PHY408 Lab 0

Kevin Dang - 1003205079

2 Integration Function

Part 1

Collaborators: None

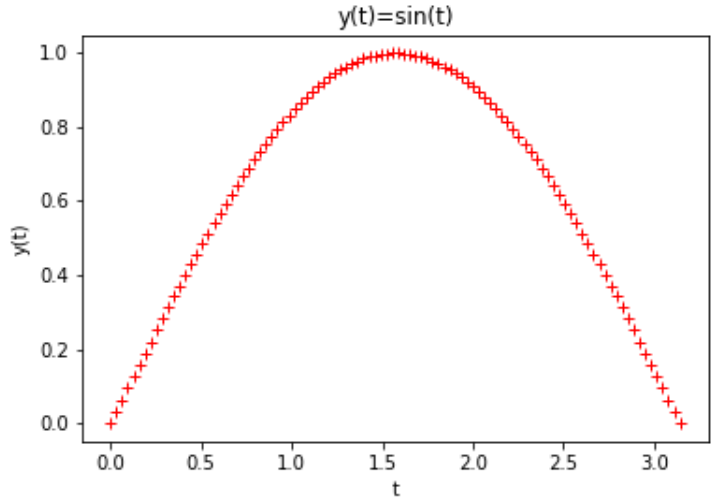

Figure 1: $y(t) = \sin(t)$

The output c value of 1.9998321638939935 is close to what I expected for the integral, which is a value of 2 if the integral is computed manually.

To improve accuracy of the computation, we can increase nt, the number of samples. This would decrease the sample interval dt so we are less likely to exclude area.

Part 2

Collaborators: None

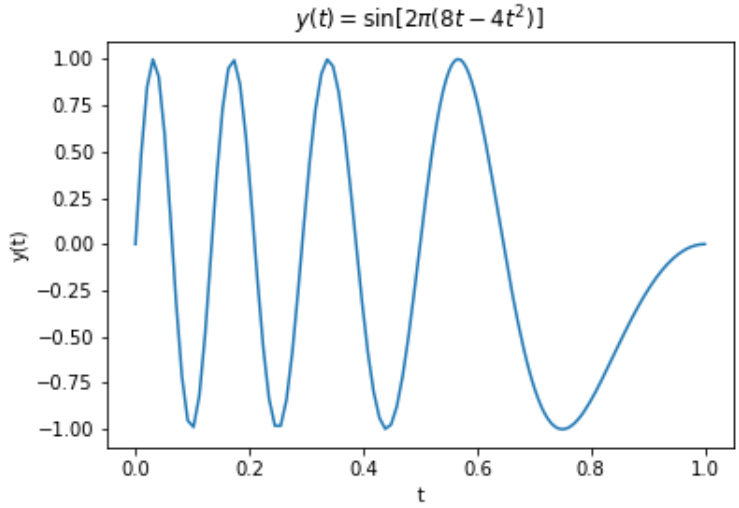

Figure 2: $y(t) = \sin[2\pi(8t - 4t^2)]$ (for $nt = 50$)

$\int_0^1 \sin[2\pi(8t - 4t^2)] = -0.10540213617112387$

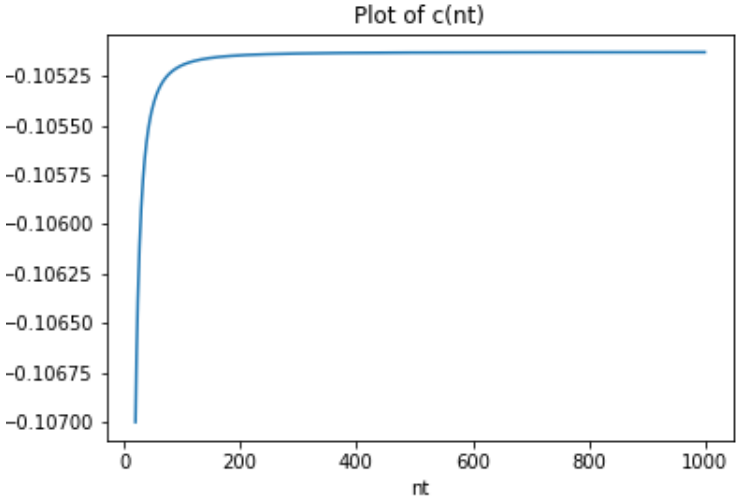

Figure 3: $c(nt)$

As nt increases, c converges to $\int_0^1 \sin[2\pi(8t - 4t^2)] = -0.10540213617112387$.

3 Accuracy of Sampling

Collaborators: Erich Fernandes

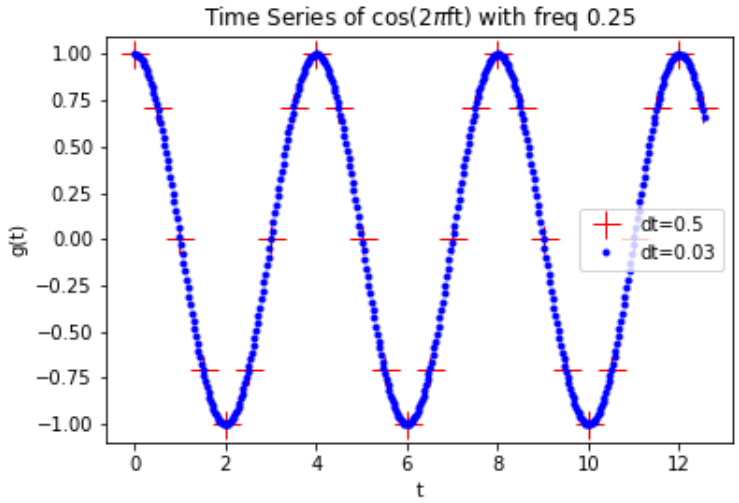

Figure 4: Time Series of cos(0.5πt)

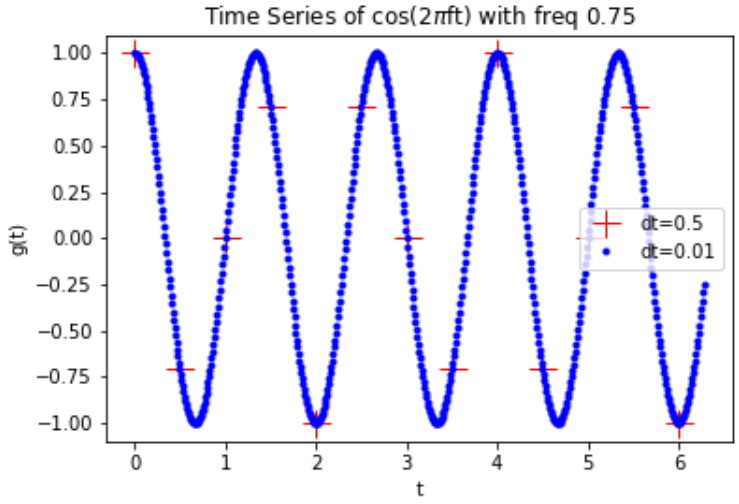

Figure 5: Time Series of cos(1.5πt)

Q: *For each frequency that you investigated, do you think the sampling time series is a fair representation of the original time series $g(t)$?*

A: The sampling time series is a fair representation of the original time series $g(t)$ at frequencies such as 0, 0.25, 0.5 and 1 hertz. The samples hit important points like the minima, maxima and points of inflection and they also have an apparent frequency

that is equal to the true frequency. However when we get to larger frequencies like 0.75, 1.5, 2 hertz these sampling time series miss crucial points that define the original time series so they are not a good representation. In addition the apparent frequencies are not equal to the true frequency.

Q: *What is the apparent frequency for the sampling time series?*

A: The apparent frequency for the sampling time series is in Table 1 below. For example, if we have $f = 0.75$ then the apparent frequency is 0.25, even though the true frequency is 0.75. This is because the samples occur N = 8 times per cycle so the frequency is 1/(N*dt) = 1/(8*0.5) = 0.25.

frequency	Points the series repeats itself (N)	apparent frequency
0	N/A (flat line)	0
0.25	8	0.25
0.5	4	0.5
0.75	8	0.25
1	2	1
1.5	4	0.5
2	N/A (flat line)	0

Table 1: Frequencies and Apparent Frequencies

Q: *Can you guess with a sampling interval of* $dt = 0.5$ *, what is the maximum frequency* f *of* $g(t)$ *such that it can be fairly represented by the discrete time series?*

A: I estimate the maximum frequency to be 0.5. This is because after the frequency goes beyond 0.5 the apparent frequency does not match the true frequency.