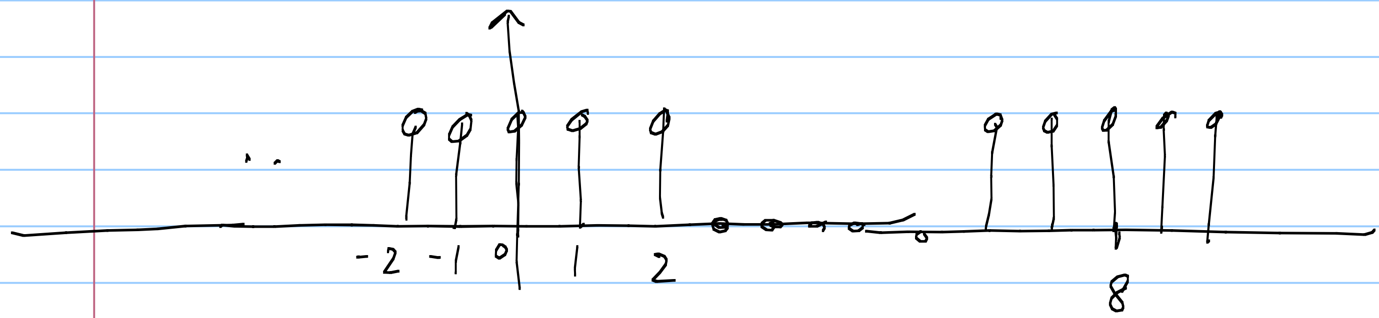
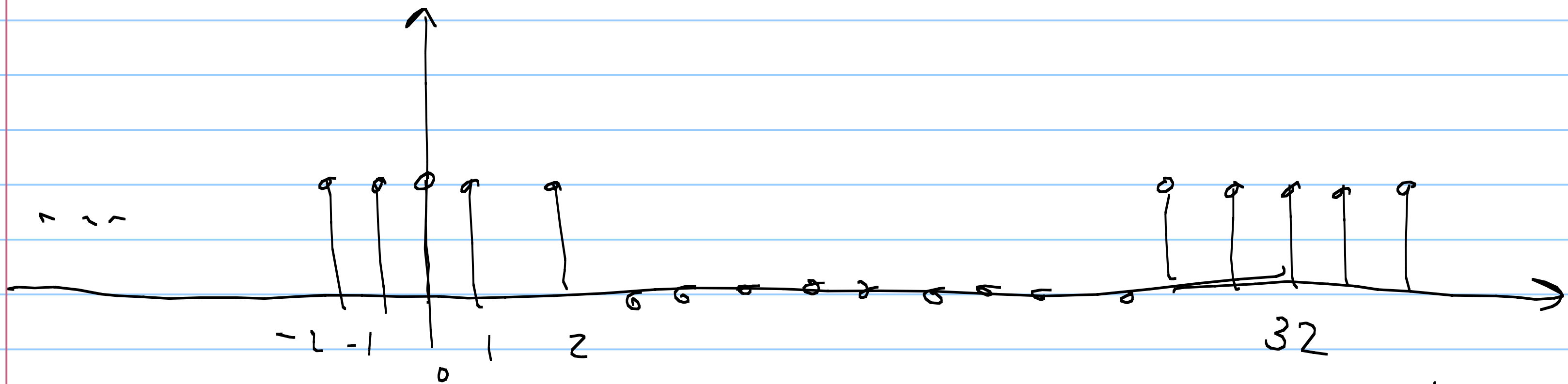
Note Title

EC 5142 Sep. 8 2011

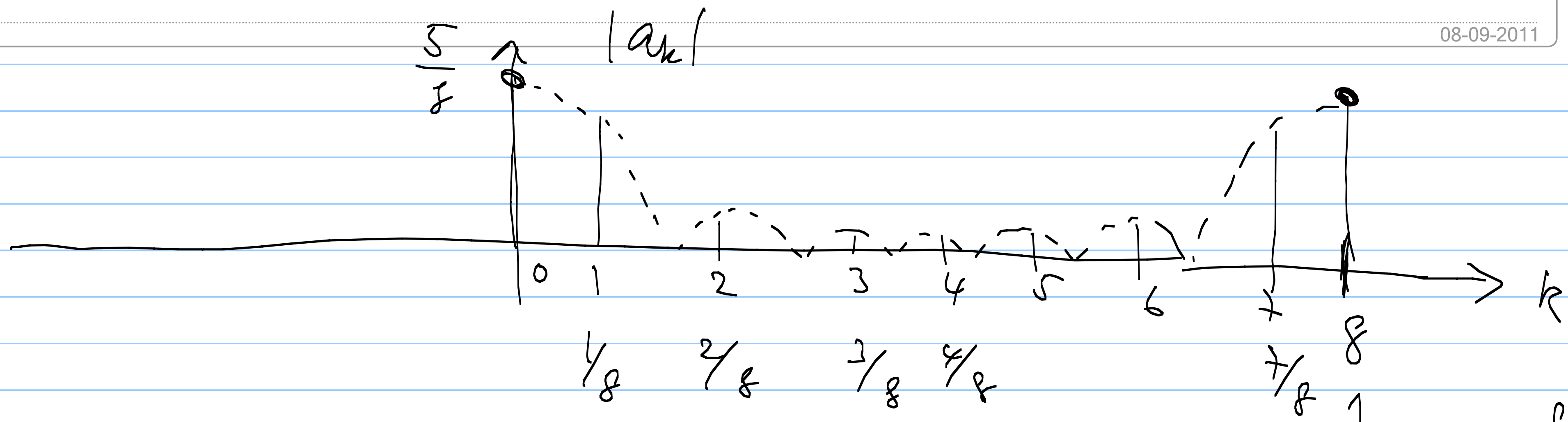
08-09-2011



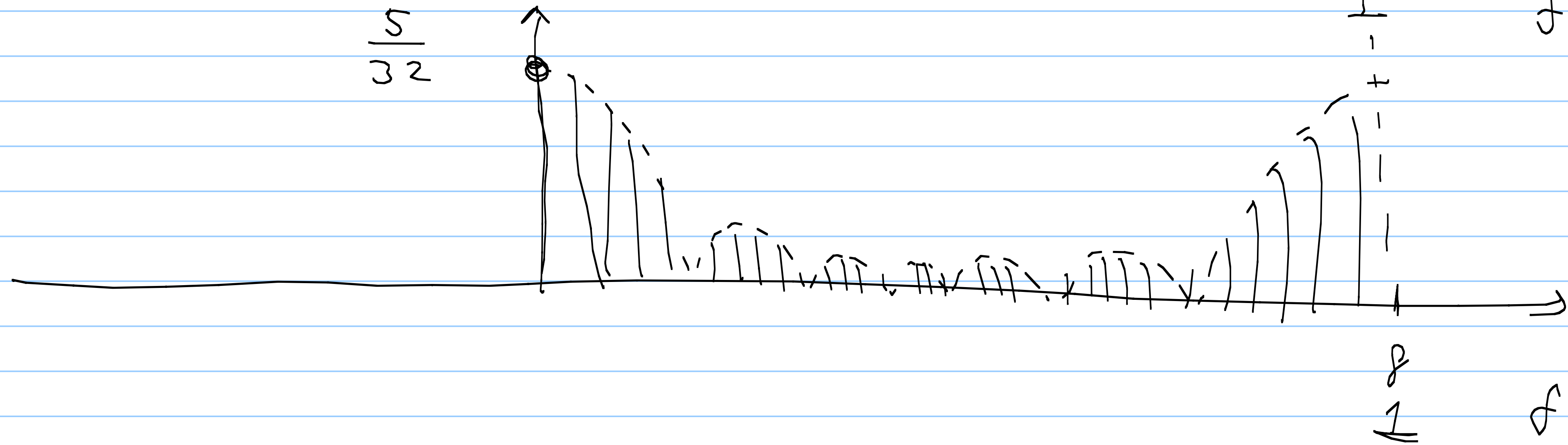
$$a_k = \frac{1}{8} \frac{\sin \frac{5\pi k}{8}}{\sin \frac{\pi k}{8}}$$



$$a_k = \frac{1}{32} \frac{\sin \frac{5\pi k}{32}}{\sin \frac{\pi k}{32}}$$



5/8
|a_k|
0
1
2
3
4
5
6
7
8
k
1/8
2/8
3/8
4/8
7/8
1
f



5/32
8
1
f

DFT

$x[n]$ given for $n = 0, 1, \ldots, N-1$

$$X[k] \overset{\text{def}}{=} \sum_{n=0}^{N-1} x[n]\, e^{-j 2\pi k n / N} \qquad \xrightarrow{\text{DFT}}$$

k^{th} DFT coefficient

$$X[k+N] = X[k]$$

$X[k]$ need to be considered only for $k = 0, 1, \ldots, N-1$

$$x[n] = \frac{1}{N}\sum_{k=0}^{N-1} X[k]\, e^{j\frac{2\pi k n}{N}} \qquad \text{IDFT}$$

$$x[n+N] = x[n]$$

Recall:

$$x(n) = \sum_{n=0}^{N-1} a_k\, e^{j\frac{2\pi k n}{N}}$$

Where $x[n+N] = x[n]$

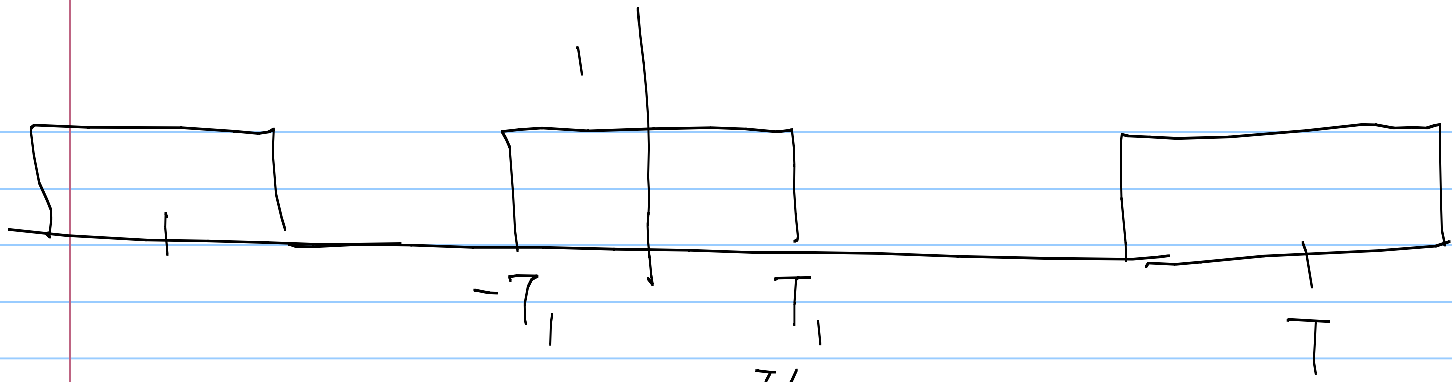
$$a_k = \frac{1}{N} \sum_{n=0}^{N-1} x[n]\, e^{-j\frac{2\pi k n}{N}}$$

$$N a_k = \sum_{n=0}^{N-1} x[n]\, e^{-j 2\pi k n/N} = X[k]$$

$$x(t+T) = x(t)$$

$$x(t) = \sum_{k=-\infty}^{\infty} a_k e^{-jk\Omega_0 t} \qquad \Omega_0 = 2\pi/T$$

$$a_k = \frac{1}{T} \int_T x(t) e^{+jk\Omega_0 t} dt$$



$$a_k = \frac{1}{T}\int_{-T/2}^{T/2} 1 \cdot e^{-jk\frac{2\pi}{T}t}\,dt$$

$$= \frac{1}{T}\int_{-T_1}^{T_1} e^{-jk\frac{2\pi}{T}t}\,dt = \frac{1}{T}\,\frac{\sin\frac{2\pi k T_1}{T}}{k\,\pi/T}$$