1. Which of the JCF interfaces would be the most useful if we want to store a collection of students enrolled in COMP2402 so that we can quickly check if a student is enrolled in COMP2402?

   (a) List
   (b) Map
   (c) Set

2. Which of the JCF interfaces would be the most useful if ...

   (a) Set
   (b) SortedSet
   (c) Map
   (d) Sortedmap
   (e) List

3. The running time of the methods get(i) and remove(i) for an ArrayList are

   (a)
   (b)
   (c)

4. The running time of the methods get(i) and remove(i) for a LinkedList are

   (a)
   (b)
   (c)

5. If an method call to foo() is constant time, what is the worst-case time complexity associated with the following:

```
for (i = n; i > 1; i--) {
   for (j = 0; j < i; j++) {
      foo();
   }
}
```

   (a) $O(\log n)$
   (b) $O(n \log n)$
   (c) $O(n^2)$

6. Which of the following interfaces does NOT have Collection as a superinterface?

   (a) Set
   (b) Deque
   (c) Map

7. Consider the following method:

```
void getZero(List<Integer> x, int n) {
  for (int i = 0; i < n; i++) {
    x.get(0);
  }
}
```

   This method is

   (a) much faster when x is an ArrayList compared to when x is a LinkedList

(b) much slower when x is an ArrayList compared to when x is a LinkedList

(c) the difference is not significant when x is an ArrayList or a LinkedList

8. Consider the following method:

```
void addAtZero(List<Integer> x, Integer n) {
  for (int i = 0; i < n; i++) {
    l.add(0, new Integer(i));
  }
}
```

This method is

(a) much faster when x is an ArrayList compared to when x is a LinkedList

(b) much slower when x is an ArrayList compared to when x is a LinkedList

(c) the difference is not significant when x is an ArrayList or a LinkedList

9. Which of the following operations on an ArrayDeque require an operation with linear time complexity?

(a) get(i)

(b) remove()

(c) remove(i)

10. If a perfectly balanced (i.e., potential $\Phi = 0$) DualArrayDeque of n elements is subjected to a sequence of $(n/4 + 1)$ function calls to either $add(i, x)$ or $remove(i)$, what is the MINIMUM possible potential Φ?

(Remember: the potential Φ is the difference in size between the two array-backed stacks front and back)

(a) 0

(b) 1

(c) $n/4 + 1$

11. Which of the following operations on a DualArrayDeque require an operation with linear time complexity?

(a) get(i)

(b) remove()

(c) remove(i)

12. Consider a DualArrayDeque that uses two array-backed stacks that have been denoted front and back, respectively. If the deque contains exactly n elements and

$$front.size() = n/3$$

how many elements would need to be shifted by a function call to balance()?

(a) 0

(b) $n/6$

(c) n

13. Consider a circular array-backed deque (i.e., ArrayDeque) that has n = 10 elements and the index of its "front" element is at j = 3. What is the value of j after the function call:

$$add(7, x)$$

assuming that it is not necessary to resize the backing array?

(a) 2

(b) 3

(c) 4

14. If a RootishArrayStack has r blocks, then what is the cost of removing an element with remove(i) if the shrink() function (i.e., the function used to remove all but one of the unused blocks) is NOT called?

    (a) $O(1+i)$

    (b) $O(1+n-i)$

    (c) $O(1+\min\{i, n-i\})$

15. Assuming that it is NOT necessary to call the grow() function, when adding a list element to a RootishArrayStack, which of the following tasks dominates the cost (i.e., accounts for the largest component of the cost of the whole operation)?

    (a) Finding the block and local index of where to add the element

    (b) Shifting elements to create the gap needed for adding

    (c) Neither of the above dominate the overall cost

16. At any instance, if a RootishArrayStack has r blocks, then what is the MAXIMUM number of elements it can store?

    (a) $\frac{1}{2}(r-2)(r-1)$

    (b) $\frac{1}{2}(r-1)(r)$

    (c) $\frac{1}{2}(r)(r+1)$

17. If a RootishArrayStack has 12 blocks (i.e., r = 12), then within which block is list index 17?

    (a) 4

    (b) 5

    (c) 6

18. If a RootishArrayStack has 12 blocks (i.e., r = 12), then what is the local block index for an element that would be at list index 17? To clarify, if you already knew within which block the element at index 17 was, what would be its index within that block?

    (a) 0

    (b) 1

    (c) 2