1. Student Information
   Filled out.

2. Administrivia
   I need to do the following two things:
   (1) Attend at least 75% of the discussions (not including discussions in the first week of class);
   (2) Perform better on the corresponding part of the final (linear algebra or circuits) than my lowest midterm.

3. Stojanovic's Optimal Smoothies.

(a). Let Professor Ranade's ratings for strawberries, bananas, mangos, blueberries (a) (b) (c) (d)
be a, b, c, d, respectively

So, given the information, we have:
$$\begin{cases} \frac{1}{3}a + \frac{1}{3}b + 0\cdot c + \frac{1}{3}d = 7, & (1) \\ \frac{1}{3}a + \frac{1}{3}b + \frac{1}{3}c + 0\cdot d = 7, & (2) \\ 0\cdot a + \frac{2}{5}b + \frac{3}{5}c + 0\cdot d = 7\frac{2}{5} & (3) \\ \frac{2}{3}a + \frac{1}{3}b + 0\cdot c + 0\cdot d = 6\frac{1}{3}. & (4) \end{cases}$$

(Eq. 1 − Eq. 2) ×3 : $d - c = 0$ so $c = d$. (5)

(Eq 4 − Eq 1) ×3 : $a - d = -2$ so $a = d - 2$ (6)

Plug Eq 5, 6 into Eq 2 : $\frac{1}{3}(d-2) + \frac{1}{3}b + \frac{1}{3}d = 7$, so $d - 2 + b + d = 21$.

so $b = 23 - 2d$. (7)

Plug Eq 5, 7 into Eq 3 : $\frac{2}{5}(23-2d) + \frac{3}{5}d = 7\frac{2}{5}$, so $46 - 4d + 3d = 37$.

so $d = 9$. (8)

Plug Eq 8 into Eq 5, 6, 7. so $c = 9$, $a = 7$, $b = 5$

Thus, Professor Ranade's rating for strawberries is $\boxed{7}$.
for bananas is $\boxed{5}$.
for mangos is $\boxed{9}$.
for blueberries is $\boxed{9}$.

(b). Professor Stojanovic should put in any combination mangos and blueberries.
Since there are infinite-many answers, I'll pick $\frac{1}{2}$ mangos and $\frac{1}{2}$ blueberries.
The score Professor Ranade would give is: $(\frac{1}{2}\cdot 9 + \frac{1}{2}\cdot 9) = \boxed{9}$

Since 9 = 9 > 7 > 5.

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4. Filtering Out The Troll

(a). $\vec{m_1} = \cos(45°)\cdot\vec{a} + \cos(-30°)\cdot\vec{b}$

and $\vec{m_2} = \sin(45°)\cdot\vec{a} + \sin(-30°)\cdot\vec{b}$

Thus, $\vec{m_1} = \frac{\sqrt{2}}{2}\vec{a} + \frac{\sqrt{3}}{2}\vec{b}$, $\vec{m_2} = \frac{\sqrt{2}}{2}\vec{a} - \frac{1}{2}\vec{b}$

(b) We have $\begin{cases} \frac{\sqrt{2}}{2}\vec{a} + \frac{\sqrt{3}}{2}\vec{b} = \vec{m_1} & (1) \\ \frac{\sqrt{2}}{2}\vec{a} - \frac{1}{2}\vec{b} = \vec{m_2} & (2). \end{cases}$

Eq.1 + $\sqrt{3}\cdot$ (Eq.2): $\frac{\sqrt{2}}{2}\vec{a} + \frac{\sqrt{3}}{2}\vec{b} + \frac{\sqrt{6}}{2}\vec{a} - \frac{\sqrt{3}}{2}\vec{b} = \vec{m_1} + \sqrt{3}\vec{m_2}$

so, $\frac{\sqrt{6}+\sqrt{2}}{2}\vec{a} = \vec{m_1} + \sqrt{3}\vec{m_2}$

Thus, $\vec{a} = \frac{2}{\sqrt{6}+\sqrt{2}}\vec{m_1} + \frac{2\sqrt{3}}{\sqrt{6}+\sqrt{2}}\vec{m_2}$

which means that, $\vec{a} = \frac{\sqrt{6}-\sqrt{2}}{2}\vec{m_1} + \frac{3\sqrt{2}-\sqrt{6}}{2}\vec{m_2}$

Thus, $u = \frac{\sqrt{6}-\sqrt{2}}{2}$ and $v = \frac{3\sqrt{2}-\sqrt{6}}{2}$

(c). "All human beings are born free and equal in dignity and rights."

It is taken from the Universal Declaration of Human Rights.

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EE16A: Homework 1

Problem 4: Filtering Out The Troll

In [4]:
```
import numpy as np
import matplotlib.pyplot as plt
import wave as wv
import scipy
from scipy import io
import scipy.io.wavfile
from scipy.io.wavfile import read
from IPython.display import Audio
import warnings
warnings.filterwarnings('ignore')
sound_file_1 = 'm1.wav'
sound_file_2 = 'm2.wav'
```

Let's listen to the recording of the first microphone (it can take some time to load the sound file).

In [5]:
```
Audio(url='m1.wav', autoplay=False)
```

Out[5]:

And this is the recording of the second microphone (it can take some time to load the sound file).

In [6]:
```
Audio(url='m2.wav', autoplay=False)
```

Out[6]:

We read the first recording to the variable `corrupt1` and the second recording to `corrupt2`.

In [7]:
```
rate1,corrupt1 = scipy.io.wavfile.read('m1.wav')
rate2,corrupt2 = scipy.io.wavfile.read('m2.wav')
```

Enter the gains of the two recordings to get the clean speech.

Note: The square root of a number a can be written as `np.sqrt(a)` in IPython.

In [8]:
```
# enter the gains u (recording 1) and v (recording 2)
u = (np.sqrt(6) - np.sqrt(2)) / 2
v = (3 * np.sqrt(2) - np.sqrt(6)) / 2
```

Weighted combination of the two recordings:

In [9]:
```
s1 = u*corrupt1 + v*corrupt2
```

Let's listen to the resulting sound file (make sure your speaker's volume is not very high, the sound may be loud if things go wrong).

In [10]:
```
Audio(data=s1, rate=rate1)
```

Out[10]:

5. Homework Process and Study Group

   I worked alone without getting any help, except asking about format questions on Piazza.