Quiz Week6.

Part 1.

1. F 2. F 3. T 4. F 5. T

6. F 7. F

Part 2.

8. C. 9. B.D.

Part 3.

10. (1).

Aliasing occurs when the sampling rate is insufficient to capture the high-frequency details of a scene, leading to artifacts such as jagged edges or moire patterns.

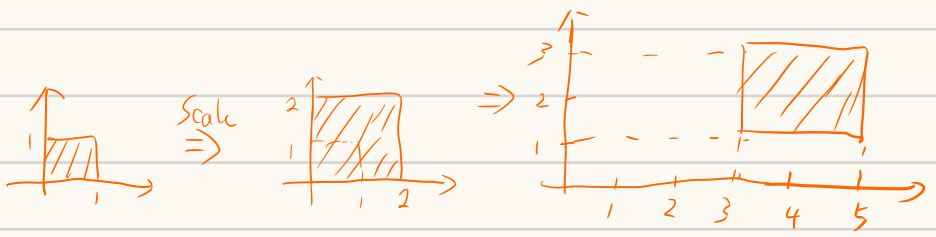
(2). Increase resolution: Higher resolution can reduce the visibility of aliasing by sampling more points.

Pre filtering: Applying low-pass filter before sampling to smooth out high-frequency components.

Post filtering: Applying smoothing filter after sampling to reduce visible artifacts like jagged edges.

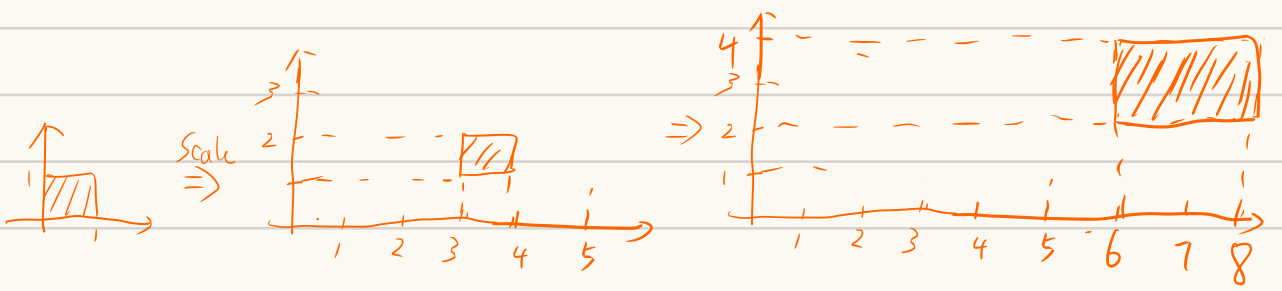
11.

(1)



$(x, y) \rightarrow (2x, 2y) \rightarrow (2x+3, 2y+1)$.

(2).



$(x, y) \rightarrow (x+3, y+1) \rightarrow (2x+6, 2y+2)$

12.

Algebraic Surfaces : use $F(x,y,z)=0$ to define surfaces

Level Sets : store a grid of values approximating function

Distance Functions : use $f(x)$ to define distance

Fractals: a geometric shape containing detailed structure at arbitrarily small scales

NeRF : volumetric representation using neural network

13. Obviously, $T=\begin{bmatrix}1&0&0&0\\0&1&0&1\\0&0&1&2\\0&0&0&1\end{bmatrix}$,

Let $M=\begin{bmatrix}\frac{3\sqrt{2}}{2}&-\frac{3\sqrt{2}}{2}&0\\\frac{5\sqrt{2}}{2}&\frac{5\sqrt{2}}{2}&0\\0&0&7\end{bmatrix}$, Say $M=S_0R_0$ $\Rightarrow MM^T=S_0S_0^T$

$$MM^T=\begin{bmatrix}9&0&0\\0&25&0\\0&0&49\end{bmatrix}\Rightarrow S_0=\begin{bmatrix}3&&\\&5&\\&&7\end{bmatrix}$$

$$R_0=S_0^{-1}M=\begin{bmatrix}-\frac{\sqrt{2}}{2}&-\frac{\sqrt{2}}{2}&0\\\frac{\sqrt{2}}{2}&\frac{\sqrt{2}}{2}&0\\0&0&1\end{bmatrix}$$

Hence $S=\begin{bmatrix}3&&\\&5&\\&&7\end{bmatrix}$ $R=\begin{bmatrix}-\frac{\sqrt{2}}{2}&-\frac{\sqrt{2}}{2}&\\\frac{\sqrt{2}}{2}&\frac{\sqrt{2}}{2}&\\&&1\end{bmatrix}$, 1

14. $R=\begin{bmatrix}\frac{3}{4}+\frac{\sqrt{2}}{8}&\frac{3}{4}-\frac{\sqrt{2}}{8}&\frac{\sqrt{2}}{4}\\\frac{\sqrt{3}}{4}-\frac{\sqrt{6}}{8}&\frac{1}{4}+\frac{3\sqrt{2}}{8}&-\frac{\sqrt{6}}{4}\\-\frac{\sqrt{2}}{4}&\frac{\sqrt{6}}{4}&\frac{\sqrt{2}}{2}\end{bmatrix}$ $\theta=\cos^{-1}\left(\frac{\text{trace}R-1}{2}\right)=45°$

$u=\frac{(R_{21}-R_{12},R_{02}-R_{20},R_{10}-R_{01})}{2\sin\theta}$.

Rotate about $u=\begin{bmatrix}\frac{\sqrt{6}}{4}\\\frac{\sqrt{2}}{4}\\0\end{bmatrix}$ with $45°$.

15. $T(x,y,z)=(x+2,2y+10,2z+12)$

$T(\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}})=(2+\frac{\sqrt{3}}{3},\frac{2\sqrt{3}}{3}+10,\frac{2\sqrt{3}}{3}+12)$.

$n'=\frac{(A^{-1})^Tn}{\|(A^{-1})^Tn\|}=\frac{(1,\frac{1}{2},\frac{1}{3})}{\|(1,\frac{1}{2},\frac{1}{3})\|}=(\frac{6}{7},\frac{3}{7},\frac{2}{7})$