CS596-032 Midterm Exam Test-2

Student ID: 
Test ID: 00002

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

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Please use No. 2 pencils

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

Problem 1) 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 1:

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 2) 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 2:

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 3) 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 3:

a) SyntaxError: invalid syntax
b) 0 0 catmiou
c) 3 -1 catmiou
d) -1 3 catmiou
e) 3 -1 SyntaxError: invalid syntax
Problem 4) Python string

What will be the output of the following code?

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

Answers 4:

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 5) 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 5:

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 6) 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 6:

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, 4, 0, -6, -14]

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([[[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 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, 87, 117])  
e) array([15, 51, 86, 96])

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

Answers 9:

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  
2 foo  
4 bar  
Name: A, dtype: object  

e)  
0 foo  
1 foo  
2 foo  
Name: A, dtype: object
**Problem 10)** 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 10:**

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>foo</td>
<td>one</td>
</tr>
<tr>
<td></td>
<td>bar</td>
<td>one</td>
</tr>
<tr>
<td>2</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>c</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>foo</td>
<td>two</td>
</tr>
<tr>
<td>1</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>b</td>
<td>foo</td>
<td>one</td>
</tr>
<tr>
<td></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>d</td>
<td>foo</td>
<td>one</td>
</tr>
<tr>
<td></td>
<td>bar</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>

**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>a</td>
<td>foo</td>
<td>one</td>
</tr>
<tr>
<td></td>
<td>foo</td>
<td>one</td>
</tr>
<tr>
<td>2</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>b</td>
<td>foo</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>foo</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>c</td>
<td>foo</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>d</td>
<td>foo</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>bar</td>
<td>3</td>
</tr>
</tbody>
</table>
Problem 12) 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 12: (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 13) 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 13:

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 14) 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 14:

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 15) 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 15:

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

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

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

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

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

Problem 16) 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 16:

a) 0  
b) NaN  
c) -52  
d) 4  
e) -42
**Problem 17**) 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 17:* (Select all the correct ones.)

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

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

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

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

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

**Problem 18**) 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 18:* (Select all the correct ones.)

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

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

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

d) \(df = \text{df}.ix[:, ['\text{Month}', '\text{Name}']]; \text{df}[\text{Bonus}] = (20, 21,22,23)\)
Problem 19) 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 19:

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

Problem 20) 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 20:

<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>0</td>
<td>23</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>21</td>
</tr>
</tbody>
</table>