ECS 332: In-Class Exercise # 5

Instructions

1. Separate into groups of no more than three persons.
2. **The group cannot be the same as any of your former groups.**
3. Only one submission is needed for each group.
4. Write down all the steps that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.
5. **Do not panic.**

Date: 11 / 10 / 2017			
Name	ID (last 3 digits)		
Prapun	**5**	**5**	**5**

1. Consider the impulse train $g(t)$ shown on the left in Figure 1. Plot its Fourier transform $G(f)$ from $f=-2$ to $f=2$. Explanation is not required for this question.

[See 4.46 in the lecture notes.]

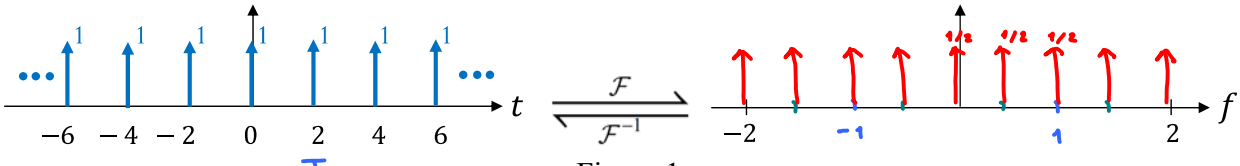

Figure 1

T_0

$f_0 = \frac{1}{2}$

2. Consider a "square" wave (a train of rectangular pulses) $r(t)$ shown in Figure 2.

Its value periodically alternates between A and 0 with period T_0. Suppose $A = 2$.

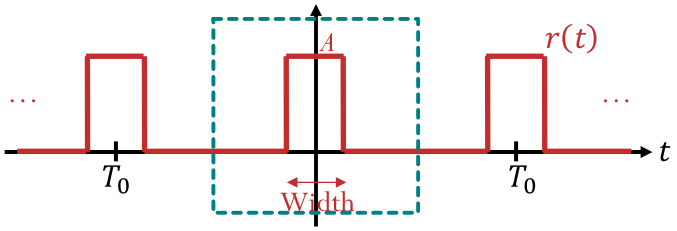

Figure 2

The Fourier series expansion of $r(t)$ is given by $\sum_{k=-\infty}^{\infty} c_k e^{j2\pi(kf_0)t}$ where $f_0 = 1/T_0$.

See recipe 4.44 on p. 56 of the lecture notes

$c_k = \frac{1}{T_0} R_{T_0}(kf_0)$

d

a. Suppose the duty cycle is 50%. Find c_0 and c_2.

1/2

$\frac{1}{2} \times 2 = c_0 =$ 1, $c_2 =$ 0

$c_0 = \frac{1}{T_0} R_{T_0}(0) = \langle r(t) \rangle$

See the last sentence on p. 59 of the lecture notes.

$R_{T_0}(0)$ = area under one rectangular function

= width × A

= d × T_0 × A

b. Suppose the duty cycle is 20%. Find c_0 and c_5.

1/5

$\frac{1}{5} \times 2 = c_0 =$ 0.4, $c_5 =$ 0

$c_0 = \frac{1}{T_0} R_{T_0}(0) = d \times A$