BEGINNING METAL

Part 4: Indices and Constants

Indexed Drawing

V0
(-1, 1)

V3
(1, 1)

(-1, -1)
V1

(1, -1)
V2
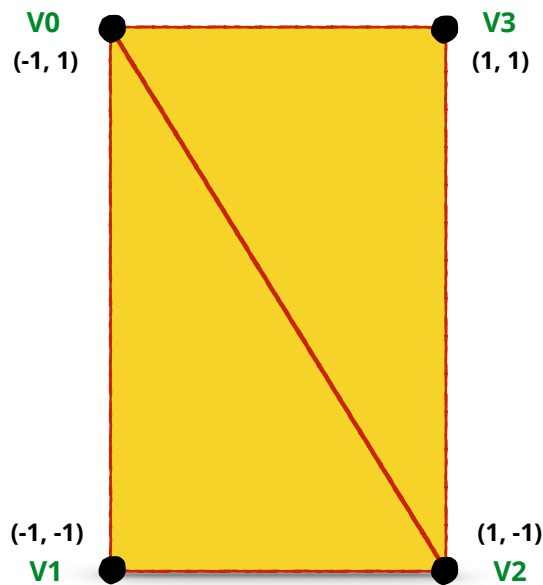
```swift
let vertices: [Float] = [
   -1,  1, 0,  // V0
   -1, -1, 0,  // V1
    1, -1, 0,  // V2
    1,  1, 0]  // V3
    1,  1, 0,  // V3
   -1,  1, 0]  // V0
```
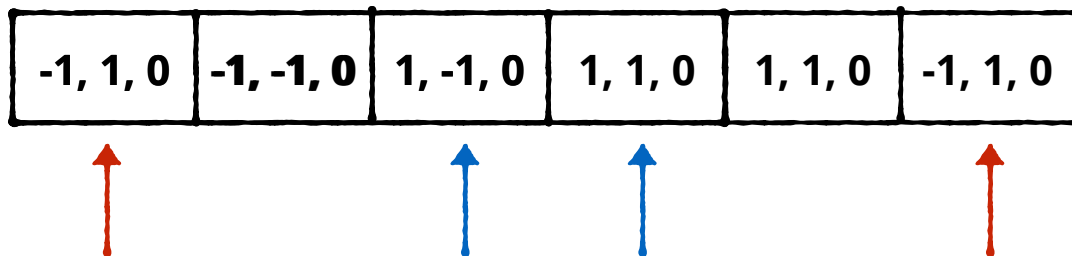
```swift
let indices: [UInt16] = [
   0, 1, 2,
   2, 3, 0]
```

-1, 1, 0	-1, -1, 0	1, -1, 0	1, 1, 0	1, 1, 0	-1, 1, 0

Indexed Drawing

```swift
var vertexBuffer: MTLBuffer?
var indexBuffer: MTLBuffer?
```

```swift
vertexBuffer = device.makeBuffer(bytes: vertices,
                                 length: vertices.count * MemoryLayout<Float>.size,
                                 options: [])
indexBuffer  = device.makeBuffer(bytes: indices,
                                 length: indices.count * MemoryLayout<UInt16>.size,
                                 options: [])
```

```swift
commandEncoder.drawIndexedPrimitives(type: .triangle,
                                     indexCount: indices.count,
                                     indexType: .uint16,
                                     indexBuffer: indexBuffer,
                                     indexBufferOffset: 0)
```
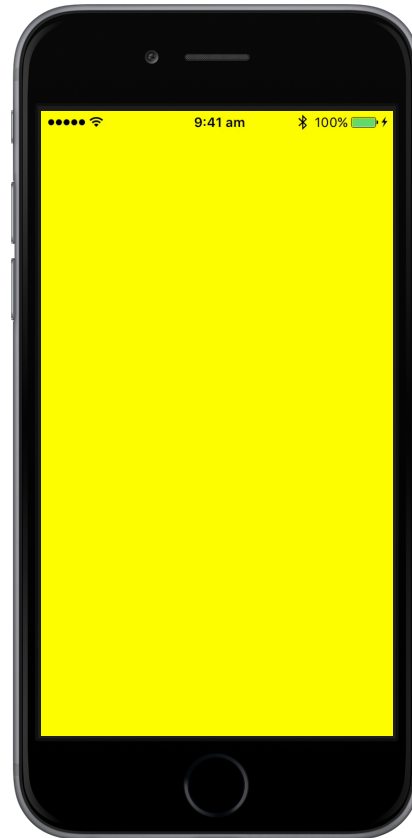
Constants

V0 (-1, 1)   V3 (1, 1)   V0 (-0.5, 1)   V3 (1.5, 1)
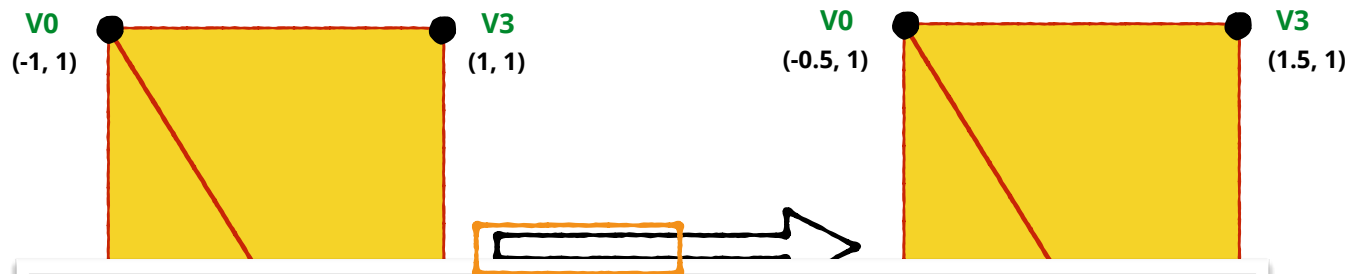
```swift
struct Constants {
    var moveBy: Float = 0
}
var constants = Constants()
```

```cpp
vertex float4 vertex_shader(const device packed_float3 *vertices [[buffer(0)]],
                            constant Constants &constants [[buffer(1)]],
                            uint vertexId [[vertex_id]]) {
    float4 position = float4(vertices[vertexId], 1);
    position.x += constants.moveBy;
    return position;
}
```

Demo

Challenge Time!


```
          Scene
         (Node)
        /   |    \
       /    |     \
  Dog Body  Tree   Camera
  (Node)   (Node)  (Node)
     |      /  \
  Dog Head Branch1 Branch2
  (Node)  (Node)  (Node)
```