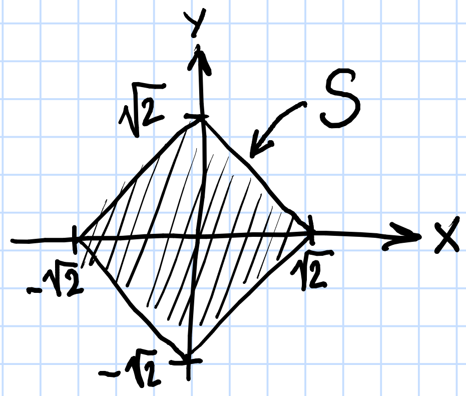
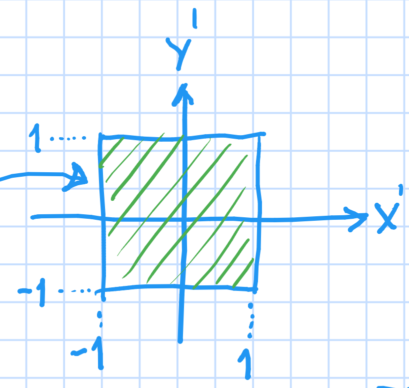


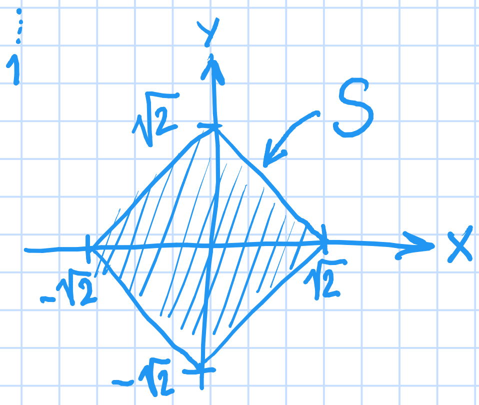
Solution using rotation:

Generate random points at S'



$$\Rightarrow \begin{cases} X'_{rnd} = 2\cdot U_1 - 1 \\ Y'_{rnd} = 2\cdot U_2 - 1 \end{cases}$$

Rotate these coordinates $\theta = 45^\circ \Rightarrow$



Rotation is done using the rotation matrix $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} = \begin{bmatrix} 2^{-1/2} & -2^{-1/2} \\ 2^{-1/2} & 2^{-1/2} \end{bmatrix}$

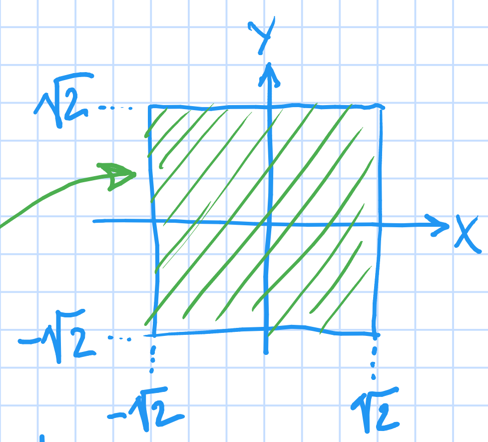
$$\Rightarrow \begin{cases} X_{rnd} = 2^{-1/2}\cdot(2\cdot U_1 - 1) - 2^{-1/2}\cdot(2\cdot U_2 - 1) = \sqrt{2}\cdot(U_1 - U_2) \\ Y_{rnd} = 2^{-1/2}\cdot(2\cdot U_1 - 1) + 2^{-1/2}\cdot(2\cdot U_2 - 1) = \sqrt{2}\cdot(U_1 + U_2 - 1) \end{cases}$$

Answer:

$$\boxed{\begin{aligned} X_{rnd} &= \sqrt{2}\cdot(U_1 - U_2) \\ Y_{rnd} &= \sqrt{2}\cdot(U_1 + U_2 - 1) \end{aligned}}$$

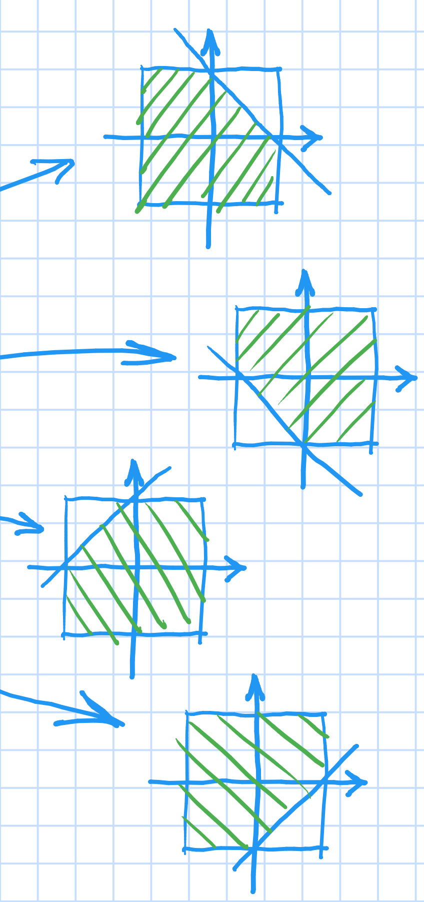
Solution using Accept-reject

Generate random points at S'



i.e. let $\begin{cases} X_{rnd} = \sqrt{8}\left(U_1 - \frac{1}{2}\right) \\ Y_{rnd} = \sqrt{8}\left(U_2 - \frac{1}{2}\right) \end{cases}$ be your candidat.

Answer: The canditate is accepted if $\begin{cases} Y \leq \sqrt{2} - X \\ Y \geq -\sqrt{2} - X \\ Y \leq \sqrt{2} + X \\ Y \geq -\sqrt{2} + X \end{cases}$ are all fullfilled



$\Rightarrow$