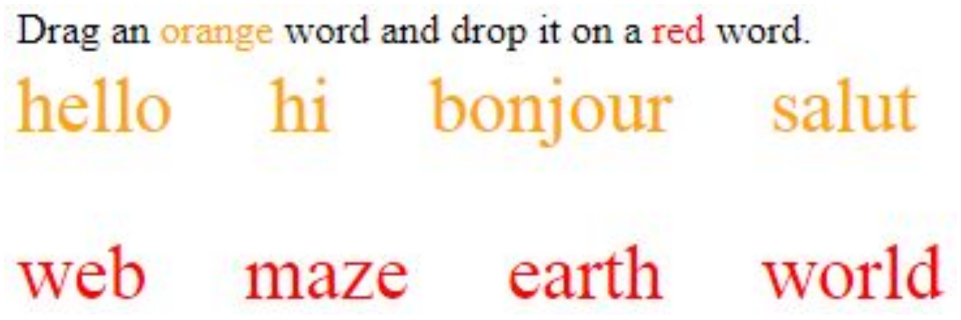


hello hi bonjour salut

web maze earth world

hello world

## Drag and Drop: Hello World



Drag an orange word and drop it on a red word.

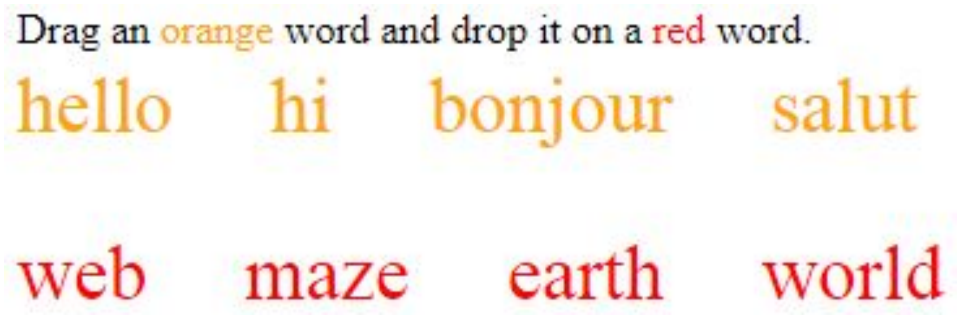
hello hi bonjour salut

web maze earth world

***draggable elements**: elements that we can be dragged*

***droppable elements**: elements that can be dropped on*

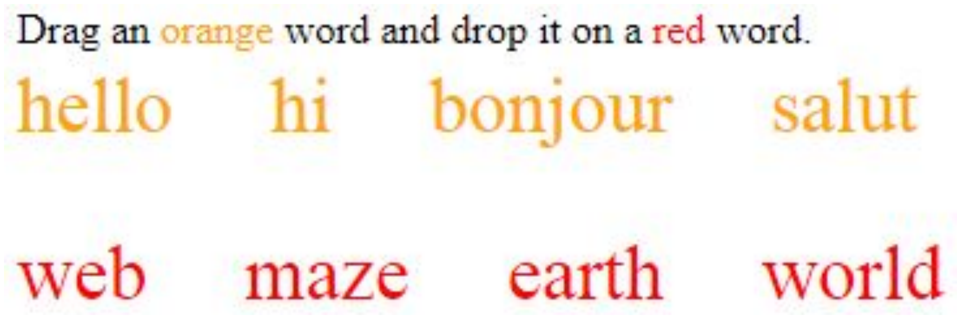
# Drag and Drop: Hello World


Drag an orange word and drop it on a red word.

***draggable elements**:*
*elements that we can drag*

```
<span id="hello" draggable="true"
onDragStart="dragStart(event)" >hello</span>


<span id="hi" draggable="true"
onDragStart="dragStart(event)" >hi</span>


<span id="bonjour" draggable="true"
onDragStart="dragStart(event)" >bonjour</span>
. . .
```

# Drag and Drop: Hello World


Drag an orange word and drop it on a red word.

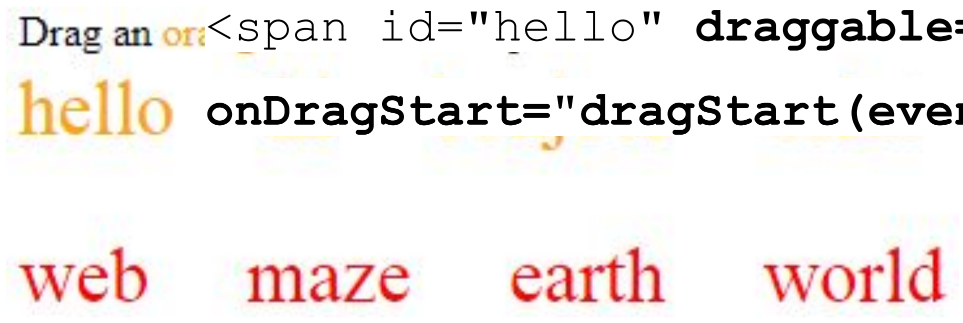
hello hi bonjour salut

web maze earth world

***droppable elements**: elements that can be dropped on*

```
<span id="web" onDrop="drop(event)"
onDragOver="dragOver(event)">web</span>


<span id="maze" onDrop="drop(event)"
onDragOver="dragOver(event)">maze</span>


<span id="earth" onDrop="drop(event)"
onDragOver="dragOver(event)">earth</span>

. . .
```

# Drag and Drop: Hello World

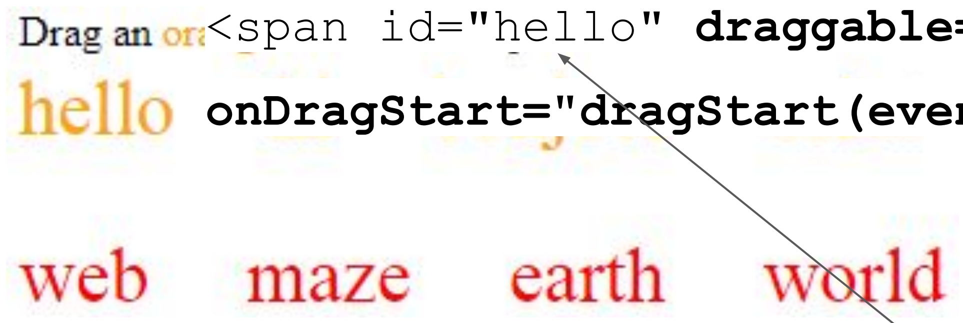


```
<span id="hello" draggable="true"
onDragStart="dragStart(event)" >hello</span>
```

dragStart event is fired when the user starts dragging an element

```
function dragStart(event){
  // get the dragged element ID
  var dragId = event.target.id;


  // store the dragged element ID into the dataTransfer object
  event.dataTransfer.setData("dragId", dragId);
}
```

## Drag and Drop: Hello World

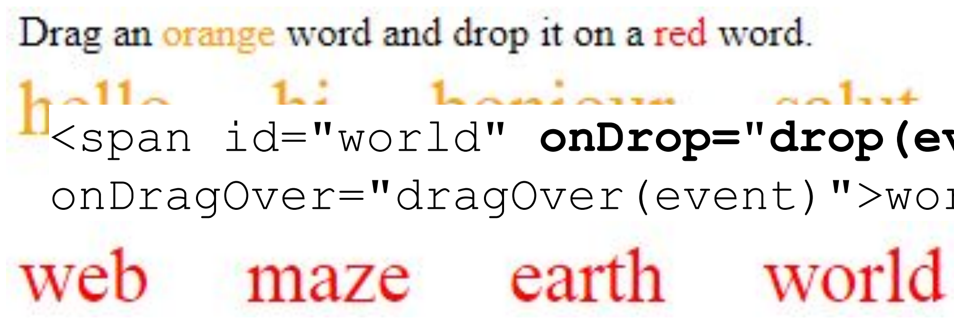


```
<span id="hello" draggable="true"
onDragStart="dragStart(event)" >hello</span>
```

If hello is dragged, then
`event.target.id = "hello"`
and we store `"hello"` into the dataTransfer object

```
function dragStart(event){
  // get the dragged element ID
  var dragId = event.target.id;


  // store the dragged element ID into the dataTransfer object
  event.dataTransfer.setData("dragId", dragId);
}
```

# Drag and Drop: Hello World


Drag an orange word and drop it on a red word.

hello hi bonjour salut

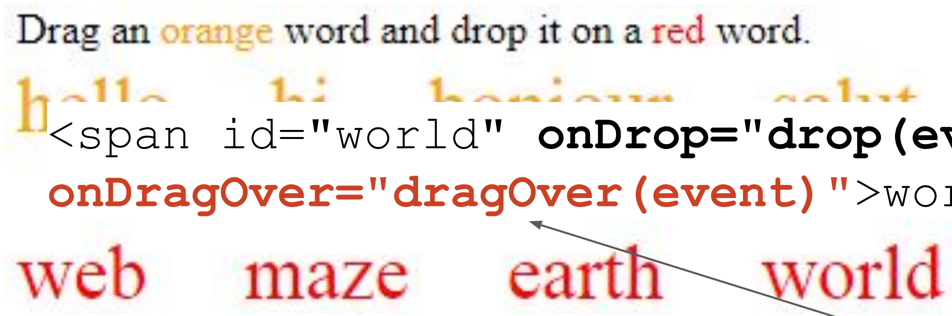
web maze earth world

```
<span id="world" onDrop="drop(event)"
onDragOver="dragOver(event)">world</span>
```

*The **drop** event is fired when an element is dropped on a valid drop target.*

```
function drop(event){

  // get the drop element ID

  var dropId = event.target.id;

  // retrieve the dragged element ID from the dataTransfer object

  var dragId = event.dataTransfer.getData("dragId");

  // display the message

  var messageSpan = document.getElementById("message");

  messageSpan.innerHTML = dragId + " " + dropId;

}
```

## Drag and Drop: Hello World


Drag an orange word and drop it on a red word.

hello hi bonjour salut

web maze earth world

```
<span id="world" onDrop="drop(event)"
onDragOver="dragOver(event)">world</span>
```

*What is the **dragOver** event for?*

*Calling the preventDefault() method during a **dragOver** event will indicate that a drop is allowed at that location.*

```
function dragOver(event){
   event.preventDefault();
}
```

## References

- https://www.w3schools.com/html/html5_canvas.asp
- https://developer.mozilla.org/en-US/docs/Web/API/Canvas_API/Tutorial
- https://www.w3schools.com/html/html5_draganddrop.asp
- https://developer.mozilla.org/en-US/docs/Web/API/HTML_Drag_and_Drop_API