Image

(3)

Let's compute $\sqrt{x}$,

Checking for $x>1$, then divide by multiples of 2, until $x<1$.

for $x>1 \rightarrow \sqrt{x} = 2^n\sqrt{\frac{x}{2^{2n}}}$.

$n \rightarrow$ storing n register for later

$\downarrow x$ input.

$\boxed{\text{check } x>1} \xrightarrow{\text{Yes}}$ compute x'

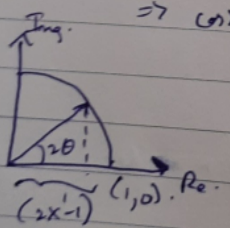
$\frac{x}{2^{2n}} = x'$.

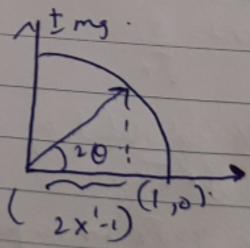
$\Rightarrow \sqrt{x} = 2^n\sqrt{\underbrace{\frac{x}{2^{2n}}}_{x'}} = 2^n\sqrt{x'}$

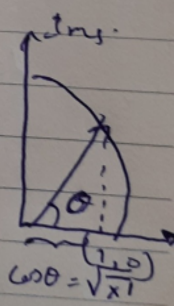
Now, $x<1$,.

$\Rightarrow x' = \cos^2\theta$.

$\Rightarrow \cos 2\theta = 2x-1$

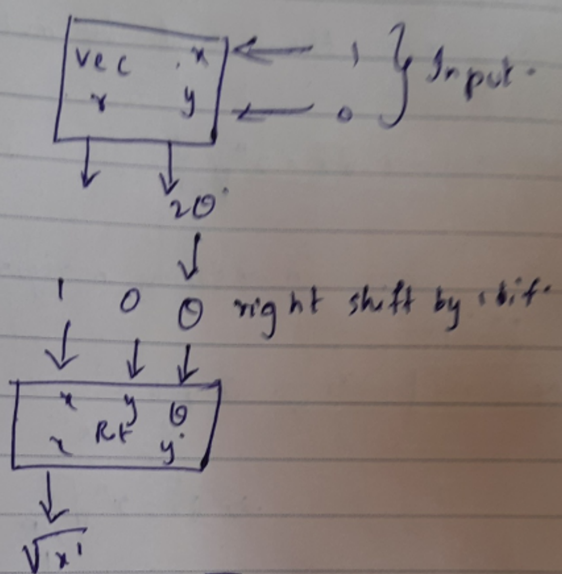






Reference.

$2x'-1$



Left shift by n bits $\Rightarrow 2^n \sqrt{x'} = \sqrt{x}$

Now, computing $Z = \frac{y}{\sqrt{x}}$,

Let $\cos d = \frac{y}{\sqrt{x}}$.

ξ is calculated by rotation mode.

if $y < \sqrt{x}$.

for $y > \sqrt{x} \Rightarrow$ compute Z,

$$\frac{y}{\sqrt{x}} = Z + \frac{y'}{\sqrt{x}}.$$

If $y < \sqrt{x} \rightarrow y' = y$.

If $y > \sqrt{x} \rightarrow y' = \left(\frac{y}{\sqrt{x}} - z\right)\sqrt{x}$.

Right shift y until $\sqrt{x} > y$.

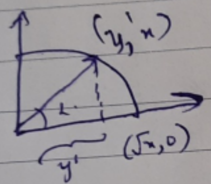
$n = 0$.

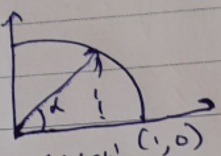
$y \xrightarrow[\text{right shift}]{n \text{ bit}} y' \longrightarrow (y' < \sqrt{x})$ $n = n+1$; $n = n$.

$\Downarrow$?

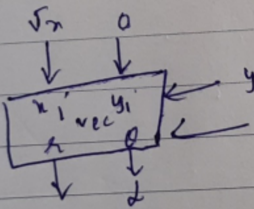
$\Rightarrow y'$ where $y' \sqrt{x}$.

$\cos\alpha = \frac{y'}{\sqrt{x}}$.





$\cos\alpha = \frac{y'}{\sqrt{x}}$



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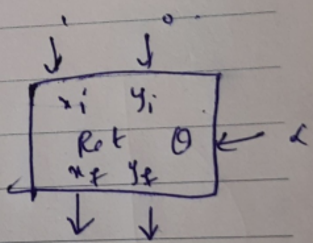

$\frac{y'}{\sqrt{x}}$

left shift of n bits.

$z = \frac{y}{\sqrt{x}}$.