Scientific Visualization I

Assignment 8

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Exercise 8.1

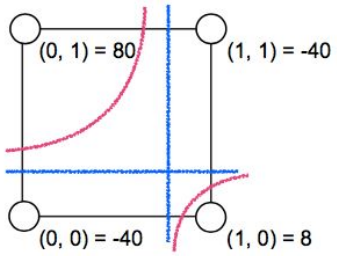
$$f(x,y) = f_{i,j}(1-x)(1-y) + f_{i+1,j}x(1-y) + f_{i,j+1}(1-x)y + f_{i+1,j+1}xy$$
$$= Axy + Bx + Cy + D$$
$$= 80(1-x)(1-y) - 40x(1-y) - 40(1-x)y + 8xy$$
$$= 80 - 80x - 80y + 80xy - 40x + 40xy - 40y + 40xy + 8xy$$
$$= 168xy - 120x - 120y + 80$$

$A \neq 0$, *contour equation is* :

$$c = 168(x - \tfrac{120}{168})(y - \tfrac{120}{168}) + 80 - \tfrac{14400}{168}$$
$$= 168(x - \tfrac{120}{168})(y - \tfrac{120}{168}) - \tfrac{960}{168}$$

D-BC/A is value at the intersection of asymptotes(saddle point)

D-BC/A = $-\frac{960}{168} \approx -5.71$



Exercise 8.2

(a) In a full octree, each node has eight children and all leaf nodes are in the same tree depth. The volume to be visualized contains $500 \times 500 \times 200$ voxels, and it is going to be stored in an array.

$Depth = log_8(500 \times 500 \times 200) \approx 9$

$Total\ number\ of\ nodes = \sum_{i=0}^{9} 8^i = \frac{8^{9+1}-1}{7} = 153,391,689$

$Memory\ consumption = 4 \times 153,391,689 \approx 614\ MB$

(b) $Number\ of\ leaf\ nodes = 8^9 = 134,217,728$

$Number\ of\ non\ leaf\ nodes = 19,173,961$

$Memory\ consumption = non\ leaf\ node\ with\ minimum\ and\ maximum + leaf\ node\ with\ floating\ point$

$= 2 \times 4 \times 19,173,961 + 4 \times 134,217,728 \approx 691\ MB$