1. a. Character / words in an email are raw data
   words can be classified into "no-spam" or "spam", based on a pre-defined database (this is information).
   If a certain amount of words is associated with "spam", the the email is classified as spam. (Knowledge)

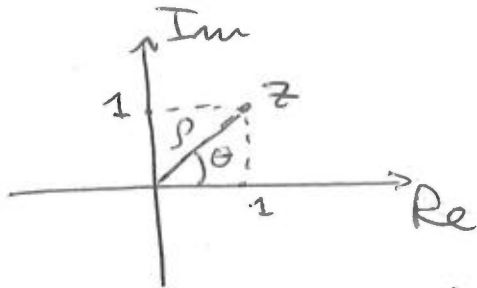   b. if number of words classified as "spam" is larger than a given threshold, then classify email as spam

2.a) $\bar{z} = 1 - i$

b) $|z| = \sqrt{1^2 + 1^2} = \sqrt{2}$

c) $z = 1 + i$

$\rho = |z| = \sqrt{2}$

$\theta = atan\left(\frac{b}{a}\right) = atan\left(\frac{1}{1}\right) = \frac{\pi}{4}$ (given the table provided)

d) $\dfrac{\bar{z}}{w} = \dfrac{1-i}{2-i} \cdot \dfrac{(2+i)}{(2+i)} = \dfrac{(1-i)(2+i)}{4+1} = \dfrac{2+i-2i+1}{5} =$

$= \dfrac{3-i}{5} = \dfrac{3}{5} - i\dfrac{1}{5}$

e) $\bar{x} = i(x-1)$ given $x = a + ib$

$\underline{a - ib = i(a + ib - 1) = ia - b - i = -b + i(a-1)}$

$\Rightarrow \begin{cases} a = -b \\ -b = a - 1 \end{cases} \rightarrow -b = -b - 1 \rightarrow 0 = -1$

$\underline{\underline{NO\ SOLUTION}}$

3. $x = \{1, 0, 1, 1\}$, $Y = \{0, 2, 1, -1\}$, $z = \{1, 0, 0, 4\}$

a) $d(x, Y) = |1-0| + |0-2| + |1-1| + |1+1| =$

$$= 1 + 2 + 0 + 2 = 5$$

$\boxed{d(x, z)} = |1-1| + |0-0| + |1-0| + |1-4| =$

$$= 0 + 0 + 1 + 3 = 4$$

$d(Y, z) = |0-1| + |2-0| + |1-0| + |-1-4| =$

$$= 1 + 2 + 1 + 5 = 9$$

x and z are most similar time series, based on dissolute distance
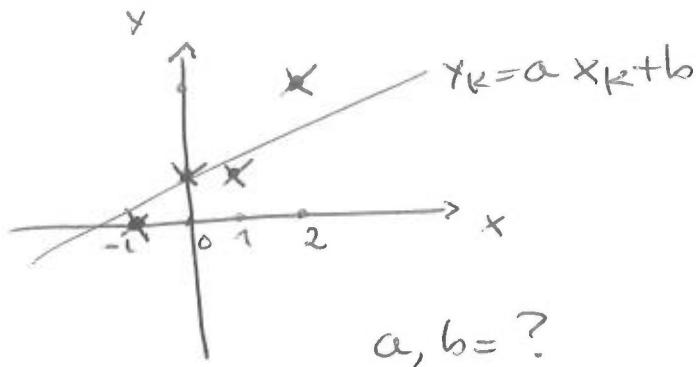
b) $\boxed{d(x, Y)} = 2$
   $d(x, z) = 3$
   $d(Y, z) = 5$

x and y are most similar time series, based on infinity distance

c) $d(x, Y) = 3$
   $\boxed{d(x, z)} = 2$
   $d(Y, z) = 4$

x and z are most similar time series, based on Edit distance

4.

x_K	-1	0	1	2
y_K	0	1	1	3

$y_K = a x_K + b$

$a, b = ?$

$y_K = a x_K + b$

$e_K = y_K - (a x_K + b)$

$e_1 = 0 - (-a + b) = a - b \Rightarrow e_1^2 = a^2 + b^2 - 2ab$

$e_2 = 1 - (b) = 1 - b \Rightarrow e_2^2 = 1 + b^2 - 2b$

$e_3 = 1 - (a + b) = 1 - a - b \Rightarrow e_3^2 = 1 + a^2 + b^2 - 2a - 2b + 2ab$

$e_4 = 3 - (2a + b) = 3 - 2a - b \Rightarrow e_4^2 = 9 + 4a^2 + b^2 - 12a - 6b + 4ab$

$$\frac{\partial V}{\partial a} = \begin{array}{l} 2a - 2b \\ 2a - 2 + 2b \\ 8a - 12 + 4b = \\ 12a - 14 + 4b = 0 \end{array}$$

$$\frac{\partial V}{\partial b} = \begin{array}{l} 2b - 2a \\ 2b - 2 \\ 2b - 2 + 2a \\ 2b - 6 + 4a = \\ 8b - 10 + 4a = 0 \end{array}$$

$\begin{cases} 12a - 14 + 4b = 0 \\ 8b - 10 + 4a = 0 \end{cases}$ $\rightarrow 4b = 14 - 12a$

$\rightarrow 2(14 - 12a) - 10 + 4a = 0 \Rightarrow$

$\Rightarrow 28 - 24a - 10 + 4a = 18 - 20a = 0 \Rightarrow \boxed{a = \dfrac{18}{20} = \dfrac{9}{10}}$

$4b = 14 - 12 \cdot \dfrac{9}{10} = 14 - \dfrac{54}{5} = \dfrac{16}{5} \Rightarrow \boxed{b = \dfrac{4}{5}}$

$$\boxed{y_K = \frac{9}{10} x_K + \frac{4}{5}}$$

5.

Fruit type	Probability	Cumulative probability
a) apples	8/22	8/22
oranges	6/22	14/22
bananas	3/22	17/22
pears	5/22	22/22 = 1

b) select a random number x from a uniform distribution in the interval [0, 1]

if $0 < x \le \frac{8}{22}$, then select "apple"

if $\frac{8}{22} < x \le \frac{14}{22}$, then select "oranges"

if $\frac{14}{22} < x \le \frac{17}{22}$, then select "banana"

if $\frac{17}{22} < x \le 1$, then select "pear"

c) given $\{-1, 0, 2, 2\}$

1. $\{2, 0, 2, 2\}$

2. $\{-1, 0, 0, 2\}$

3. $\{0, -1, 2, 2\}$

6. a)

	B	
A	G	L
G	-1,-1	[1], ⓪
L	[0] ①	0, 0

b) No, the payoffs do not sum to zero

c) Best payoff for player A: ☐
(given each strategy of player B)

Best payoff for player B: ○
(given each strategy of player A)

(Not a unique Nash equilibrium!)
there are two Nash equilibria
(no stable solution)