Numerical Analysis and Programming

Lab Worksheet #5

1. The following function approximately determines the *machine epsilon* (ϵ) for a given type (defaults to `float`), using the definition that ϵ is the smallest positive number such that $1 + \epsilon \neq 1$.

```
def machineEpsilon(func=float):
    machine_epsilon = func(1)
    while func(1)+func(machine_epsilon) != func(1):
        machine_epsilon_last = machine_epsilon
        machine_epsilon = func(machine_epsilon) / func(2)
    return machine_epsilon_last
```

   Understand what the function does, and determine ϵ for `int`, `float`, and `complex`. How is `float` in Python represented, single or double precision?

2. Determine the machine representation in hexidecimals in IEEE single precision for the following decimal numbers: a. 2^{30}, b. 64.015625, c. 8×2^{24}.

3. Determine the decimal numbers that have the following machine representations: a. $[3F27E520]_{16}$, b. $[3BCDCA00]_{16}$, c. $[BF4F9680]_{16}$.

4. In the homework, you are required to write programs to perform the conversions above. Explore the `struct` module in Python. Learn to use two functions in the module: `pack` and `unpack`. Try the following code

```
import struct
ss=struct.pack("I",0xBF4F9680)
print "ss", ss
output, =struct.unpack("I", ss)
print output
```

   What does the code do? What if you change the format string `"I"` to `"i"`?