From classic computers to quantum computers (A)

In these series of articles, we will explore quantum computers using the knowledge of complex numbers from classic computers.

1. Complex numbers Imaginary Unit Circle
2. Shape of :

A graph with a red line

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A graph with lines and numbers

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B) what if multiply x by some real number [A] < 1 and [A] > 0 then the shape characteristic of the function will not going to change only the function will be factored by this number [A] until [A] will be very small and close to 0 then f(x) =1

A graph of a function

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A graph with numbers and lines

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Based on this and the definition of imaginary unit number [i] in complex plane if [i] is the sqrt root of [-1] and it is some real number then we should have the same characteristic for the function if [i] is a real number

But this is not the case if we try to visualize you will be going to have totally different visualization for this function in the complex plane because [i] in complex plane is not a real number it is a rotation for an angular value or quantized value with an angle.

This is what you are going to see if you visualize

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A graph paper with a circle in center

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Which is clearly two different representation/visualization for Euler number raised to some power!

And this is a visualization proof that the imaginary unit number [i] in complex plane is an angular representation for a quantitative value moves in an angular rotation movement but in 2-D. in complex plane and not just a real number.

The maximum circle in the complex plane for the visualization for

If exactly a circle as we see here both intersect at ( , 0)

A graph of a circle with numbers and a line

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Two questions here

1. why it is ?
2. Why it is square root ?

To answer the first question, we must talk about the frame of reference in the complex plane.

Complex planes have its base frame of reference to do a correct angular rotation and skew and shifting movements in complex plane.

This frame of reference is for number system base 10, therefore it has one line for each number between 0 and 10.

And if you draw these 10 lines as x=0 and x =1 and x=2 and x= 3 and …

And y = 0 and y = 1 and y = 2 and y=3 and …. The intersection will be square 10X10.

And if we take into consideration the negative numbers, we will have another three squares 10X10 for the rest of the complex plane.

So, in total we have 4 squares 10X10 each in its own side of the number lines in the complex plane.

And in total we have 20 lines for X values 10 positive and 10 negatives

And this will give us the complex plane frame of reference 40X40 square.

And these answers the first question why 20.

A grid of blue squares

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A grid with red writing on it

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Second the complex plane is built on the imaginary unit number [i] which is a measure unit for the movement in 3-D projected on 2-D.

And this imaginary unit number [i] is a square root of -1. And this is why the square root is a main concept in most of the intersections in the complex plane.

And this answer the second question why maximum circle unitary rotation in a complex plane is

A note here we are dealing with square roots we must have to take care of the two values for any square root.

Because this gives us the duality in the complex plane quantitative values

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A screenshot of a math equation

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And more importantly we need to be careful when dealing with complex planes and respectively with square roots because.

As we see here in this grave there is a big difference in the negative sides of the complex plane

But for the negative values for X, it is totally different.

If X is negative, we have 90 degrees rotation in the complex plane for any value because of the square root concept of the complex plane.

Similarly, if X is a negative value, we have rotation 120 degrees for the any positive value of X.

As we see the green line in the negative side should be Zero as in the positive side, but it is shown as rotation for the positive value by 120 degrees or a rotation of 60 degrees for the negative values of X.

So, to reach Zero on the whole X values +ev or -ev we must do rotation for the negative values of X or the positive values of X.

And of course, we know what this rotation stands for

A graph of a function

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A graph of mathematical equations

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Similarly, the negative side for as you see the purple line the negative side of X is not X it is rotated by 45 degrees.

A graph of a function

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Going back to the complex plane and its maximum unitary circle unit

And

Each circle in this function starting from this maximum unitary circle and going towards the origin is a visualization for one line of the frame of reference or a visualization for one number. for example. is the visualization for X =20.

This maximum unitary circle includes other smaller circles, one for each line number in the frame of reference.

But why it is moving in even powers and not odd why the next smaller unitary circle is.

and not

A circular graph with numbers and lines

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As we see here is a circle (the green circle) in the exact middle in between the two circles.

Because if we used the complex plane square root concept

The intersection point with the X axes should by at

Which means for the odd number we must use

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A graph of a circular chart

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Therefore, for odd numbers we must use because the nature of the complex plane that uses the square root concept.

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A graph paper with numbers and a circle

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And this means for the odd numbers the maximum unitary circle in complex plane will be at 21 and not at 20 and this makes sense because it is odd numbers so the maximum needs to be odd number as will so it is 21 and not 20.

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A graph of a circle with numbers and a green circle

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And if we overlaid both even and odd line numbers of the frame of reference over each other we will get all line numbers of unitary circles in one visualization as it is shown in the next graph.

A white background with black text

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A graph with numbers and circles

Description automatically generated

And these unitary circles continue until we reach circle 0 one function for even lines and one function for the odd frame of reference lines because of the square root concept of the complex plane.

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A graphing chart with numbers and circles with Crust in the background

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If we continue to go towards Zero, the circles will continue to get smaller and smaller until we reach X = 0

So, the unit circle for the even numbers will be at and its unitary circle will be

Similarly, for the odd number will be

Therefore, the unitary unit circle for the odd numbers is which readjust the difference between the even and odd again to be 1

And this unitary circle has a very specific property its area = ratio between π and e

The area of the zero unitary circle for odd numbers =

which do the adjustment for the next circles {or the frame of reference lines} for all negative values of X to have exactly difference = 1 between the even and the odd numbers.

A math equation with numbers and symbols

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A graph paper with circles and lines

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Once this adjust is done at X=0 for even and at X =-1 for the odd we will go with the difference = 1 between both powers for all X < -1

The next two unitary Circles for both odd and even functions will be

A number and plus and two symbols

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And from these visualizations for the maximum unitary circles in complex plane for both function of the frame of reference, it is clearly it is a 2-D visualization for a 3-D Circle [Sphere].

And this is correct because complex plane represents rotational and shifting movements in 3D projected on 2-D in the complex plane.

And the projection for the first half of a 3-D Sphere on a 2-D complex plane for the complex plane frame of reference lines will be exactly match the projection for the second half of the 3-D Sphere.

And therefore, in complex plane if we know one projection for these Sphere in complex plane will be exactly the opposite of the other half projection, they should have 180 degrees in between them.

And this is exactly what the quantum concept is built on, which measures the state of any system in a 3-D Sphere (quantum) which represents all rotations on and inside a Sphere in a probabilistic way instead.

So, instead of using a complex number as the systems states in 2-D in the complex, the quantum uses the full sphere and then measures the state that has the maximum probability as the quantitative measurement.

So, measurements on complex plane for the 3-D Sphere also is applicable with complex numbers as they are projected on the 2-D plane on the complex plane and taking advantage of the symmetrical property of the Spherical shape in the projection on the 2-D. but just taking in consideration the concept of duality for square root of the complex plane.

The advantage of quantum computations is the computational speed power because it uses tensor and it uses full Sphere states as systems status which gives any system more configurable states, also uses the concept of threading/parallelism as it uses multiple qubits at the same time in its calculations, and this gives quantum computing advantage in the calculations and measurement speed in many fields.

Now let us see the mapping between the complex plane and quantum.

1. If we considered using complex plane, then our states in complex plane = (i-1)

Then we can consider a transformation in complex plane

And this equivalent to Hadamard in quantum

A math equation with numbers and symbols

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As the negative values as we show previous is different at the negative side of X and this is why adding [X] to the frame of reference [i \* X] give us the rotation in the complex plane A math problem with numbers and a number

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Similarly, the complex plane unit circle

A graphing of a circle with lines and numbers

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And for odd numbers as we showed the adjust at X =0 we will have another complex plane Hadamard matrix for the odd numbers

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A math equations and numbers

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And as it is shown in the complex plane unit circle. We can map complex plane stats into quantum states.

(1, -1) into (|0>, -|0>) and (i,-i) into (|1> , -|1> )

So, quantum Zero state is a 1 state in complex plane and quantum 1 state is [i] state in complex plane.

So if we have vector [1 0] in quantum then it is [i 1] in complex plane.

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So, the super positions state for a wave is mapped to a complex number in the complex plane.

Next article [TBD]