CS596-032 Midterm Exam Test-3

Student ID: Test ID: 00003

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 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 1:

a) SyntaxError: invalid syntax  
b) 0 0 catmiou  
c) -1 3 catmiou  
d) 3 -1 SyntaxError: invalid syntax  
e) 3 -1 catmiou
**Problem 2) 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 2:**

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 3) Python list comprehension**

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

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

**Answers 3:**

a) [0, 1, 2, 3, 4, 5, 6, 7]  
b) [0, 1, 2, 3, 4, 5, 6, 7, 8]  
c) [-1, -1, -1, -1, -1, 5, 6, 7, 8]  
d) [-1, -1, -1, -1, 4, 5, 6, 7]  
e) [-1, -1, -1, -1, -1, 5, 6, 7]
Problem 4) Python for loop

What will be the output of the following code?

```python
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 4:

- a) [-1, 0, 1, 2, 3, 10, 12, 14]
- b) [-4, -2, 2, 2, 4, 0, -6, -14]
- c) [0, -1, -2, -3, -4, 25, 36, 49]
- d) [0, 3, 0, 3, 0, -5, -12, -21]
- e) [4, 4, 2, 4, 4, 10, 18, 28]

Problem 5) 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 5:

- a) {'a':1, 1:'b','c':2, 3:'3'}
- b) {'a':1, 1:'2', 1:'bar', 3:'3'}
- c) {'a':1, 1:'bar', 3:'3'}
- d) {'a':1, 1:'2', 'c':2, 3:'3'}
- e) {1:'a', 1:'2', 1:'2', 3:'3'}
Problem 6) 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 6:

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

Problem 7) 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 7:

a) array([[0, 0, 0], [6, 6, 6]])
b) array([[1, 2, 3], [12, 13, 14]])
c) array([[12, 13, 14], [-5, -6, -7]])
d) array([[20, 20, 20], [32, 32, 32]])
e) array([[14, 13, 12], [2, 1, 0]])
Problem 8) 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 8:

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

Problem 9) 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]*2+[3]*2})
df['A'][::2]
```

Answers 9:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| a) | 0    foo
|    | 1    bar
|    | 2    foo
|    | 3    bar
|    | 4    foo
|    | Name: A, dtype: object
| c) | 0    foo
|    | 1    foo
|    | 2    foo
|    | Name: A, dtype: object
| b) | 0    foo
|    | 2    foo
|    | 4    bar
|    | Name: A, dtype: object
| d) | Name: A, dtype: object
|    | 0    foo
|    | 1    foo
|    | 2    foo
|    | 3    bar
|    | 4    bar
|    | Name: A, dtype: object
Problem 10) pandas DataFrame

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

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

Answers 10:

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

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<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></th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<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>

Problem 11) 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 11:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>C</th>
</tr>
</thead>
<tbody>
<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></th>
<th>A</th>
<th>C</th>
</tr>
</thead>
<tbody>
<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></th>
<th>A</th>
<th>C</th>
</tr>
</thead>
<tbody>
<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></th>
<th>A</th>
<th>C</th>
</tr>
</thead>
<tbody>
<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 12) 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 12:

a) [2, 16, 6, 10, 36]
b) [0, 4, 11, 24, 16]
c) [1, 8, 3, 5, 18]
d) [1, 8, 3, 5, 18, 1, 8, 3, 5, 18]
e) [0, 4, 11, 24, 16, 0, 4, 11, 24, 16]

Problem 13) 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 13:

a) array([[97, 20],[72]])
b) array([[4, 32],[12, 65]])
c) array([[3, 17, 45],[97, 20, 65]])
d) array([[3, 4, 17],[97, 12, 20]])
e) array([[17, 32],[20, 65]])
Problem 14) 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 14:

a) 
- a -19
- c 23
- d -6
- f 65
dtype: float64

b) 
- a -19
- c 23
- d -6
- e 81
- f 65
dtype: float64

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

d) 
- a -19
- b 61
dtype: float64

e) 
- a -19
- b 61
- e 81
dtype: float64

dtype: float64

Problem 15) 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 15:

a) 0
b) NaN
c) 4
d) -52
e) -42
Problem 16) pandas DataFrame

Which of the following Python commands will create the DataFrame object 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 16: (Select all the correct ones.)

a) `df = DataFrame({'Name': ['Amy', 'Betty', 'Rachel', 'Ellen'], 'Month': [1, 3, 5, 2], 'Salary': [120, 120, 90, 90]})`
b) `df = DataFrame({'Name': ['Amy', 'Betty', 'Rachel', 'Ellen'], 'Month': [1, 3, 5, 2], 'Salary': [120, 120, 90, 90], columns = ['Name', 'Month', 'Salary'])`
c) `df = DataFrame({'Salary': [120, 90]*2,'Month': [1, 3, 5, 2]}); df['Name'] = ['Amy', 'Betty', 'Rachel', 'Ellen']`
d) `df = DataFrame({'Month': [1,3,5,2], 'Salary': [120]*2 +[90]*2, 'Name': ['Amy','Betty','Rachel','Ellen']})`
e) `df = DataFrame({'Name': ['Amy', 'Betty', 'Rachel', 'Ellen'], 'Month': [1, 3, 5, 2], 'Salary': [120, 90]*2})`

Problem 17) pandas DataFrame

Continuing from previous code, which of the following commands will modify the DataFrame object 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 17: (Select all the correct ones.)

a) `df['Bonus'] = [20, 21,22,23]; df = df[['Month','Name']]`
b) `df['Bonus'] = np.arange(20,24); del df['Salary']`
c) `df = df.ix[:,;'Month':'Name']; df['Bonus'] = (20, 21,22,23)`
d) `df['Bonus'] = [20, 21,22,23]; df = df.ix[:,;'Month':'Name']`
Problem 18) 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 18:

<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>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Month</th>
<th>Name</th>
<th>Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Betty</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>Rachel</td>
<td>22</td>
</tr>
</tbody>
</table>

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

Problem 19) 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 19:

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

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

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

<table>
<thead>
<tr>
<th>Month</th>
<th>Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>1</td>
<td>21</td>
</tr>
</tbody>
</table>
Problem 20) 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 20: (Select all the correct ones.)

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

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

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

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

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