Exam: Programming & Scientific Computing in Python (AE1205)
Date: Tuesday July 1st, 2014 , 09:00-12:00 hr (total 100 pts)

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Part I: Reading Python (18 pts, 3 pts per question)

1. What will be printed by the following program?

```
n = 1
for i in range(0,10,3):
    if i%2==0:
        n = n + n
print n
```

2. What will be printed by the following program?

```
count = 0
n     = 4
for i in range(n):
    for j in range(i):
        count = count+1
print count
```

3. What will be printed by the following program?

```
n = 0
while n<10:
    n = n + 1
    k = n
    for i in range(k):
        n = n + i
    n = n + 5
print n
```

4. What will be printed by the following program?

Note: `ord('a') = 97, ord('b')=98,… ord(' ')=32, ord('!')=33`

```
def encrypt(word):
   wordlen = len(word)
   i = 0
   while i<wordlen-6:
      asc = ord(word[i])
      print chr(asc+1),
      i = i + 1
   return

encrypt('Hello World'.lower())
```

5. What will be printed by the following program?

```
import numpy as np
a = np.linspace(0,10,5)
b = np.arange(-10,10,0.1)
print a[-1]+b[1]
```

6. What will be printed by the following program?

```
from numpy import *
a = array(range(1,21))
print sum(a[(a%4==0)+(a%5==0)])
```

Part II Debugging Python: multiple choice (3 x 3 pts) and one open question(4 pts)

7. The following program is executed:

```
from math import *
import numpy as np
x = np.ones(8)
y = cos(x)
print 'Ready'
```

Unfortunately, it returns the following error message:

```
Traceback (most recent call last):
  File "D:/My Documents/Python/prob7.py", line 4, in <module>
    y = cos(x)
TypeError: only length-1 arrays can be converted to Python
scalars
```

How should this error be fixed?

A) np.ones() call is wrong, it should be ones(8), without the prefix np.
B) np.ones() call is wrong, it should be np.ones((8)), so double brackets
C) np.ones() call is wrong, arrays contain by default floating point values so it should be changed into np.ones(8.), with a decimal point behind the 8
D) Math should not be imported as it causes a problem with duplicate names cos
E) The cos function should be changed into np.cos() so it will call numpy's cosine function
F) It is not possible in Python to calculate the cosines of a numpy array all at once, so it should be changed into a for-loop as x is a numpy array, and not a Python scalar,

8. Which statement is true about the following program?

```
x = 20
a = 5
for i in range(a):
    x = x + i/x
print x
```

A) This program will give an error message: TypeError when run
B) The program has an indentation error (too many spaces)
C) This program contains a syntax error which will give an error message
D) This program mixes data types, which will give unexpected results

9. Which statement is true about the following program?

```
ttab = []
xtab = []

for t in range(0.0,10.1,0.1):

    ttab.append(t)
    xtab.append(25.-0.5*9.81*t*t)
    print ttab[-1],int(xtab[-1])

print "Ready"
```

A) This program will give an error message: TypeError when run
B) This program has an indentation error
C) This program contains an error in the expression of xtab
D) This program mixes data types, which will give unexpected results

10. The following program is run (line numbers are added for the questions below):

```
 1) from numpy import *
 2) import matplotlib.pyplot as plt
 3)
 4) g  = 9.80665
 5) t  = linspace(0.0,10.0,1001)
 6) h0 = 25.0
 7) y  = h0-0.5*g*t*t
 8)
 9) plt.plot(t,y,’r-‘)
10) plt.plot(t,h0,’b.’)
11) plt.show()
```

It results in a screen full of error messages:

```
Traceback (most recent call last):
  File "D:/My Documents/plotfall.py", line 10, in <module>
    plt.plot(t,h0,'b.')
  File "C:\Python27\lib\site-packages\matplotlib\pyplot.py", line 2987,
in plot
    ret = ax.plot(*args, **kwargs)
  File "C:\Python27\lib\site-packages\matplotlib\axes.py", line 4137,
in plot
    for line in self._get_lines(*args, **kwargs):
  File "C:\Python27\lib\site-packages\matplotlib\axes.py", line 317, in
_grab_next_args
    for seg in self._plot_args(remaining, kwargs):
  File "C:\Python27\lib\site-packages\matplotlib\axes.py", line 295, in
_plot_args
    x, y = self._xy_from_xy(x, y)
  File "C:\Python27\lib\site-packages\matplotlib\axes.py", line 237, in
_xy_from_xy
    raise ValueError("x and y must have same first dimension")
ValueError: x and y must have same first dimension
```

So something must be wrong. One change will fix this program, There are two possibilities for which line to change. Which two lines can be changed to fix this?

Answer by just the two possibilities (so twice a line number and correct program line) which independently would make the program correct.