

QuickCheck 02: Solutions

Due: 8:00 am on Thursday, Jan 16, 2020

QuickChecks must be scanned and submitted online via Gradescope. If you have a smartphone, you can follow these steps to scan using an app: <https://www.gradescope.com/help#help-center-item-student-scanning>. Otherwise, there are scanners located at various libraries on campus which can be found here: <https://finance.uw.edu/c2/printing-copying/dawg-prints-copy-locations>. Make sure that the gray border around the edge of this page is visible in your scanned document.

1. Algorithm Analysis

1.1. True or false?

Fill in the bubble to indicate True or False for the following statements.

- (a) If a function is in $\Omega(n)$, then it could also be in $\mathcal{O}(n^2)$. True False
- (b) If a function is in $\Theta(n)$, then it could also be in $\mathcal{O}(n^2)$. True False
- (c) If a function is in $\Omega(n)$, then it is always in $\mathcal{O}(n)$. True False

Solution:

- (a) True
- (b) True
- (c) False

1.2. Runtime Bounds

Give a tight asymptotic runtime bound for `mystery` as a function of N , the length of the array, in the **best case**, **worst case**, and **overall**. Give a $\Theta(\cdot)$ bound if it exists. Otherwise, give both an $\mathcal{O}(\cdot)$ and $\Omega(\cdot)$ bound.

```
public static boolean mystery(int[] a, int target) {
    int N = a.length;
    for (int i = 0; i < N; i += 1) {
        if (a[i] == target) {
            return true;
        }
    }
    return false;
}
```

(a) Best case:

(b) Worst case:

(c) Overall:

Solution:

(a) Best case: $\Theta(1)$

(b) Worst case: $\Theta(N)$

(c) Overall: $\Omega(1), \mathcal{O}(N)$