

# Modeling Motion Midterm

## Computing Take-home

1. Write a function called `mean()` which takes an arbitrarily long list of numbers as an argument and returns the arithmetic mean of all of the numbers in that list. Following program should print "3.025":

```
print mean( [1,2,3,4,5.125] )
```

2. Write a function called `backwards` which takes a list as an argument and returns a new list with the same items in reverse order. It should make the following program print "you are how ?":

```
import string
sentence = ['how', 'are', 'you']
print string.join(backwards(sentence), '?')
```

3. Write a program which draws a sine wave by printing out successive lines to the terminal which contain a capital 'O' character with a varying number of spaces in front of it. The the number of spaces should be determined by formula  $30*(1+\sin(\theta))$ . Make it print one full period of sine in 30 lines  
Hint: the print can print copies of a string by using the '\*' operator to "multiply" strings as follows:

```
>>> print "Hello"*3
HelloHelloHello
```

4. A useful operation on vectors is the dot product. The dot product of two vectors  $(A_i+B_j)$  and  $(C_i+D_j)$  is  $AC+BD$ , a scalar quantity. Using our convention of representing 2D vectors as two element Python lists, write a function called `dot()` which takes two vectors as parameters and returns the dot product. For example:

```
>>> vector1=[1,2]
>>> vector2=[3,4]
>>> print dot(vector1,vector2)
11
```

5. Write a function, `vecadd()` which takes as an argument an arbitrarily long list of 2D vectors, adds them all together and returns the resultant vector.

```
>>> vec1 = [6,1]
>>> vec2 = [1,6]
>>> vec3 = [-7,-7]
>>> veclist = [vec1,vec2,vec3]
>>> print vecadd(veclist)
[0, 0]
```