CS 331 Midterm Exam 1

Friday, October 6th, 2016

Please bubble your answers in on the provided answer sheet. Also be sure to write and bubble in your student ID number (without the leading 'A').

1. What are the contents of `l2` after the following code is executed?

```
l1 = ['one', 'two', 'three']
l2 = [(l1[i], l1[i+1]) for i in range(len(l1)-1)]
```

(a) `[]`

(b) `[('one', 'three')]`

(c) `[('two', 'one'), ('three', 'two')]`

(d) `[('one', 'two'), ('two', 'three')]`

2. What is the value of `a` after the following code is executed?

```
a = 1
b = 2
for _ in range(5):
    a, b = b, 2*b
```

(a) 1

(b) 25

(c) 32

(d) 64

3. What is the value of the expression `dct['fish']` after the following code is executed?

```
words = ['one', 'fish', 'two', 'fish', 'red', 'fish', 'blue', 'fish']
dct = {}
for i in range(len(words)):
    w = words[i]
    if w in dct:
        dct[w][0] += 1
        dct[w][1] = i
    else:
        dct[w] = [1, i]
```

(a) `[7, 4]`

(b) `[4, 7]`

(c) `[4, 1]`

(d) `[9, 4]`

4. For this and the next problem, consider the following function definition:

```
def foo(a, b=5, c=10):
    return a+b+c
```

What is the return value of the call `foo(1, 2, 3)`?

(a) 1

(b) 6

(c) 5

(d) 16

5. What is the return value of the call `foo(2, 3)`?

(a) 15

(b) 5

(c) 2

(d) 8

6. Consider the following function definition:

```
def bar(*x):
    res = x[0]
    for x in x[1:]:
        res += x
    return res
```

What is the return value of the call `bar([1, 2], [4, 5], [9])`?

(a) `14`

(b) `[1, 4, 9]`

(c) `[1, 2, 4, 5, 9]`

(d) `[14, 7]`

7. Consider the following class definition and subsequent code:

```
class Foo:
    def __init__(self, name):
        global count
        self.identity = name + str(count)
        count += 1

count = 0
f1 = Foo('widget')
f2 = Foo('sprocket')
```

What is the value of the tuple `(f1.identity, f2.identity)`?

(a) `('widget', 'sprocket')`

(b) `('widgetzero', 'sprocketone')`

(c) `('sprocket1', 'sprocket2')`

(d) `('widget0', 'sprocket1')`

8. Consider the following class definition and subsequent code:

```
class Bar:
    def __init__(self):
        self.total = 0

    def __getitem__(self, key):
        self.total -= key
        return self.total

    def __setitem__(self, key, val):
        self.total += val

    def __len__(self):
        return self.total

b = Bar()
b[0] = 20
b[10] = 30
val = b[10]
```

What is the value of the expression `len(b)`?

(a) 40

(b) 50

(c) 60

(d) 10

9. Given that `iterable` is an iterable object, which of the following emulates the behavior of a `for` loop to iterate over its contents?

(a)
```
it = iterable
while True:
    i = iter(it)
    x = next(i)
    # do something with x
    if not i:
        break
```

(b)
```
it = iter(iterable)
while True:
    try:
        x = next(it)
        # do something with x
    except StopIteration:
        break
```

(c)
```
it = next(iterable)
while True:
    try:
        x = iter(it)
        # do something with x
    except StopIteration:
        break
```

(d)
```
it = iter(iterable)
while True:
    x = next(it)
    # do something with x
else:
    raise StopIteration
```

10. Consider the following class definition and subsequent code:

```
class MyIter:
    def __init__(self, x, y):
        self.x = x
        self.y = y

    def __iter__(self):
        return self

    def __next__(self):
        if self.x > self.y:
            raise StopIteration
        else:
            ret = self.x
            self.x *= 2
            return ret

l = []
for x in MyIter(3, 50):
    l.append(x)
```

What are the contents of the list `l`?

(a) `[3, 50]`

(b) `[3, 6, 12, 24, 48]`

(c) `[53]`

(d) `[6, 12, 18, 24, 30, 36, 42, 48]`

11. What is the worst-case run-time complexity of locating and retrieving the element in middle position (by index) of an array-backed list of N elements?

    (a) O(1)

    (b) O(log N)

    (c) O(N)

    (d) $O(N^2)$

12. What is the worst-case run-time complexity of counting the number of times a given value occurs in an unsorted, array-backed list of N elements?

    (a) O(1)

    (b) O(log N)

    (c) O(N)

    (d) $O(N^2)$

13. What is the worst-case run-time complexity of using binary search to determine whether a given value exists in a sorted, array-backed list of N elements?

    (a) O(1)

    (b) O(log N)

    (c) O(N)

    (d) $O(N^2)$

14. What is the worst-case run-time complexity of extending an array-backed list with the contents of another list containing N elements?

    (a) O(1)

    (b) O(log N)

    (c) O(N)

    (d) $O(N^2)$

15. What is the worst-case run-time complexity of removing an arbitrary element from an array-backed list of N elements?

    (a) O(1)

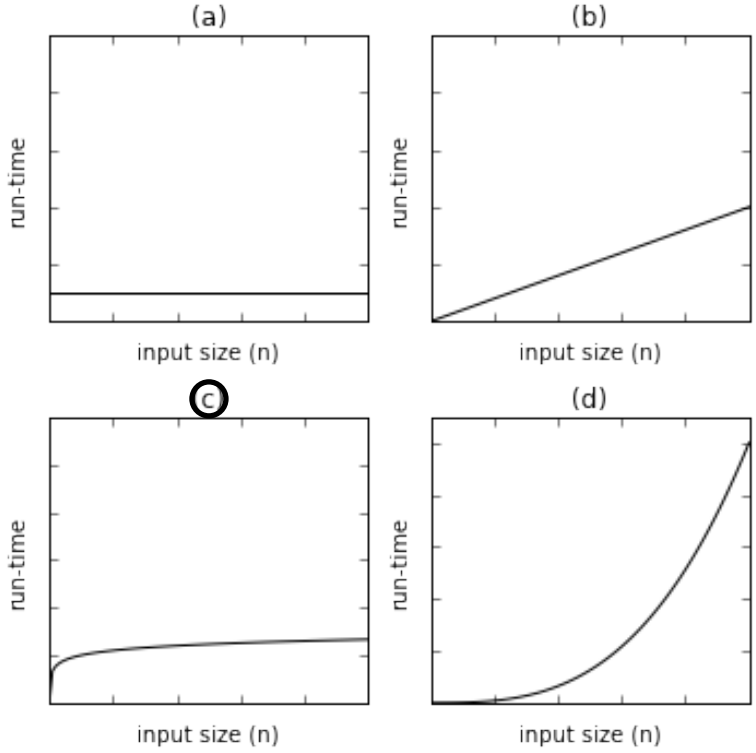
    (b) O(log N)

    (c) O(N)

    (d) $O(N^2)$

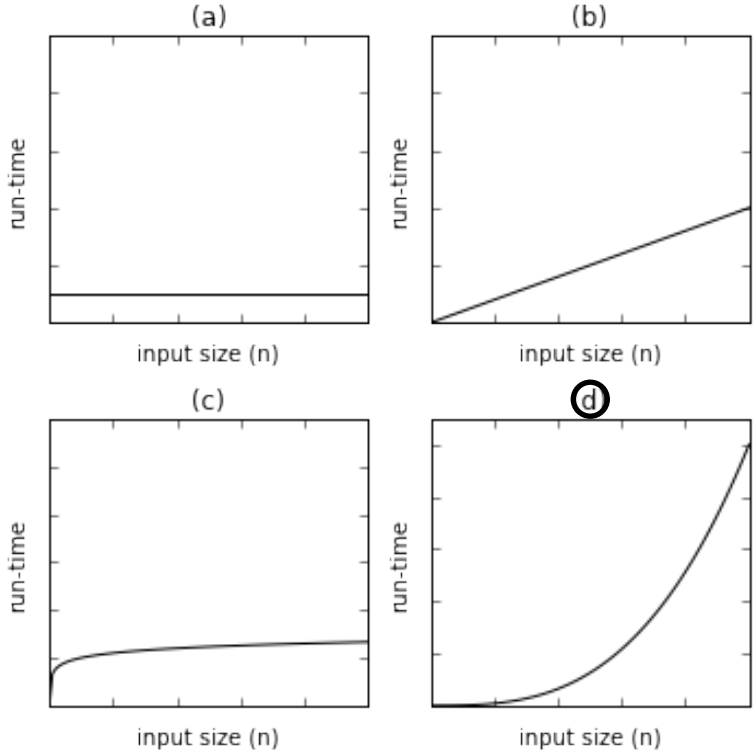
16. Which of the plots best depicts the worst-case run-time complexity of the following function?

```
def f(n):
    res = 0
    while n > 0:
        res += n
        n = n // 10
    return res
```



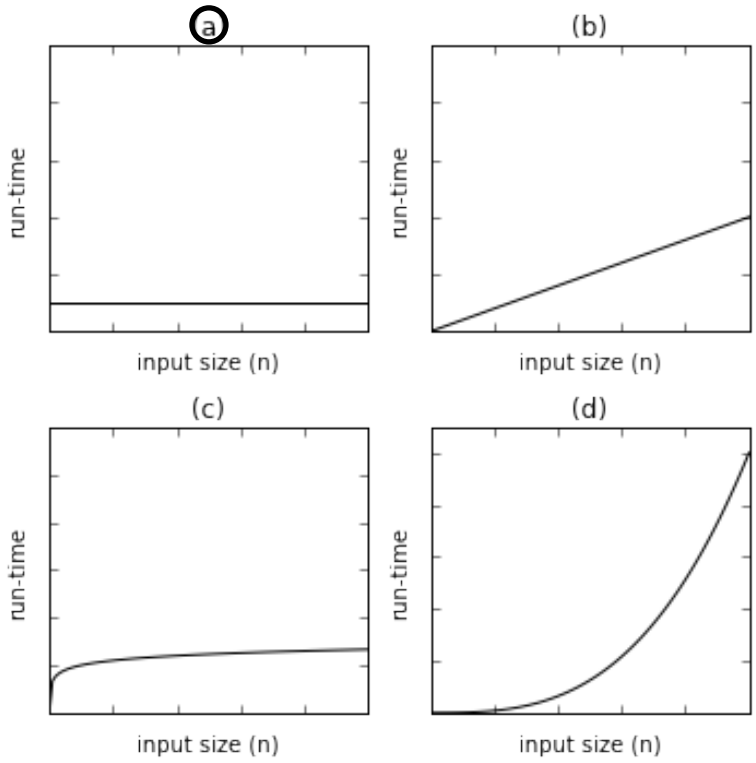
17. Which of the plots best depicts the worst-case run-time complexity of the following function?

```
def f(lst): # `lst` is a Python list
    n = len(lst) - 1
    while n >= 0:
        for i in range(len(lst)):
            if i != n:
                lst[i] *= lst[n]
        n -= 1
    return lst
```



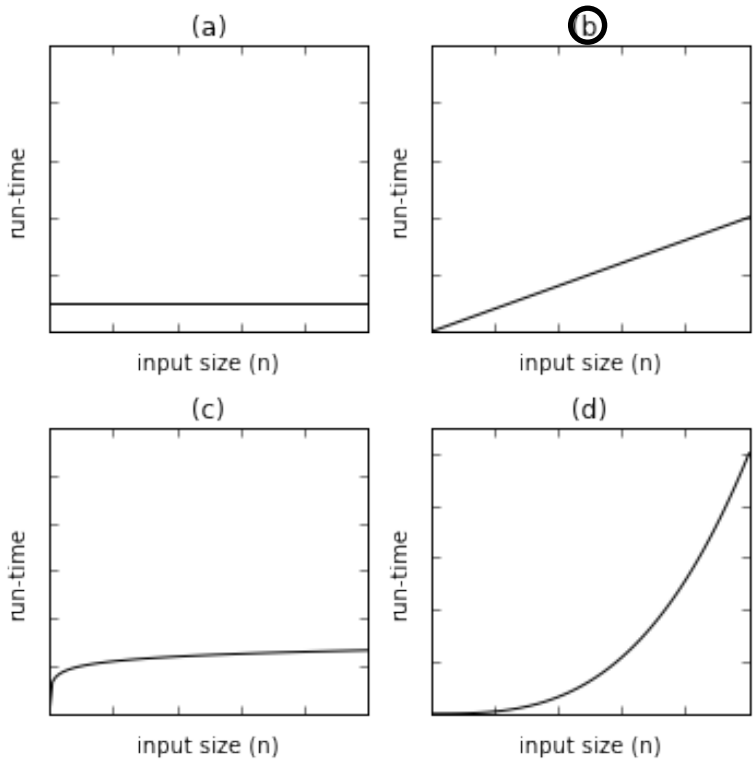
18. Which of the plots best depicts the worst-case run-time complexity of the following function?

```
def f(lst): # `lst` is a Python list
    res  = 0
    step = len(lst) // 10
    for i in range(0, len(lst), step):
        res += lst[i]
    return res
```



▼ 19. Which of the plots best depicts the worst-case run-time complexity of the following function?

```
def f(n):
    res = 0
    for i in range(n, 0, -1):
        res += i
    return res
```



▼ 20. Which snippet correctly completes the implementation of insertion sort on a list?

```
def insertion_sort(lst):
    for i in range(1, len(lst)):
        _____________________________
        _____________________________
        _____________________________
```

(a)
```
for j in range(i, 0, -1):
    if lst[j-1] > lst[j]:
        lst[j-1], lst[j] = lst[j], lst[j-1]
```

(b)
```
for j in range(i, 1, -1):
    if lst[j-1] > lst[j+1]:
        lst[j-1], lst[j+1] = lst[j+1], lst[j-1]
```

(c)
```
for j in range(i):
    if lst[i] > lst[j]:
        lst[i] = lst[j]
```

(d)
```
for j in range(1, i+1):
    if lst[j] > lst[i]:
        lst[j] = lst[i]
```

▼ 21. Which snippet correctly completes the implementation of `__delitem__` in an array-backed list (assuming a valid index ≥ 0)?

```
def __delitem__(self, idx):
    for i in _________________________:
        self.data[i-1] = self.data[i]
    del self.data[len(self.data)-1]
```

(a) `range(idx)`

(b) `range(len(self.data))`

(c) `range(idx+1, len(self.data))`

(d) `range(len(self.data), idx, -1)`

22. Which snippet correctly completes the implementation of `__iter__` in an array-backed list?

```
def __iter__(self):
    ____________________________
    ____________________________
    ____________________________
```

(a)
```
for x in self:
    yield x
```

(b)
```
while iter(self):
    yield next(self)
raise StopIteration
```

(c)
```
for i in range(len(self)):
    return self.data[i]
```

(d)
```
for i in range(len(self)):
    yield self.data[i]
```

23. Which snippet correctly implements `pop` in an array-backed list, given a working `__delitem__` method and that `self.data` is a `ConstrainedList` (as in lab)?

```
def pop(self, idx=-1):
    ____________________
    ____________________
    return val
```

(a)
```
val = self.data.pop(idx)
```

(b)
```
val = self[idx]
self.remove(val)
```

(c)
```
val = self.data[idx]
del self.data[idx]
```

(d)
```
val = self[idx]
del self[idx]
```

▼ 24. Which snippet correctly implements `splice` in an array-backed list, which inserts the contents of the provided list argument (`lst`) into the array list starting at position `idx`?

```
def splice(self, idx, lst):
    m = len(self)
    n = len(lst)
    for _ in range(n):
        self.data.append(None)
    ____________________________
    ____________________________
    ____________________________
    ____________________________
```

E.g., calling `splice` with `idx=2` and `lst=['one', 'two', 'three']` on an ArrayList which currently contains `[1, 2, 3, 4, 5]` should result in `[1, 2, 'one', 'two', 'three', 3, 4, 5]`

(a)
```
for i in range(m+n, m, -1):
    self.data[i-1] = self.data[i-n-1]
for i in range(n):
    self.data[idx+i] = lst[i]
```

(b)
```
for i in range(m, idx, -1):
    self.data[i+n-1] = self.data[i-1]
for i in range(n):
    self.data[idx+i] = lst[i]
```

(c)
```
for i in range(idx, m+n):
    self.data[m+n-1] = self.data[m-1]
for i in range(idx, idx+n):
    self.data[i] = lst[i]
```

(d)
```
for i in range(idx, m+n):
    self.data[m+n-i-1] = self.data[m-i-1]
for i in range(idx, m):
    self.data[i] = lst[i]
```