Last Name: _____

First Name: _____

ID Number: _____

I have neither given nor received aid on this examination, nor have I concealed any Honor Code violation.

Signature: _____

Eng. 100 (Music Signal Processing) Exam 1, 2015-10-22 (in class)

- There are **??** DSP problems for a total of **??** points. (THIS IS JUST A DRAFT!)
- This exam has **??** pages for the DSP part. Make sure your copy is complete.
- This exam is closed notes, closed book, no calculators or other electronic devices.
- Give *units* for problems involving numerical values that have units.
- When sketching plots, label both axes to the full extent possible from the information given.
- For full credit, ~~cross out~~ any incorrect intermediate steps.
- Clearly $\boxed{\text{box}}$ your final answers. For full credit, show your complete work clearly.
- Legible writing will help when it comes to partial credit.
- Some of the following formulas may be helpful.

$$\text{MIDI} = 69 + 12\log_2(f/440)$$

$$f = \frac{S}{2\pi}\arccos\left(\frac{x[n+1]+x[n-1]}{2\,x[n]}\right)$$

$$\cos(a+b) = \cos(a)\cos(b) - \sin(a)\sin(b)$$
$$\cos(a-b) = \cos(a)\cos(b) + \sin(a)\sin(b)$$
$$2\cos(a)\cos(b) = \cos(a+b) + \cos(a-b)$$

ϕ	0	$\pi/6$	$\pi/4$	$\pi/3$	$\pi/2$	π
$\cos(\phi)$	1	$\sqrt{3}/2$	$\sqrt{2}/2$	$1/2$	0	-1

If $x(t)$ is periodic with period T, then $x(t) = c_0 + \sum_{k=1}^{\infty} c_k \cos\left(2\pi\frac{k}{T}t - \theta_k\right)$
and $x(t) = a_0 + \sum_{k=1}^{\infty} a_k \cos\left(2\pi\frac{k}{T}t\right) + b_k \sin\left(2\pi\frac{k}{T}t\right)$, where $c_k = \sqrt{a_k^2 + b_k^2}$ and $\tan\theta_k = b_k/a_k$.

Notes	A	A♯	B	C	C♯	D	D♯	E	F	F♯	G	G♯
Hertz	440	466.2	493.9	523.3	554.4	587.3	622.3	659.3	698.5	740.0	784.0	830.6

Useful powers of 2: $2^3 = 8$, $2^4 = 16$, $2^5 = 32$, $2^6 = 64$, $2^7 = 128$, $2^8 = 256$, $2^9 = 512$,
$2^{10} = 1024$, $2^{11} = 2048$, $2^{12} = 4096$, $2^{13} = 8192$.