COMP.SGN.100 Introduction to Signal Processing
Exercise 3 - Task 1, 2

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Task 1

COMP.SGN.100 INTRODUCTION TO SIGNAL PROCESSING

EXERCISE 3

SUBMITTED BY WAJEEHA JAMIL

TASK 1

→ (a) Yes, aliasing occurs, because the signal is sampled at intervals of 0.0006 seconds.
So our sampling frequency $= \frac{1}{T} = \frac{1}{0.0006} = 1666\ Hz$
Thus, Fs is not twice the frequency of the given analog signal which is 1000 Hz.

→ (b) The frequency that the signal is interpreted to have after the sampling is:

$$\frac{Fs}{2} = \frac{1666}{2} = 833\ Hz$$

→ (c) The sufficient sampling frequency to prevent aliasing would be twice the maximum frequency of the signal. i.e,

$$2(1000\ Hz) = 2000\ Hz$$

Task 2

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Task 2

(a) $T = 0.05$ seconds

Five samples = $n = 0, 1, 2, 3, 4$

$t = nT$

$x(t) = \sin(20\pi t)$

$x(t) = \sin(20\pi n \cdot 0.05)$

$x(t) = \sin(n\pi)$ $\quad \therefore 20 \cdot 0.05 = 1$

For $n = 0$:

$x(t) = \sin(0\pi)$

$x(0) = 0$

For $n = 1$:

$x(1) = \sin(1 \cdot \pi)$

$x(1) = 0$

For $n = 2$:

$x(2) = \sin(2 \cdot \pi)$

$x(2) = 0$

For $n = 3$:

$x(3) = \sin(3 \cdot \pi)$

$x(3) = 0$

For $n = 4$:

$x(4) = \sin(4 \cdot \pi)$

$x(4) = 0$

So, all five sample values are equal to 0

Therefore, original signal cannot be reconstructed from these sample values.

WAJEEHA JAMIL TASK 2 (continue)

(b)

Sampling starts at $t = 0.025s$

so, $t = 0.025, 0.075, 0.125, 0.175, 0.225$

$$x(t) = \sin(20\pi t)$$

→ For $t = 0.025s$

$x(0.025) = \sin(20\pi \cdot 0.025)$

$x(0.025) = 1$

→ For $t = 0.075s$

$x(0.075) = \sin(20\pi \cdot 0.075)$

$x(0.075) = -1$

→ For $t = 0.125s$

$x(0.125) = \sin(20\pi \cdot 0.125)$

$x(0.125) = 1$

→ For $t = 0.175s$

$x(0.175) = \sin(20\pi \cdot 0.175)$

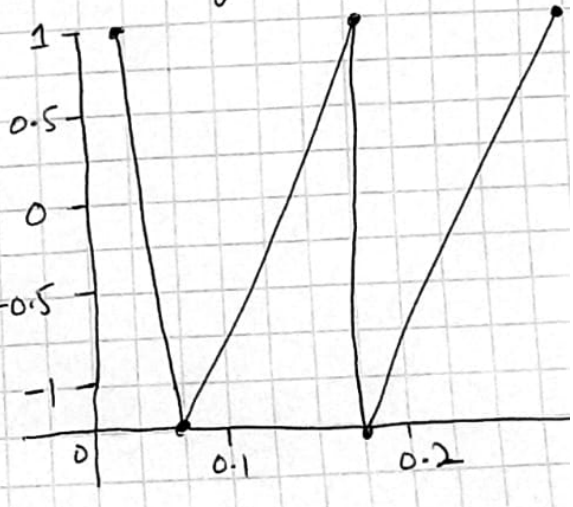
$x(0.175) = -1$

→ For $t = 0.225s$

$x(0.225) = \sin(20\pi \cdot 0.225)$

$x(0.225) = 1$

Sampling with these frequencies would give a signal like this :



As, we get maximum and minimum frequencies with this sampling (+1, -1) So, we can generate original signal with it.

No, it wouldn't present any other signal having same frequency.