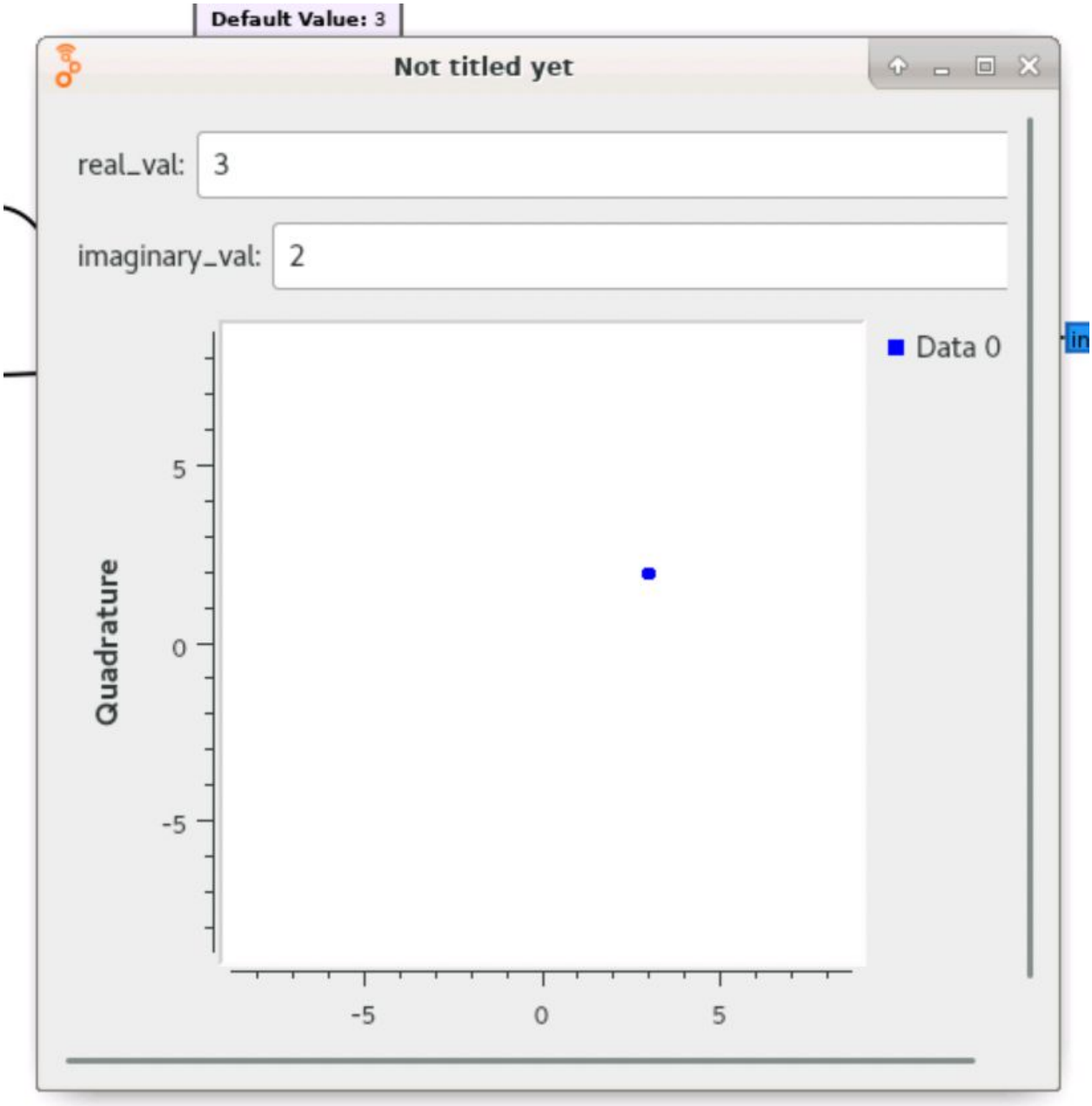
EC 415 Software Radios
3/2/21
Michael Kremer, U45121665
Constantinos Gerontis, U62058027

Lab 2

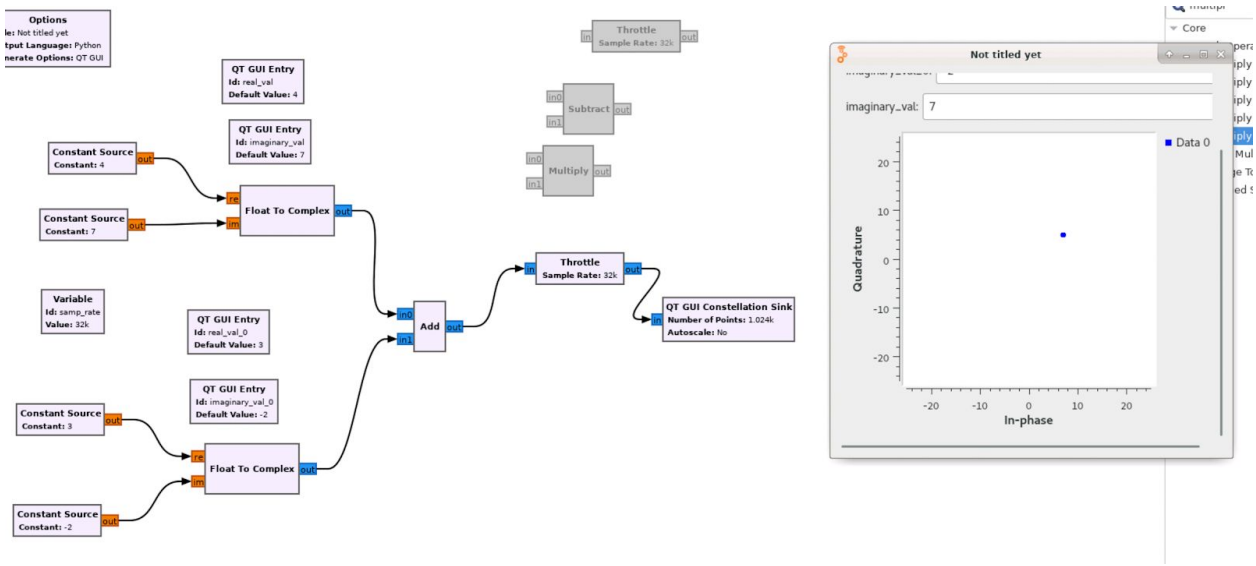
1) Question 1:

The dot in the plot seems accurate, and changing the values moves the dot around as expected

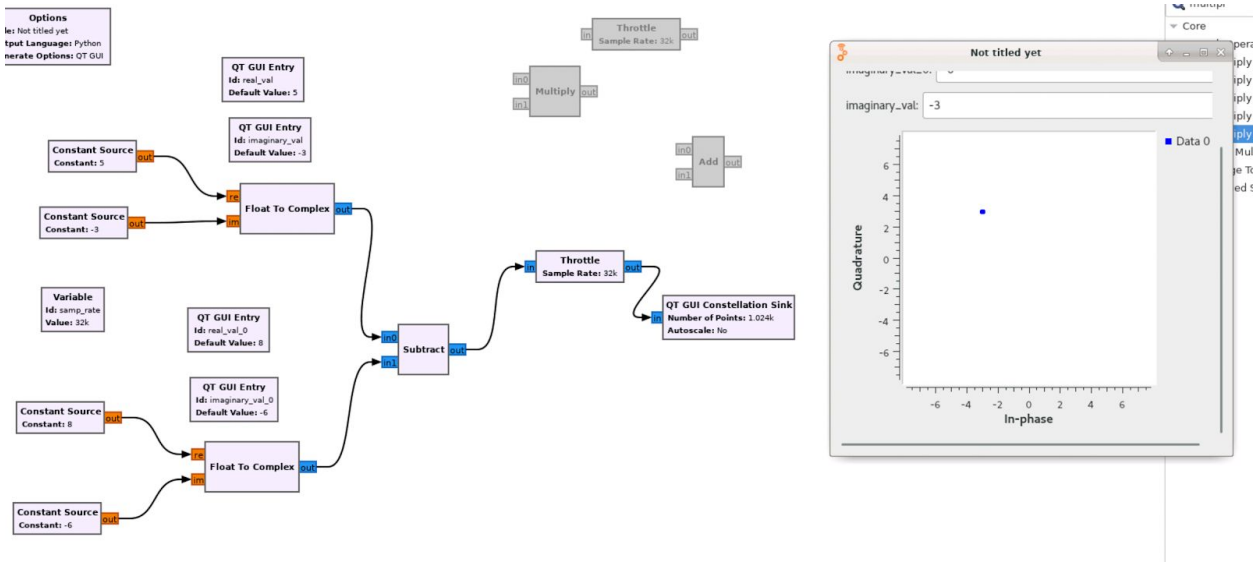


2) Question 2:

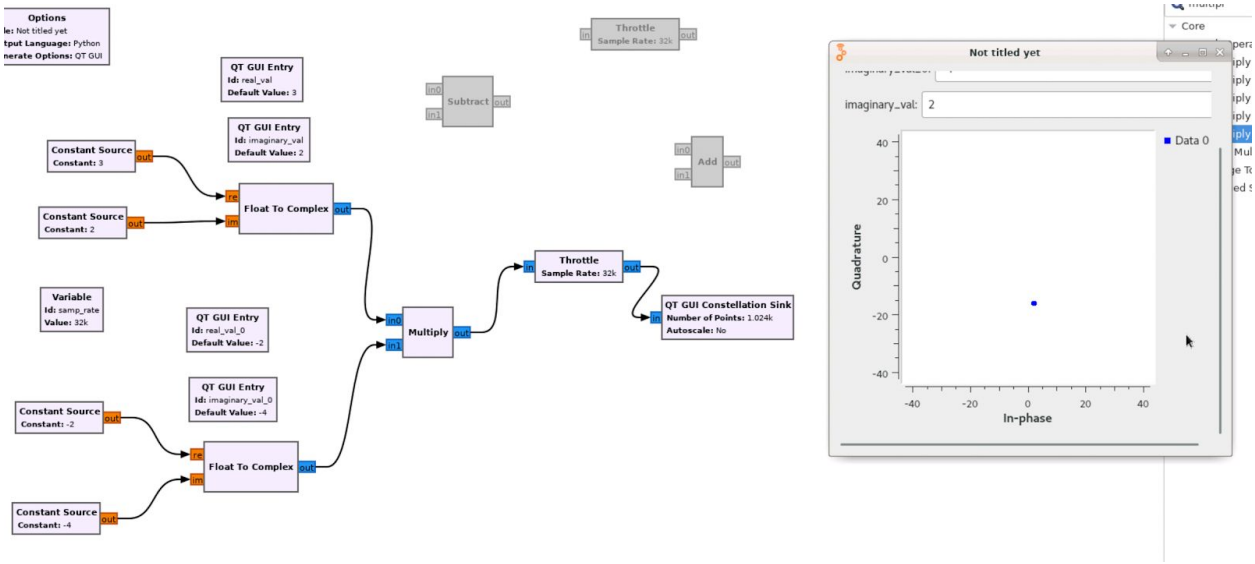
4 + 7j and 3 - 2j = 7 - 5j (as seen below)



Subtract 8 - 6j from 5 - 3j = -3 + 3j (as seen below)



Multiply 3 + 2j and -2 - 4j = 2 - 16j (as seen below)



3) Three

Part 1)

7 + 5j

r = $\sqrt{74}$

φ = arctan(7/5) = 0.95

$z = \sqrt{74}e^{j0.95}$

Part 2)

-3 + 3j

r = $3\sqrt{2}$

φ = arctan(-3/3) = -π/4

$z = 3\sqrt{2}e^{-j\pi/4}$

Part 3)

2 - 16j

r = 16.1

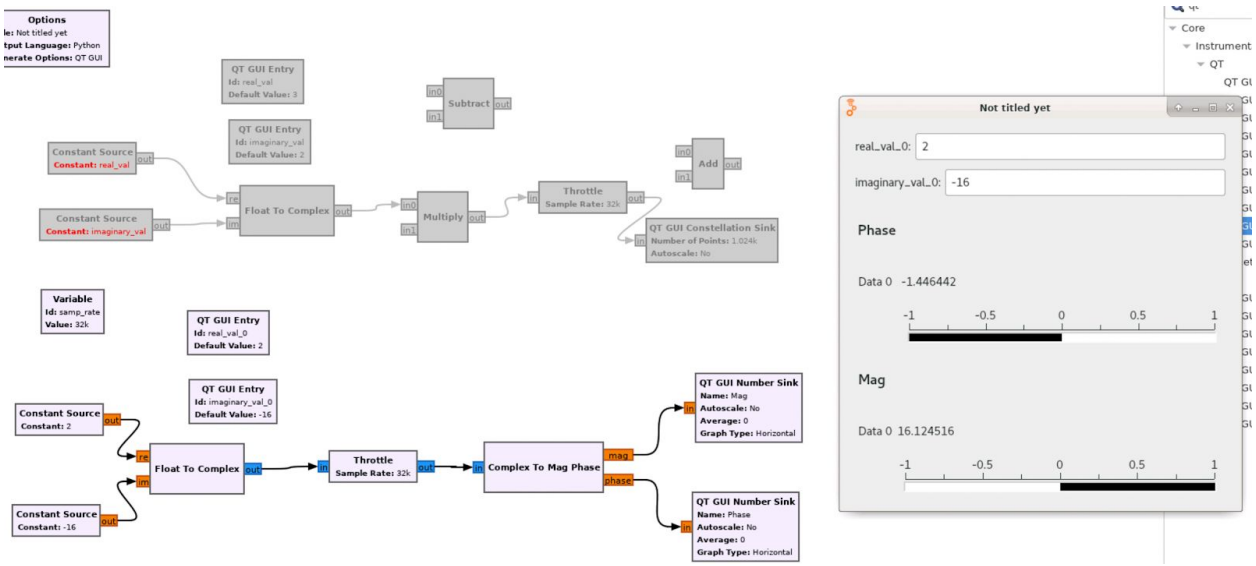
φ = arctan(6/8) = -0.124

$z = 16.1e^{-j0.124}$

4) Four

Magnitude = $\sqrt{2^2 + 16^2} = 16.1$

φ = arctan(6/8) = -0.124 radians



5) As the absolute value of the frequency is increased, the dot travels the circular pattern faster. The opposite is true as the absolute value of the frequency is decreased. The dot travels clockwise when the frequency is negative and counterclockwise when the frequency is positive.

6) As the amplitude increases, the radius of the circle is increased.

7) Blue - real, red -complex, quadrate - circle?

$$Blue = Re\{Quadrate\} = \text{Amp*cos}(\varphi)$$

$$Red = Im\{Quadrate\} = \text{Amp*sin}(\varphi)$$

$$Quadrate = Amp * e^{-j*\varphi}$$

8) By observing the radius of the plotted quadrate circle,

$Amplitude = 1.5$

From judging the rough time in between peaks of the Amplitude signals, $f = 1/(26ms - 3ms) = 43Hz$

From judging the rough time in between troughs of the real and imaginary signals, $\phi = (2 * \pi * 6ms)/(23ms) = \pi/2$

9) For any given conversion from exponential form to cartesian form: $z = cos(2\pi ft + \phi) + jsin(2\pi ft + \phi)$

Using the values observed in question 8:

$z = cos(86\pi t + \pi/2) + jsin(86\pi t + \pi/2)$