

HW2 1060615 | 彭文得
 彭文得

Prob. 1

1. CFT

$$X_1(\omega) = \int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} x_1(t) e^{-j\omega t} dt e^{+j\omega t} dt$$

$$X_1(f) = \int_{-\infty}^{+\infty} x_1(t) e^{-j2\pi f t} dt$$

$$x_1(t) = \int_{-\infty}^{+\infty} X_1(f) e^{+j2\pi f t} df$$

2. DFT

$$X_1[n] = \int_{-\frac{1}{2}}^{+\frac{1}{2}} \left[\sum_{k=-\infty}^{+\infty} x_1[k] e^{-j2\pi f n} \right] e^{+j2\pi f n} df$$

$$\tilde{X}_1(f) = \sum_{k=-\infty}^{+\infty} x_1[k] e^{-j2\pi f n}$$

$$x_1[n] = \int_{-\frac{1}{2}}^{+\frac{1}{2}} \tilde{X}_1(f) e^{+j2\pi f n} df$$

prob. 2

$$X_\Delta(t) = x(t) \times \sum_{k=-\infty}^{+\infty} \delta(t - kT_s)$$

$$X[k] = x(kT_s)$$

1.

$$X_\Delta(t) = x(t) \times \sum_{k=-\infty}^{+\infty} \delta(t - kT_s)$$

$$= x(t) \times \frac{1}{T_s} \sum_{k=-\infty}^{+\infty} 1 \times e^{j\frac{2\pi n}{T_s} t}$$

$$X_\Delta(f) = X(f) * f_s \sum_{k=-\infty}^{+\infty} \delta(f - kf_s)$$

2. it-

$$X_\Delta(f) = \int_{-\infty}^{+\infty} X_\Delta(t) e^{-j2\pi f t} dt$$

$$= \int_{-\infty}^{+\infty} x(t) \sum_{k=-\infty}^{+\infty} \delta(t - kT_s) e^{-j2\pi f t} dt$$

$$= \sum_{k=-\infty}^{+\infty} \int_{-\infty}^{+\infty} x(t) e^{-j2\pi f t} \delta(t - kT_s) dt$$

$$= \sum_{k=-\infty}^{+\infty} x(kT_s) e^{-j2\pi f \cdot kT_s} \int_{-\infty}^{+\infty} \delta(t - kT_s) dt$$

$$= \sum_{k=-\infty}^{+\infty} x[k] e^{-j2\pi f \frac{1}{f_s} n}$$

$$= \tilde{X}\left(\frac{f}{f_s}\right)$$

it =

$$X_\Delta(f) = X(f) * f_s \sum_{k=-\infty}^{+\infty} \delta(f - kf_s)$$

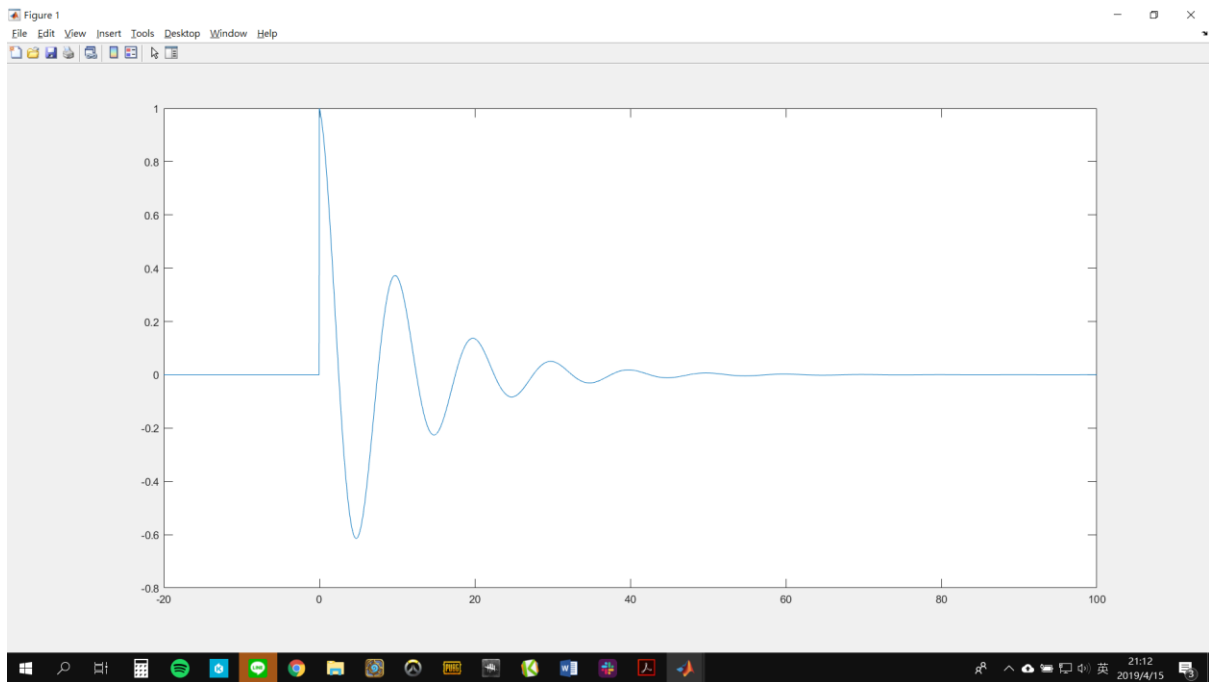
$$= f_s \sum_{k=-\infty}^{+\infty} X(f) * \delta(f - kf_s)$$

$$= f_s \sum_{k=-\infty}^{+\infty} X(f - kf_s)$$

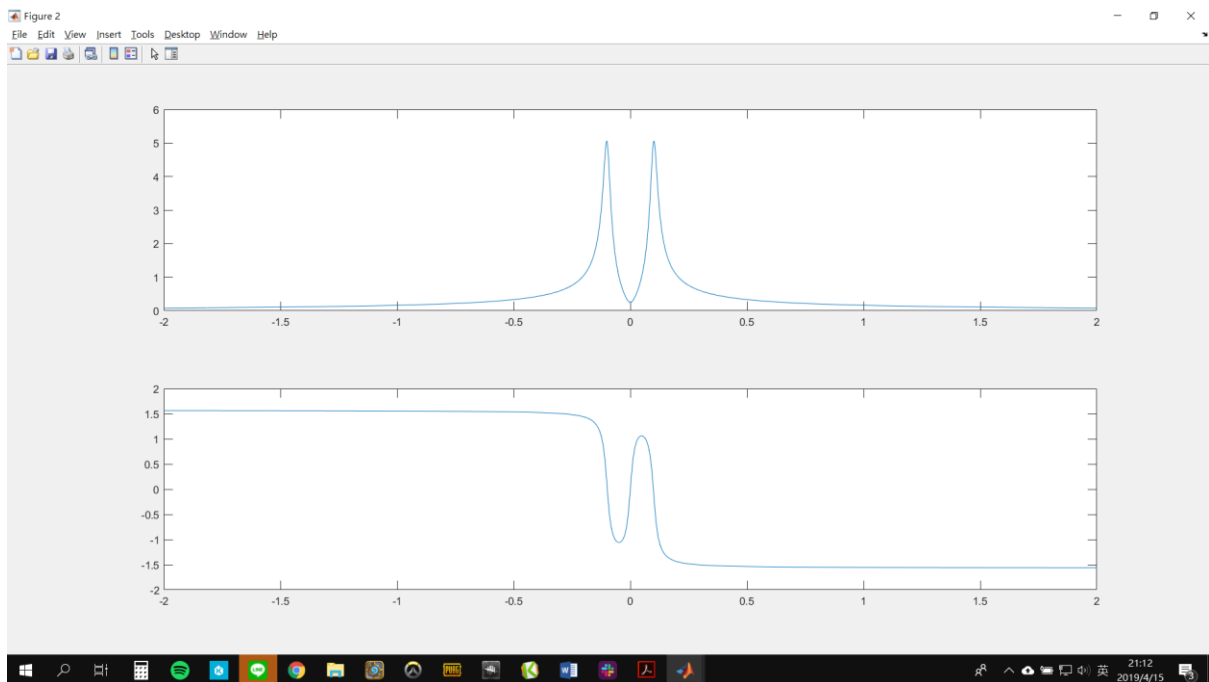
$$= \tilde{X}(f)$$

CFT of Impulse sampling = DFT of point sampling

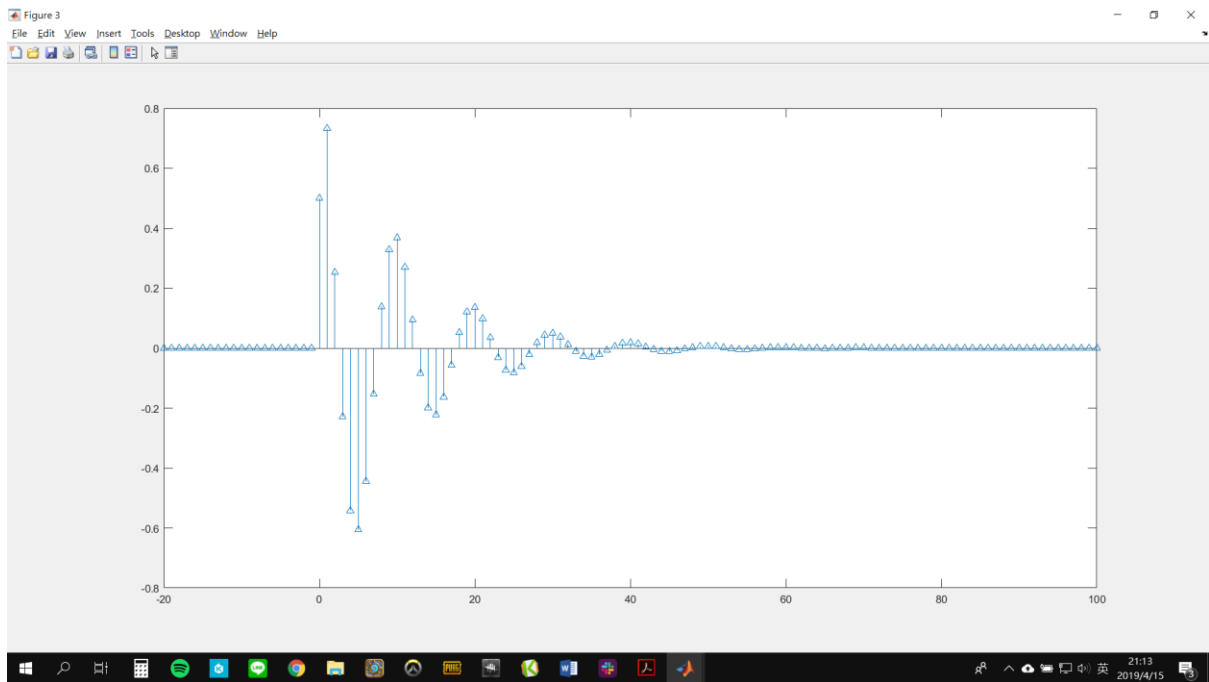
2. (a)



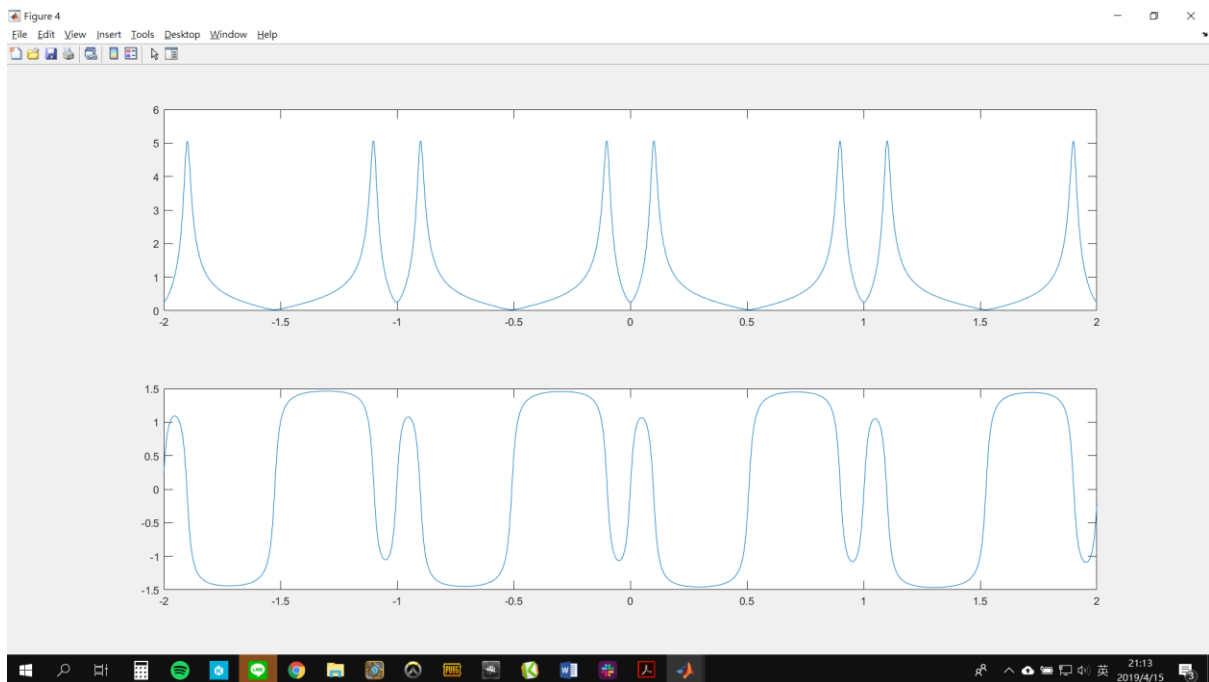
2. (b)



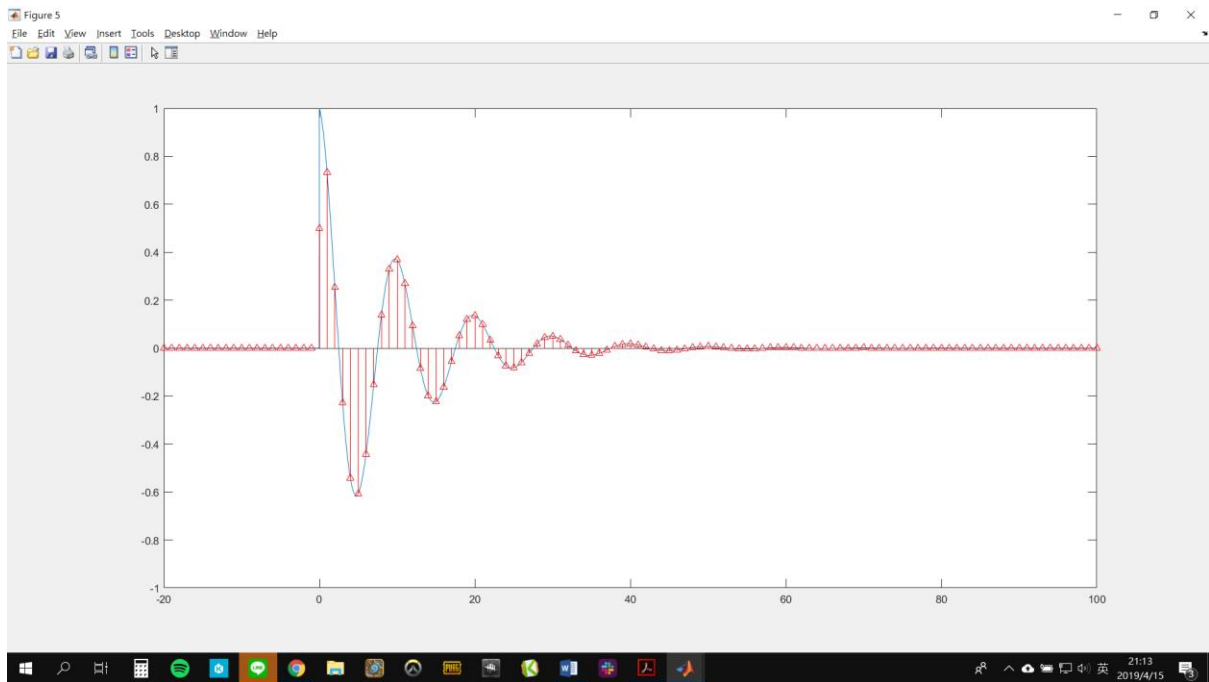
2. (c)



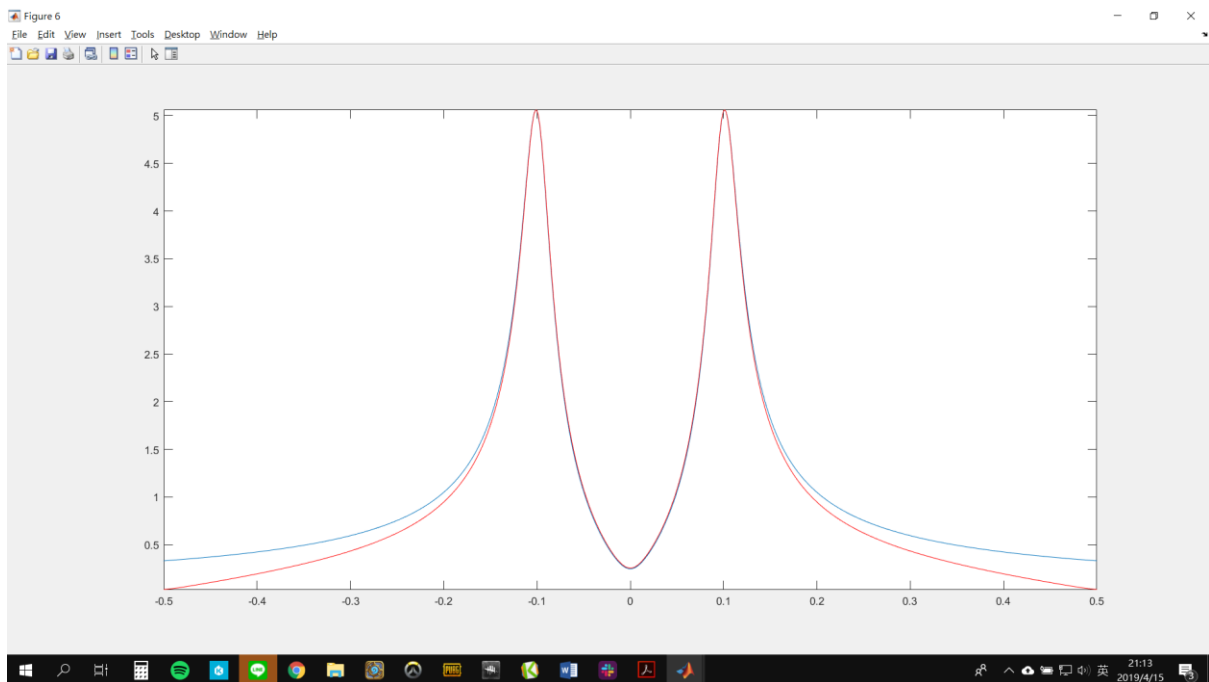
2. (d)



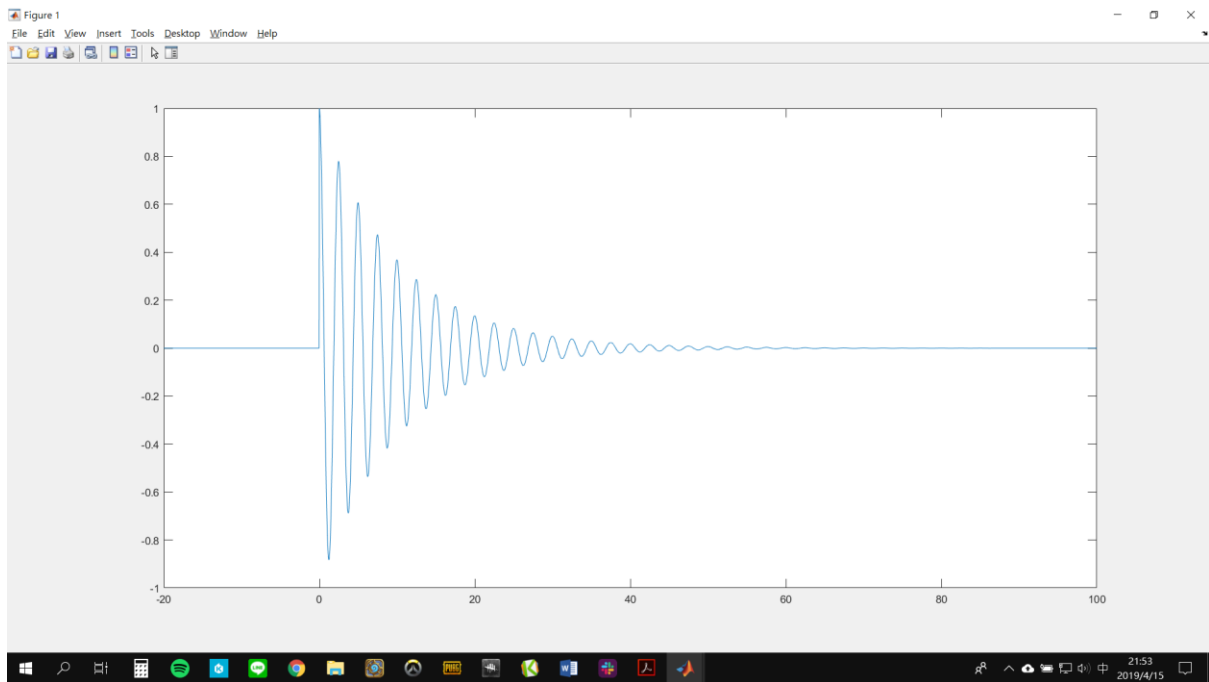
$x(t)$



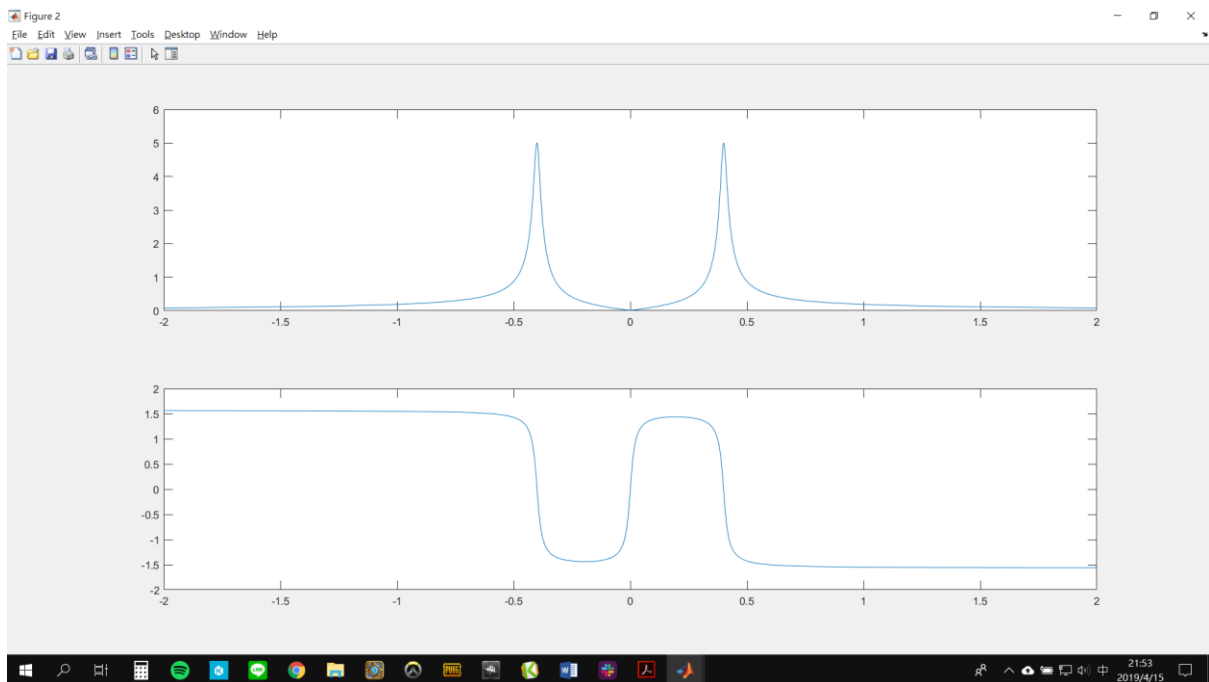
$X(f)$



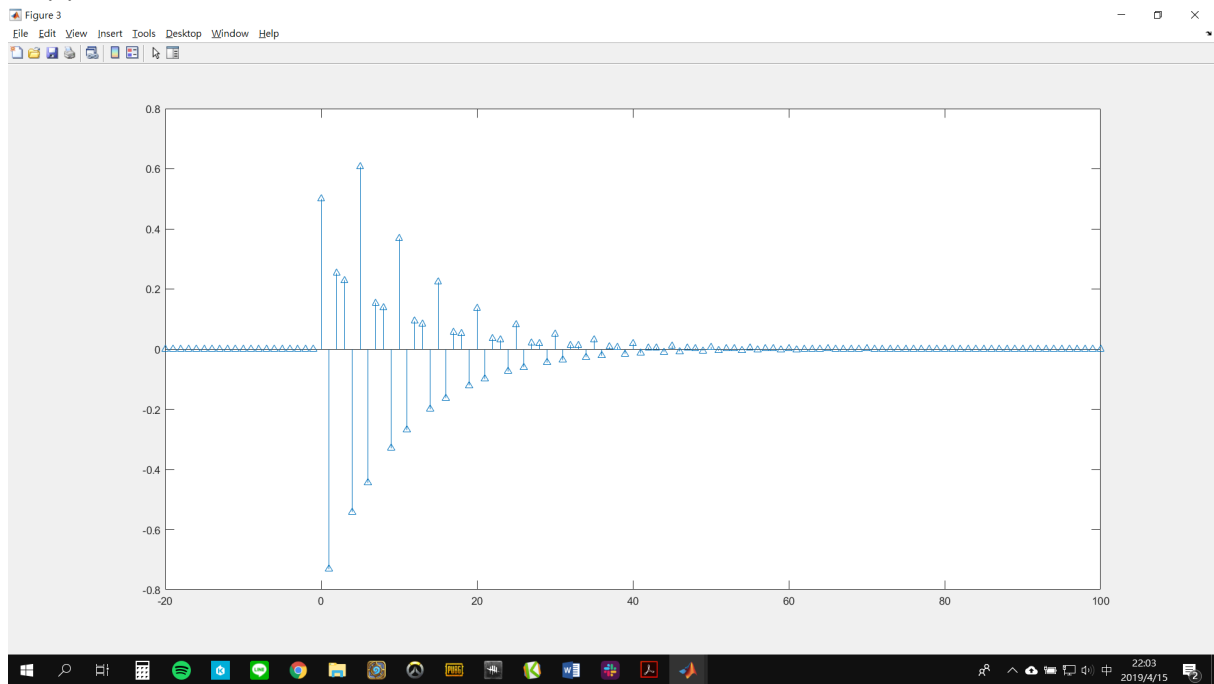
3. (a)



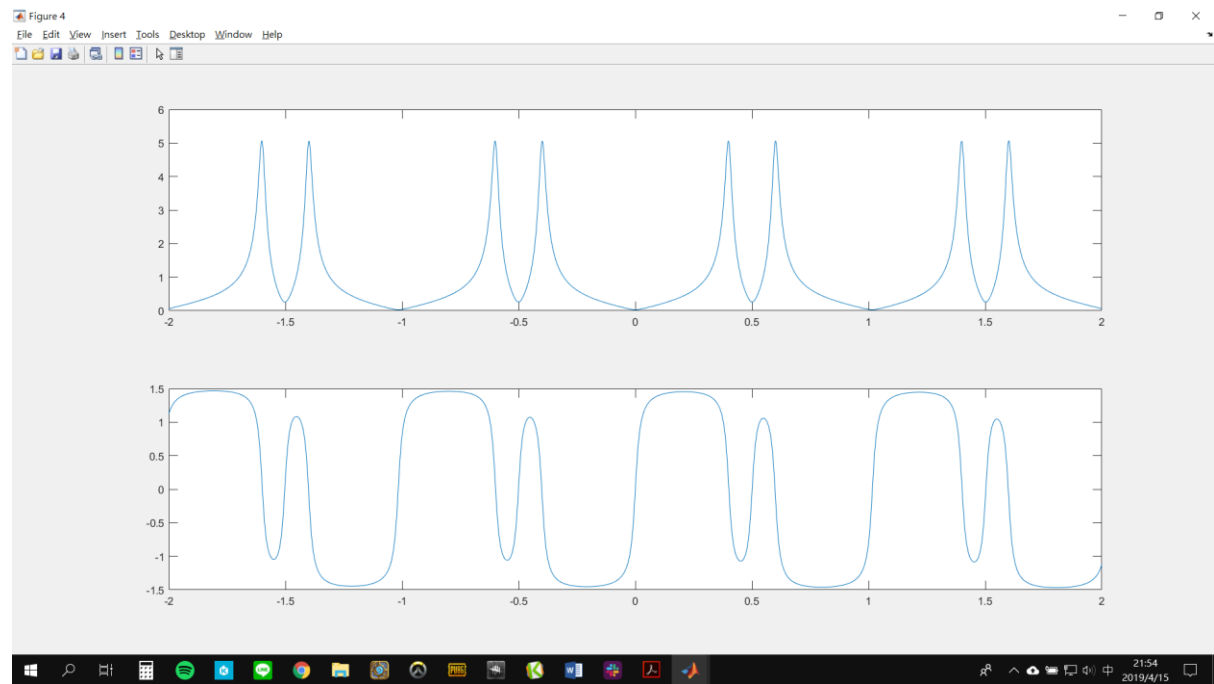
3. (b)



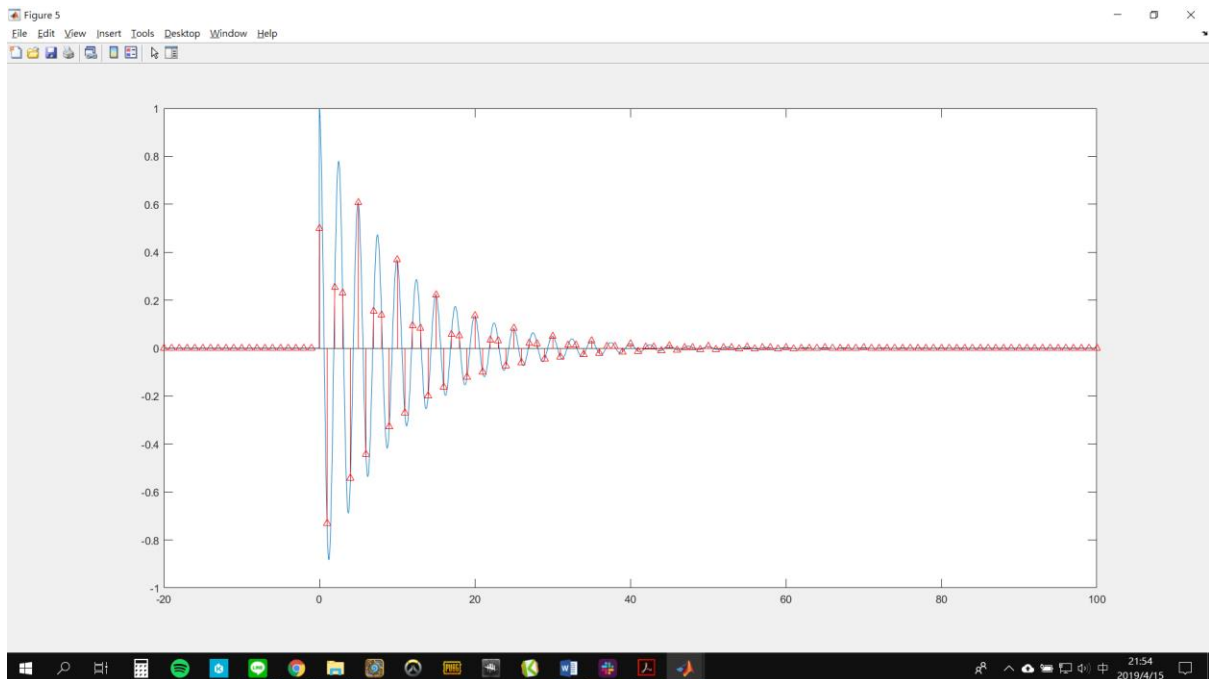
3. (c)



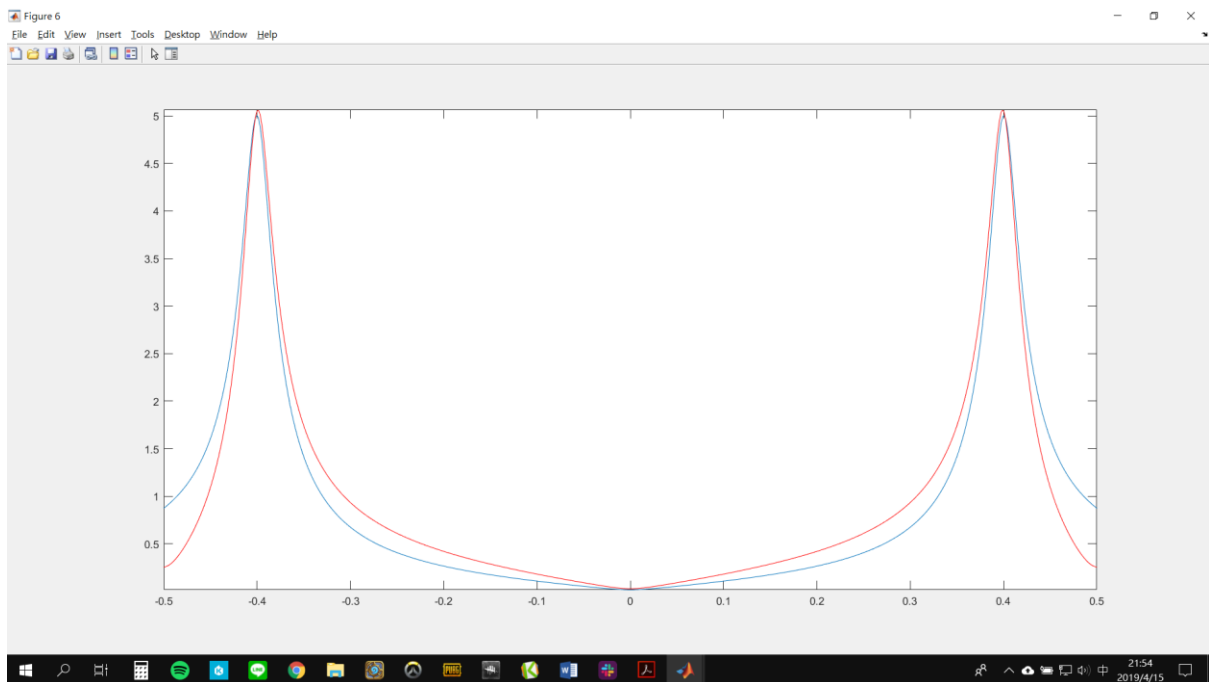
3. (d)



$x(t)$



$X(f)$



4.

2 跟 3 的差別在於 sample frequency, 2 為 0.1, 3 為 0.4, 因為 3 的 sample frequency 較大, 所以 sample 後的機率比較不接近原圖