CS 519: Scientific Visualization
In-class Worksheet

Fall 2017

# Volume Visualization

**The Over Operator**
Suppose we store colors with an alpha value that indicates the level of transparency with 0 being transparent and 1 being opaque. Compositing of two colors with alpha values can be accomplished using the over operator:

$C_A$ over $C_B = \alpha_A C_A + (1-\alpha_A)\,\alpha_B C_B$
$\alpha_{AB} = \alpha_A + (1-\alpha_A)\,\alpha_B$

## 1. Blending

Suppose $C_A$=(0.5, 0.5, 0.75, 0.75) and $C_B$=(0.0, 0.25, 0.25, 0.5)

a. Compute $C_A$ over $C_B$

$3/4\,(1/2, 1/2, 3/4) + 1/4\;1/2\,(0, 1/4, 1/4) = (3/8, 3/8, 9/16) + (0, 1/32, 1/32)$
$= (3/8, 13/32, 19/32)$

b. Compute $\alpha_{AoverB}$

$3/4 + 1/4\;1/2 = 3/4 + 1/8 = 7/8$

## 2. Algebra for the over operator

a. Prove that the Over operator is not commutative

Anything involving 2 different colors with $\alpha = 1$

b. Is it true that Over is associative
$C_A$ over ($C_B$ over $C_C$) = ($C_A$ over $C_B$) over $C_C$ ?

No, not using post-multiplied alpha