8. Determine the big-O notation for the following:

   a. $5n^{5/2} + n^{2/5}$
   b. $6\log(n) + 9n$
   c. $3n^4 + n\log(n)$
   d. $5n^2 + n^{3/2}$

12. If the efficiency of the algorithm `doIt` can be expressed as $O(n) = n^2$, calculate the efficiency of the following program segment:

```
for (i = 1; i <= n;; i++)
    for (j = 1; j < n, j++)
         doIt (...)
```

14. Given that the efficiency of an algorithm is $5n^2$, if a step in this algorithm takes 1 nanosecond (10^{-9} seconds), how long does it take the algorithm to process an input of size 1000?

20. Three students wrote algorithms for the same problem. They tested the three algorithms with two sets of data as shown below:

    a. Case 1: $n = 10$
       - Run time for student 1: 1
       - Run time for student 2: 1/100
       - Run time for student 3: 1/1000

    b. Case 2: $n = 100$
       - Run time for student 1: 10
       - Run time for student 2: 1
       - Run time for student 3: 1

    What is the efficiency for each algorithm? Which is the best? Which is the worst? What is the minimum number of test cases (n) in which the best algorithm has the best run time?

31. Write the pseudocode for a program that builds a frequency array for data values in the range 1 to 20 and then prints their histogram. The data are to be read from a file. The design for the program is shown in Figure 1-17.

Each of the subalgorithms is described below.

a. The `getData` algorithm reads the file and stores the data in an array.
b. The `printData` algorithm prints the data in the array.
c. The `makeFrequency` algorithm examines the data in the array, one element at a time, and adds 1 to the corresponding element in a frequency array based on the data value.
d. The `makeHistogram` algorithm prints out a vertical histogram using asterisks for each occurrence of an element. For example, if there were five value 1s and eight value 2s in the data, it would print

```
1: *****
2: ********
```

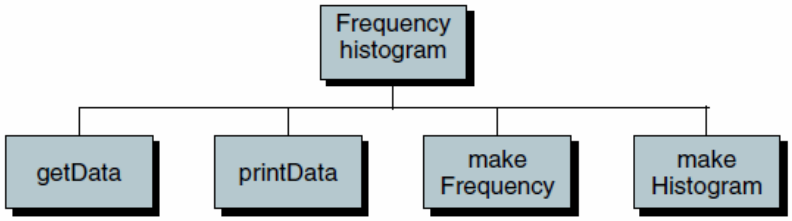

FIGURE 1-17 Design for Frequency Histogram Program