German University in Cairo - German International University in Berlin
Media Engineering and Technology
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Embedded System Architecture, Berlin Winter Semester 2024
Practice Assignment 3
Discussion: 7/10/2024 - 11/10/2024

Exercise 3-1

a) Explain Pulse Width Modulation(PWM).

b) State what is meant by Duty Cycle.

c) Write a formula that links Vin, Vout and Duty Cycle together.

d) What would be the Duty Cycle in % if we want to output a voltage of 0.6V from a 3.2V input?

e) What would be the output voltage of a signal with 20% duty cycle and a 7V input.

Solution:

a) PWM helps adjust the width of the signal. This can help change the speed of motor, brightness of an LED or the sound of the buzzer.

b) Duty Cycle = ON Period/(ON+OFF Period) = ON Period/Time Period

c) Vout = Vin * Duty Cycle

d) Duty Cycle = 0.6/3.2 = 0.1875 = 18.75%

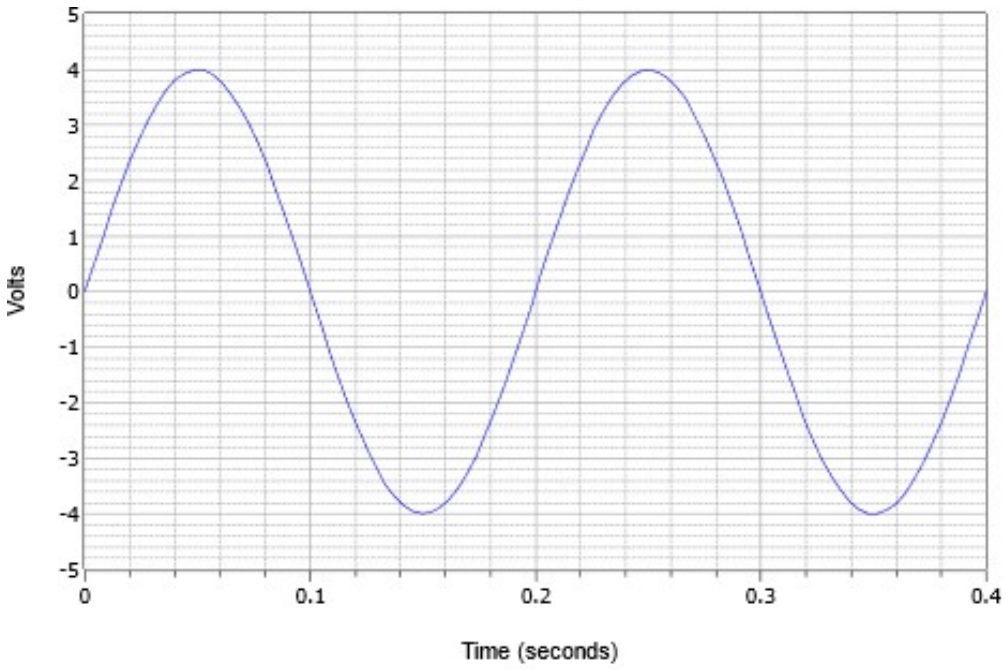
e) Vout = 20% * 7 = 1.4V

Exercise 3-2

a) Explain Pulse Proportional Modulation(PPM).

b) What are the steps to generate a PPM digital signal from an analog signal.

c) For the analog signal below draw the equivalent PPM signal.

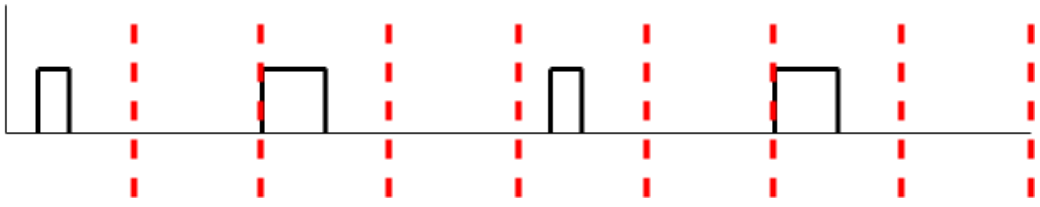


Solution:

a) PPM is a way that creates a specific code for each signal and sends this code to the servo motor so it would know which direction it should move in.

b)
1. Sampling
2. Quantization
3. Encoding

Sample x value	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4
Sampled y value	4	0	-4	0	4	0	-4	0
Quantized	4	0	-4	0	4	0	-4	0
Encoded (2's comp)	0100	0000	1100	0000	0100	0000	1100	0000



c)