Disclaimer: This mock exam is only for practice. It was made by tutors in the Polytechnic Tutoring Center and is not representative of the actual exam given by the CS Department.

1. Write a recursive function that takes a list, first and last index of the list in as parameters and prints it in reverse (in place).

   **Sample Output:**

   ```python
   lst = [1,2,3,4]
   revPrint(lst, 0, 3)
   >> 4 3 2 1
   
   **Code:**
   ```

2. Circle the faster runtime:

   - $O(n\log(n))$ or $O(\sqrt{n})$
   - $O(\sqrt{n})$ or $O(\log(n))$
   - $O(n\log(n))$ or $O(n^{1.25})$
3. Let \( f(x,n) = \sum_{i=1}^{n} \frac{x}{i} = \frac{x}{1} + \frac{x}{2} + \frac{x}{3} \ldots \), so \( f(4,3) = \frac{4}{1} + \frac{4}{2} + \frac{4}{3} = 7.333 \). Write a function for \( f \). State your runtime.

**Code:**

4. What is the runtime of the following code snippets?
   a. `def function3(lst, low, high):
      
      if (low >= high):
         return 3
      for elem in lst:
         elem += 2
      return function3(lst, low+1, high-1)
   
   b. `def function2(lst):
      
      if (len(lst) == 1):
         lst[0] = 0
      return 2
      return function2(lst[: len(lst)//2])`
c  def function1(lst, lst2):
    for elem in lst:
        if (elem in lst2):
            print('iteration')

5  If A = [0,0,0,0,0,0], B = [3,1,6,2], what does A and B look like after function2(B) and function3(A, 2, len(A)-1) ? (Refer to Question 4)

6  Write a generator function that provides the values for a harmonic series of n elements. Hint: Harmonic series is 1, 1/2, 1/3...

Sample Output:

iters = 4

display_list = list(harmonic(iters))

display_list

>> [1.0, 0.5, 0.33, 0.25]

Code:
7. Given a non-empty list with integers, write a function `separate_num()` to separate a list of even numbers and odd numbers and returns a list that contains all the odd numbers in the front and all even numbers in the back.

Example: an input list \([3,15,44,2,51,89,20]\) to `separate_num()` will return \([3,15,51,89,44,2,20]\)

**Requirement: O (n) runtime and in place**

(1) Do the implementation of `separate_num()` **iteratively**

(2) Do the implementation of `separate_num()` **recursively with helper function**
8. Write a class Fraction that has two attributes: numerator and denominator. If the denominator is 0, there should be an exception raised. The default value for the numerator and denominator should be 0 and 1 respectively.

- Write a method to find the greatest common divisor between the numerator and the denominator. Use this method to create a simplify function to simplify the fraction (eg: 14/21 will be simplified to 2/3).

- We also need to implement the methods to support addition between two Fraction objects. The method will return new simplified Fraction objects.

- We also want to be able to print Fraction object to the screen in the form of numerator/denominator (eg: 3/5, 14/15, ...).