

CS 320 Exam 1 (14%) - Fall 2022

Instructor: Tyler Caraza-Harter

First/Given Name: _____. Last/Surname: _____

Net ID: _____@wisc.edu

Fill in these fields (left to right) on the scantron form (use pencil):

1. LAST NAME (surname) and FIRST NAME (given name), fill in bubbles
2. IDENTIFICATION NUMBER is your Campus ID number, fill in bubbles
3. Under A of SPECIAL CODES, write your lecture number, fill in bubbles. 1=8:50am, 2=11am
4. Under B of SPECIAL CODES, tell us about the nearest person (if any) to your left. 0=no person to the left in your row, 1=somebody you do not know is there, 2=somebody you do know is there.
5. Under C of SPECIAL CODES, do the same as B, but for the person to your right
6. **Under D of SPECIAL CODES, write 1 and fill in bubble 1.** This is very important!

Make sure you fill all the special codes above accurately in order to get graded.

You have 40 minutes to take the exam. Use a #2 pencil to mark all answers. When you're done, please hand in these sheets in addition to your filled-in scantron. You may not sit adjacent to your friends or other people you know in the class (having only one empty seat is considered "adjacent"). You may only reference your notesheet. You may not use books, your neighbors, calculators, or other electronic devices on this exam. Please place your student ID face up on your desk. Turn off and put away portable electronics now.

(Blank Page for You to Do Scratch Work)

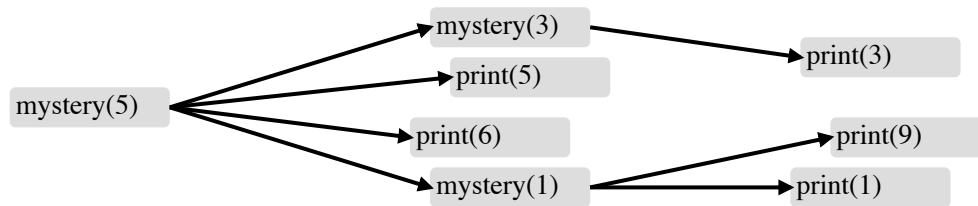
Q1. If a BST is constructed using the algorithm we learned in class, and the insert order is [4, 9, 1, 11], where will 11 be?

- (A) root.left.left (B) root.left.right (C) root.right.left (D) root.right.right

Q2. What are stack frames for?

- (A) holding objects
 (B) holding variables
 (C) containing function code
 (D) grouping together all the attributes of an object
 (E) separating the methods of a class from methods in other classes

Q3. Someone is drawing a call graph, as in lecture, to trace through a recursive function. What is the THIRD number printed?



- (A) 1 (B) 3 (C) 5 (D) 6 (E) 9

Q4. What is x?

```

class Dog:
    def __init__(self, vals):
        self.vals = vals

    def __len__(self):
        return 5

    def __getitem__(self, lookup):
        return 2
  
```

```

obj = Dog([3, 1, 4])
x = obj.vals[2] # careful!
  
```

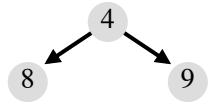
- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5

Q5. The complexity of BST search is $O(N)$, where N is _____. Choose the most informative answer.

- (A) number of nodes (B) height of the tree (C) length of shortest root-to-leaf path

Q6. A Python interpreter is best at which of the following?

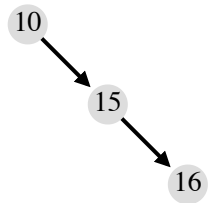
- (A) hiding details about the CPU's instruction set from the programmer
- (B) hiding details about the operating system's files from the programmer
- (C) translating Java code to Python code

Q7. Is this a BST? (infer left/right child based on arrow direction)

- (A) yes (B) no

Q8. Say you're on branch giraffe and you run "git merge zebra". A new commit is created. Which branch(es) will point to the new commit?

- (A) giraffe only (B) zebra only (C) both giraffe and zebra (D) neither branch

Q9. Is this a BST? (infer left/right child based on arrow direction)

- (A) yes (B) no

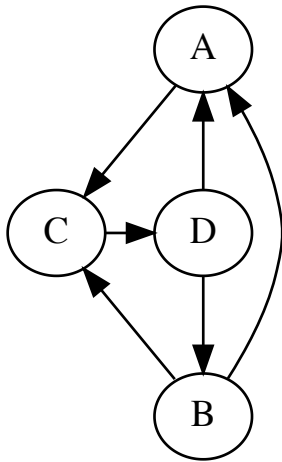
Q10. If `q` is a `deque` object with many entries, which operation is SLOWEST?

- (A) `q.popleft()`, (B) `q[len(q)//2]`, (C) `q.append(x)`

Q11. If you want to convert an object to a string that another programmer will see, what special method should you implement in your class?

- (A) `dump` (B) `__dump__` (C) `__repr__` (D) `__str__`

Q12. What can be said about the following graph?



- (A) it is not acyclic and not strongly connected
- (B) it is strongly connected but not acyclic
- (C) it is acyclic but not strongly connected
- (D) it is both strongly connected and acyclic

Q13. What is printed?

```

items = []
for item in [0.5, -1, 5, 0, 2]:
    heapq.heappush(items, item)
print(heapq.heappop(items))

```

- (A) 2 (B) -1 (C) 0 (D) 0.5

Q14. What is the complexity of the following code, if N is the length of the list L? Choose the best answer.

```

for val in L:
    threshold = max(L)
    if val >= 4 * threshold:
        print("oops!")

```

- (A) $O(1)$ (B) $O(N)$ (C) $O(N^2)$ (D) $O(N^2 + 1)$ (E) $O(N^3)$

Q15. What type does `check_output` return by default?

- (A) int (B) bytes (C) bool (D) str (E) utf8

Q16. Which complexity class is best/fastest among the following choices? If there are multiple right answers, choose the simplest one.

- (A) $O(N)$ (B) $O(0.5*N)$ (C) $O(N!)$ (D) $O(\log N)$

Q17. What changes would improve the efficiency of the BFS code?

```
def bfs(start, end):  
    todo = [start]      # change 1: use a deque  
    added = {start}     # change 2: use heapq  
    # REMAINING CODE HIDDEN
```

(A) 1 only (B) 2 only (C) both 1 and 2 (D) neither

Q18. Which operation on a list `nums` is constant time? Constant time means $O(1)$.

(A) `nums.pop(0)` (B) `nums.sort()` (C) `len(nums)` (D) `max(nums)`

Q19. What does `nums` contain after the following runs?

```
nums = []  
def count(z):  
    if z < 4:  
        count(z+1)  
    nums.append(z)  
count(1)  
print(nums)
```

(A) `[4, 3, 2]` (B) `[1]` (C) `[1, 2, 3, 4]` (D) `[2, 3, 4]` (E) `[4, 3, 2, 1]`

Q20. What is the benefit of using `csv.DictReader` instead of `pd.read_csv`?

(A) save memory space (B) save storage space