

# Assignment 9

## 1. Perlin Noise in 1D

Computing the noise was fairly easy, we just followed the instructions on the handout.

1. Compute corners  $c_0$  and  $c_1$
2. Get gradients  $g_0$  and  $g_1$  using hash function
3. Compute  $\phi_0(x - c_0)$  and  $\phi_1(x - c_1)$
4.  $t = x - c_0$
5. Mix  $\phi_0(x - c_0)$  and  $\phi_1(x - c_1)$  with the weight function computed at  $t$ .

## 2. Fractional Brownian Motion

Simply wrote the given sum in C++ code. For loop that adds the  $i$ th component at each iteration.

## 3. Perlin Noise 2D

### Noise

Same as 1D but slightly more involved, followed what the pdf said.

1. Compute corners  $c_{00}$ ,  $c_{10}$ ,  $c_{01}$  and  $c_{11}$
2. Get gradients  $g_{00}$ ,  $g_{10}$ ,  $g_{01}$ ,  $g_{11}$  with hash function
3. Compute vectors from corners to point:  $a$ ,  $b$ ,  $c$  and  $d$  (as in pdf)
4. Compute the dot products of gradient and  $(a, b, c, d)$ . Results are called  $s$ ,  $t$ ,  $u$ ,  $v$  as in pdf
5. Compute  $x$  distance from point to  $c_{00}$ , same for  $y$
6. Compute  $st$  and  $uv$  as said in pdf by mixing  $s$  &  $t$  and  $u$  &  $v$  respectively, with distance  $x$  and weight function.
7. Noise is mix of  $st$  and  $uv$  with distance  $y$ . Using weight function again.

### FBM

Again, simply rewriting the sum in C++, with a dot product

### Turbulence

Same as 2D FBM but with absolute value

## 4. Textures

### World

1. Compute  $s = fbm(p)$
2. If  $s \leq \text{water level}$ , return water color else step 3
3.  $\alpha = (s - s_{\text{water}})$
4. Mix between grass color and mountain color with alpha

### Wood

1.  $\alpha = \frac{1}{2} \times (1 + \sin(100 \times (\|p\| + 0.15 \times \text{turbulence}(p))))$
2. Mix between dark brown and light brown with alpha

### Marble

1.  $q = (fbm(p), fbm(p + (1.7, 4.6)))$
2.  $\alpha = \frac{1}{2} \times (1 + fbm(p + 4 \times q))$
3. Mix between light brown and dark brown with alpha

## 5. Terrain

Added a grid of vertices as said in pdf, uniformly on x and y and z is the height we get from the height\_map.

We add the faces with these vertices, 2 per little square, as said in pdf.

The shader is the same as in previous assignment we just have to get the material by mixing grass and mountain if we are above sea level and otherwise it's water color.

### Workload

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