IAP 2014 – 6.s096 Diagnostic Test

This test will be most effective if you try to complete it without outside help.

Prior Experience

A couple sentences for each question here is all that's needed.

1. Briefly describe your previous programming experience.
    a) What courses have you taken?
    b) What languages are you familiar with?

2. Describe a programming project you've worked on, either for or outside of a course.

3. What do you hope to get out of this class?

Short-Answer Knowledge

If you don't know the answer to a question, just write "I don't know" as your answer.

4. What is the difference between a stack and queue? Briefly describe both.

5. Describe a heap data structure.

6. Describe a hash table/dictionary and what it's useful for.

7. What is the point of *encapsulation* as it relates to object-oriented programming?

Programming

Feel free to use pseudocode or any language you know well.

8. Write a function **is_prime**(n) to determine if a positive integer n is prime.

9. Write a function **print_permutations**(n) that prints all permutations of the positive integers from 1 to n in the standard (increasing) order. For example, **print_permutations**(3) should output the following:

$$123, 132, 213, 231, 312, 321.$$

10. Given an array `data[]` of length N:
    a) Write a function **search**(`value`) which returns the location (index) of value `value` in the array, if it exists, in $O(N)$ time.
    b) Assume the elements of your array are comparable and that you are provided a sort function. Write a function **binary_search**(`value`) that takes $O(\log N)$ time.

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