CS596-032 Midterm Exam Test-1

Student ID:  
Test ID: 00001

Test date: 2016-06-25, 9:00am – 11:00am

Close Books/Notes/Computers

Please use No. 2 pencils

Note: In all the questions, the Python code is assumed to be executed in IPython Notebook.

**Problem 1)** Python dictionary
What will be the output of the following Python code?

```python
foo = {'a':1, 1:'b','c':2, 3:'3'}
del foo[1]
foo[1] = '2'
del foo['c']
foo['1'] = 'bar'
print foo
```

**Answers 1:**

a) {'a':1, 1:'b','c':2, 3:'3'}
b) {'a':1, 1:'bar', 3:'3'}
c) {'a':1, 1:'2', 1:'bar', 3:'3'}
d) {'a':1, 1:'2', 'c':2, 3:'3'}
e) {1:'a', 1:'2', 1:'2', 3:'3'}
Problem 2) Python list

What will be the output of the following Python code?

```python
names1 = ['Alice', 'Andrea', 'Anna', 'Audrey']
names2 = names1
sum = 0
for ls in (names1, names2):
    if 'Alice' in ls:
        sum += 1
        ls[1] = 'Alysha'
    elif 'Alysha' in ls:
        sum += 2
    if 'Ava' in ls:
        sum += 4
    else:
        ls[0] = 'Ava'
print names2, sum
```

Answers 2:

a) ['Ava', 'Andrea', 'Anna', 'Audrey'] 2
b) ['Ava', 'Alysha', 'Anna', 'Audrey'] 7
c) ['Alice', 'Andrea', 'Anna', 'Audrey'] 4
d) ['Alice', 'Alysha', 'Anna', 'Ava'] 6
e) ['Ava', 'Alice', 'Alysha', 'Anna'] 6

Problem 3) Numpy array slicing

What will be the output of the following Python code?

```python
import numpy as np
a = np.arange(24).reshape((4, 6))
b = np.ones((2, 3))
a[:,2:-1,2:-1:] - a[1::2,1::2] + b
```

Answers 3:

a) array([[ 14,  13,  12], [  2,   1,   0]])
b) array([[  0,  0,  0], [  6,  6,  6]])
c) array([[  1,  2,  3], [ 12, 13, 14]])
d) array([[12, 13, 14], [-5, -6, -7]])
e) array([[20, 20, 20], [32, 32, 32]])
Problem 4) Boolean Indexing

What will be the output of the following Python code?

```python
import numpy as np
a = np.arange(24).reshape((4, 6))
b = a >= 16
a[b] = 16
np.sum(a, axis=1)
```

Answers 4:

a) 248  
b) array([36, 40, 44, 47, 50, 53])  
c) array([15, 51, 87, 123])  
d) array([15, 51, 87, 117])  
e) array([15, 51, 86, 96])

Problem 5) pandas DataFrame

What will be the outputs of the following Python code?

```python
from pandas import Series, DataFrame
import pandas as pd
import numpy as np
df = DataFrame({'A': ['foo']*3+['bar']*2, 'B': ['one']*2+['two']*2+['three'], 'C': [1]+[2]*2+[3]*2})
df['A'][::2]
```

Answers 5:

a)
```
   0    foo
   1    bar
   2    foo
   3    bar
   4    foo
Name: A, dtype: object
```

c)
```
   0    foo
   1    foo
   2    foo
   3    bar
   4    bar
Name: A, dtype: object
```

b)
```
   0    foo
   1    foo
   2    foo
   Name: A, dtype: object
```

d)
```
   0    foo
   1    foo
   2    bar
   Name: A, dtype: object
```
Problem 6) pandas DataFrame

Continuing with the previous question, what will be the output of the following code?

```python
df1 = df.drop_duplicates(['A', 'C'])
df1[['A','B']]
```

**Answers 6:**

<table>
<thead>
<tr>
<th>a)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>foo</td>
<td>one</td>
</tr>
<tr>
<td>3</td>
<td>bar</td>
<td>one</td>
</tr>
<tr>
<td>4</td>
<td>bar</td>
<td>three</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>foo</td>
<td>one</td>
</tr>
<tr>
<td>1</td>
<td>foo</td>
<td>one</td>
</tr>
<tr>
<td>3</td>
<td>bar</td>
<td>two</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>c)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>foo</td>
<td>two</td>
</tr>
<tr>
<td>3</td>
<td>bar</td>
<td>two</td>
</tr>
<tr>
<td>4</td>
<td>bar</td>
<td>three</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>d)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>foo</td>
<td>one</td>
</tr>
<tr>
<td>1</td>
<td>bar</td>
<td>one</td>
</tr>
<tr>
<td>3</td>
<td>bar</td>
<td>three</td>
</tr>
</tbody>
</table>

Problem 7) pandas DataFrame

Continuing with the previous code, what will be the output of the following code?

```python
df2 = df.ix::2,['A','C'])
df2
```

**Answers 7:**

<table>
<thead>
<tr>
<th>a)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>foo</td>
<td>one</td>
</tr>
<tr>
<td>2</td>
<td>foo</td>
<td>one</td>
</tr>
<tr>
<td>4</td>
<td>bar</td>
<td>two</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>foo</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>bar</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>bar</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>c)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>foo</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>foo</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>bar</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>d)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>foo</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>foo</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>bar</td>
<td>3</td>
</tr>
</tbody>
</table>
Problem 8) pandas DataFrame

Start with the following code segment that uses 2 dictionaries to represent the prices and the amounts for 4 fruits. Which of the additional code below calculates and prints out the total prices of all fruits correctly?

```python
from pandas import Series, DataFrame
import pandas as pd
import numpy as np
prices = {"apple": 2, "banana": 1.2, "orange": 0.95, "watermelon": 1}
amount = {"apple": 3, "banana": 2, "orange": 4, "watermelon": 3}
```

Answers 8: (Select all the correct ones.)

a)  
```python
from pandas import Series
prices = Series(prices)
amount = Series(amount)
total = prices*amount
print total
```

b)  
```python
total = 0
for key in prices:
    total = float(prices[key]) * float(amount[key]) + total
print total
```

c)  
```python
total = 0
for key1, key2 in (prices, amount):
    if (key1 == key2):
        total = float(prices[key1]) * float(amount[key2]) + total
print total
```

d)  
```python
total = 0
for key1, key2 in zip(prices, amount):
    if (key1 == key2):
        total = float(prices[key1]) * float(amount[key2]) + total
print total
```

e)  
```python
from pandas import Series
prices = Series(prices)
amount = Series(amount)
total = prices*amount
print total.sum()
```
Problem 9) List comprehension

What will be the output of the following code?

```python
a = [3,4,17,32,45,97,12,20,65,72]
a1 = [x/4 for x in a if x%2 != 0]+2
print a1
```

Answers 9:

a) [0, 4, 11, 24, 0, 4, 11, 24, 16]

b) [2, 16, 6, 10, 36]

c) [0, 4, 11, 24, 16]

d) [1, 8, 3, 5, 18]

e) [1, 8, 3, 5, 18, 1, 8, 3, 5, 18]

Problem 10) Numpy array slicing

Continuing from the previous problem, what will be the output of the following code?

```python
b = np.array(a).reshape((2,5))
b1 = b[:,:,1::2]
print b1
```

Answers 10:

a) array([[97, 20, 72]])

b) array([[3, 17, 45], [97, 20, 65]])

c) array([[3, 4, 17], [97, 12, 20]])

d) array([[17, 32], [20, 65]])

e) array([[4, 32], [12, 65]])
Problem 11) pandas Series

What will be the outputs of the following Python code?

```python
import pandas as pd
from pandas import Series
objA = Series([94, 61, 73, 87], index=['a', 'b', 'c', 'd'])
objB = Series([75, 96, 81, 65], index=['a', 'c', 'e', 'f'])
objC = objB - objA
print objC.dropna()
```

Answers 11:

a)  
   a  -19
   c  23
dtype: float64

b)  
   a  -19
   b  61
   c  23
dtype: float64

c)  
   a  -19
   c  23

d)  
   a  -19
   f  65
dtype: float64

e)  
   a  -19
   e  81
   f  65
dtype: float64

Problem 12) pandas Series

Continuing from the previous problem, what will be the output of the following code?

```python
objD = objB.subtract(objA, fill_value=0)
objE = objC.fillna(method='ffill')
objF = objD - objE
print objF.sum()
```

Answers 12:

a) 0
b) NaN
c) -52
d) 4
e) -42
Problem 13) pandas DataFrame

Which of the following Python commands will create the DataFrame object \textbf{df} below?

<table>
<thead>
<tr>
<th>Month</th>
<th>Name</th>
<th>Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Amy</td>
<td>120</td>
</tr>
<tr>
<td>1</td>
<td>Betty</td>
<td>120</td>
</tr>
<tr>
<td>2</td>
<td>Rachel</td>
<td>90</td>
</tr>
<tr>
<td>3</td>
<td>Ellen</td>
<td>90</td>
</tr>
</tbody>
</table>

**Answers 13:** (Select all the correct ones.)

a) \texttt{df = DataFrame({'Salary': [120, 90]*2,'Month': [1, 3, 5, 2]}); df['Name'] = ['Amy', 'Betty', 'Rachel', 'Ellen']}

b) \texttt{df = DataFrame({'Month': [1,3,5,2], 'Salary': [120]*2 +[90]*2, 'Name': ['Amy','Betty','Rachel','Ellen']})

c) \texttt{df = DataFrame({'Name': ['Amy', 'Betty', 'Rachel', 'Ellen'], 'Month': [1, 3, 5, 2], 'Salary': [120, 120, 90, 90]})}

d) \texttt{df = DataFrame({'Name': ['Amy', 'Betty', 'Rachel', 'Ellen'], 'Month': [1, 3, 5, 2], 'Salary': [120, 120, 90, 90]}, columns = ['Name', 'Month', 'Salary'])}

e) \texttt{df = DataFrame({'Name': ['Amy', 'Betty', 'Rachel', 'Ellen'], 'Month': [1, 3, 5, 2], 'Salary': [120, 90]*2})}

Problem 14) pandas DataFrame

Continuing from previous code, which of the following commands will modify the DataFrame object \textbf{df} to have the contents below?

<table>
<thead>
<tr>
<th>Month</th>
<th>Name</th>
<th>Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Amy</td>
<td>20</td>
</tr>
<tr>
<td>1</td>
<td>Betty</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>Rachel</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>Ellen</td>
<td>23</td>
</tr>
</tbody>
</table>

**Answers 14:** (Select all the correct ones.)

a) \texttt{df['Bonus'] = np.arange(20,24); del df['Salary']}

b) \texttt{df['Bonus'] = [20, 21,22,23]; df = df[['Month','Name']]

c) \texttt{df['Bonus'] = [20, 21,22,23]; df = df.ix[:, 'Month':'Name']}

d) \texttt{df = df.ix[:, 'Month':'Name']; df['Bonus'] = (20, 21,22,23)}
Problem 15) pandas DataFrame

Continuing with DataFrame df from previous problem, what will be the output of the code below?

```python
df2 = df.sort_values(by='Month')
df2[df2['Bonus'] > 20]
```

**Answers 15:**

<table>
<thead>
<tr>
<th>a)</th>
<th>Month</th>
<th>Name</th>
<th>Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
<td>Ellen</td>
<td>23</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>Betty</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>Rachel</td>
<td>22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b)</th>
<th>Month</th>
<th>Name</th>
<th>Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>Amy</td>
<td>20</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>Betty</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>Rachel</td>
<td>22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>c)</th>
<th>Month</th>
<th>Name</th>
<th>Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>Betty</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>Rachel</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>Ellen</td>
<td>23</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>d)</th>
<th>Month</th>
<th>Name</th>
<th>Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
<td>Ellen</td>
<td>23</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>Betty</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>Rachel</td>
<td>22</td>
</tr>
</tbody>
</table>

Problem 16) pandas DataFrame

Continuing from previous result of DataFrame df, what will be the output of the code below?

```python
df3 = df[['Month', 'Bonus']][1::2]
df3
```

**Answers 16:**

<table>
<thead>
<tr>
<th>a)</th>
<th>Month</th>
<th>Name</th>
<th>Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>Betty</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>Ellen</td>
<td>23</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b)</th>
<th>Month</th>
<th>Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
<td>23</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>c)</th>
<th>Month</th>
<th>Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
<td>23</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>d)</th>
<th>Month</th>
<th>Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>23</td>
</tr>
</tbody>
</table>
**Problem 17)** Python function

Given the Python code below, which of the following outputs is correct?

```python
def myAdd(x=1, y=2):
    return x + y

v1 = myAdd()
v2 = myAdd(y=-2)
v3 = myAdd(x='cat', y='miou')
print v1, v2, v3
```

**Answers 17:**

a) SyntaxError: invalid syntax  
b) 0 0 catmiou  
c) 3 -1 catmiou  
d) -1 3 catmiou  
e) 3 -1 SyntaxError: invalid syntax

**Problem 18)** Python string

What will be the output of the following code?

```python
a = ((17,19), 'and', (41,43))
''.join(str(e) for e in a)
```

**Answers 18:**

a) ((17,19), 'and', (41,43))  
b) '17,19 and 41,43'  
c) '(17, 19) and (41, 43)'  
d) '(17,19) 'and' (41,43)'  
e) '(17, 19)and(41, 43)'
**Problem 19) Python list comprehension**

Given the following Python code, which of the following commands will create the output below?

```
A = range(8)
B = [x if x > 4 else -1 for x in A]
print B
```

**Answers 19:**

a) [0, 1, 2, 3, 4, 5, 6, 7]

b) [-1, -1, -1, -1, -1, 5, 6, 7]

c) [0, 1, 2, 3, 4, 5, 6, 7, 8]

d) [-1, -1, -1, -1, -1, 5, 6, 7, 8]

e) [-1, -1, -1, -1, 4, 5, 6, 7]

**Problem 20) Python for loop**

What will be the output of the following code?

```
C = [4-x if x!=2 else 0 for x in range(8)]
D = []
for x, y, z in zip(A,B,C):
    D.append(x+y*z)
print D
```

**Answers 20:**

a) [-1, 0, 1, 2, 3, 10, 12, 14]

b) [0, -1, -2, -3, -4, 25, 36, 49]

c) [0, 3, 0, 3, 0, -5, -12, -21]

d) [4, 4, 2, 4, 4, 10, 18, 28]

e) [-4, -2, 2, 2, 4, 0, -6, -14]