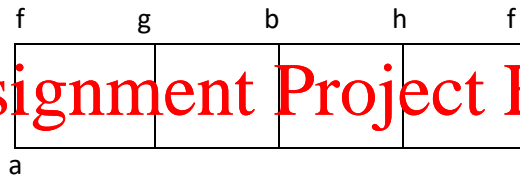
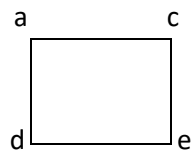
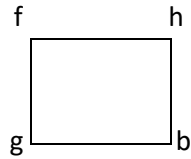


Answers to Assignment 1 Qn 1

a)



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b)

$$(A, B, C) = \overrightarrow{af} \times \overrightarrow{ad} = \begin{vmatrix} i & j & k \\ 0 & 5 & 0 \\ -15 & 0 & -12 \end{vmatrix} = (-60, 0, 0)$$

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The equation of the face $\square afhd$ is

$$-60X + 75Z = 0$$

$$(A, B, C) = \overrightarrow{ce} \times \overrightarrow{cg} = \begin{vmatrix} i & j & k \\ 1 & 0 & -12 \\ 0 & 5 & 0 \end{vmatrix} = (60, 0, 5)$$

To solve for $60X + 5Z + D = 0$, we put $(10, 0, 0)$ into the equation, $D = -600$

The equation of the face $\square cgbe$ is

$$60X + 5Z - 600 = 0$$

The system of linear inequalities are

$$-60X + 75Z < 0$$

$$60X + 5Z - 600 < 0$$

$$-12 < Z < 0$$

$$0 < Y < 5$$

Qn 2

$$\begin{aligned} \text{a) } Z &= 4\sin^{10} \alpha \\ X &= 2\cos^{10} \alpha \cos^5 \beta \\ Y &= 2\cos^{10} \alpha \sin^5 \beta \end{aligned}$$

b) Super-ellipsoid

c) makes the sampling more uniform and avoid square/cubic root, which would cause part of the shape to become missing (either reason acceptable)

Qn 3

a) i) **Assignment Project Exam Help**

$$Z^2 = \left[\left(\frac{X}{2} \right)^{2/s_1} + \left(\frac{Y}{2} \right)^{2/s_1} \right]^{s_2}$$

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$$Z = \sec(\alpha)$$

$$\left(\frac{X}{2} \right)^{2/s_1} + \left(\frac{Y}{2} \right)^{2/s_1} = \tan^2 \alpha$$

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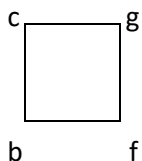
$$\frac{1}{\tan(\alpha)} \left(\frac{X}{2} \right)^{1/s_1} = \cos \beta \Rightarrow X = 2(\tan^{s_1} \alpha)(\cos^{s_1} \beta)$$

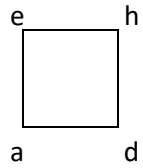
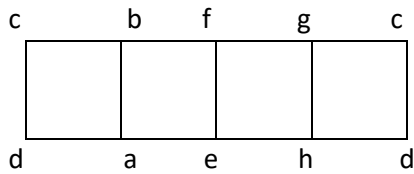
$$\text{Similarly, } Y = 2(\tan^{s_1} \alpha)(\sin^{s_1} \beta)$$

a) ii)

Super-hyperboloid (Two-sheeted Super-hyperboloid)

b)





c)

$$(A, B, C) = \overrightarrow{ae} \times \overrightarrow{ab} = (9, -9, -45) \times (0, 2, 0) = \begin{vmatrix} i & j & k \\ 9 & -9 & -45 \\ 0 & 2 & 0 \end{vmatrix} = (90, 0, 18)$$

$$5X + Z + B = 0$$

Put in $a(1, -1, -5)$ giv

$$5X + Z = 0$$

plane equation is

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d)

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By symmetry, PRP = (0, 0, 0)

$$\tan\left(\frac{\theta}{2}\right) = \frac{1}{5} \Rightarrow \theta = 22.61986495$$

The command is

gluPerspective (22.61986495, 1, 5, 50)