a) One thing that's better with algorithm RANDFINDINDEX$_1$ is that it has better space-efficiency than RANDFINDINDEX$_2$ as it doesn't need to allocate space for doneSet.

One thing that's better with algorithm RANDFINDINDEX$_2$ is that because it has doneSet, and for every while iteration, it would randomly pick a value that has not been chosen before, so this algorithm is guaranteed to halt.

b) Because each trial is Line(3) is a Bernoulli trial, with a success probability of 1/n. Under the assumption that n is a finite natural number, this algorithm terminates in expectation. As each trial in Line(3) is a Bernoulli trial, we expect to succeed after n trials. Thus, we expect n iterations of the while loop before we return in Line(6) with the correct value for the index of i.

c) For RANDFINDINDEX$_2$, because it has doneSet, so for each iteration, the trial at Line(14) would only pick j $\in \{1, \ldots, n\} \setminus$ doneSet. This means the while loop would have at most n iterations before it terminates, and n here is the upper bound for the number of iterations. In the best case, the trial at Line(14) would pick j $\in \{1, \ldots, n\} \setminus$ doneSet such that i = A[j] at the first time, and it would return in Line(15), and 1 here is the lower bound for the number of iterations. Now, let *l* be the lower-bound, and *u* be the upper-bound, and X be the random variable that's the number of iterations of the while loop, then:

$$E[X] = \sum_{i=l}^{u} i \times \Pr\{X = i\}$$

$$= \sum_{i=1}^{n} i \times \Pr\{X = i\}$$

$$= 1 \times \frac{1}{n} + 2 \times \left(\frac{n-1}{n} \times \frac{1}{n-1}\right) + 3 \times \left(\frac{n-1}{n} \times \frac{n-2}{n-1} \times \frac{1}{n-2}\right) + \cdots$$
$$+ n \times (\frac{n-1}{n} \times \frac{n-2}{n-1} \times \ldots \times \frac{n-(n-2)}{n-(n-3)} \times \frac{1}{2} \times \frac{1}{1})$$

$$= \frac{n+1}{2}$$

Hence, in the expected-case, the number of iterations of the while loop is (n+1) / 2.