Institute of Business Administration Karachi
Leadership and Ideas for Tomorrow

CSE141 Introduction to Programming (Fall'23)

IBA SMCS
School of Mathematics and Computer Science

Lab #7   Oct 6, 2023
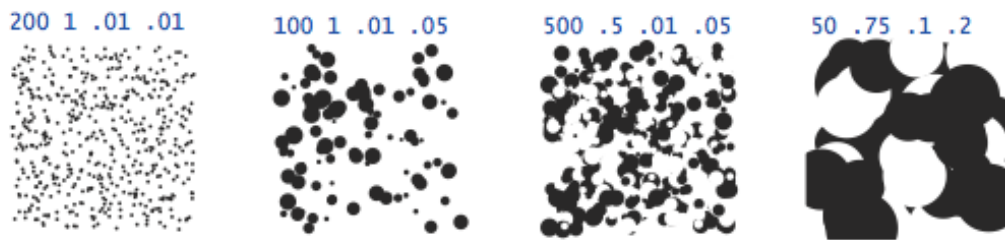
Lab Questions

1. Write a program `circles.cpp` that draws filled circles of random size at random positions in the unit square, producing images like those below. Your program should take four inputs: the number of circles, the probability that each circle is black, the minimum radius, and the maximum radius.

2. Write a program `checkerboard.cpp` that takes an input n and plots an n-by-n checkerboard with red and black squares. Color the lower-left square red. The checker boards for $n = 5$, $n = 8$, and $n = 25$ are shown below.
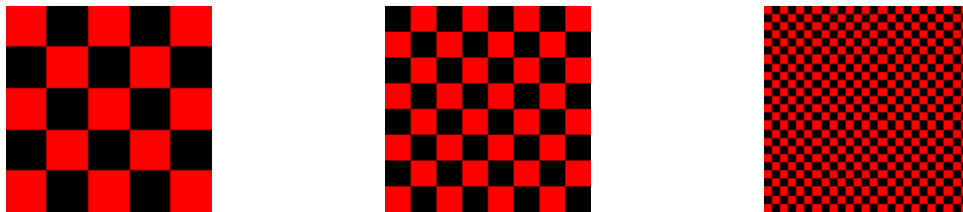
3. Write a program `ssort.cpp` that takes an integer n as input and generates n random integers between 0 and 99. Then, it sorts those n integers using *selection sort* and prints the result.

    The *selection sort* algorithm is given below.

    1. Find the smallest item in the array and exchange it with the first entry.
    2. Find the next smallest item and exchange it with the second entry.
    3. Continue in this way until the entire array is sorted.

4. Write a program `palindrome.cpp` that tests whether a given string is a palindrome. A palindrome is a string that reads the same forward and backward, for example, `madam` or `racecar`.

5. Write a program `rotate.cpp` that rotates an array by k elements. For example `{1,2,3,4,5,6}` rotated by two becomes `{3,4,5,6,1,2}`. Try solving this without creating a copy of the array. How many swap or move operations do you need?

6. Write a program `fib.cpp` that computes an array initialized with the first 100 *Fibonacci numbers*. The first two Fibonacci numbers are 1 and 1. The $n+1$-st Fibonacci number can be computed by adding the n-th and the $n-1$-th Fibonacci number. The first few are therefore 1, 1, $1+1 = 2$, $1+2 = 3$, $2+3 = 5$, $3+5 = 8$.

7. Write a `boxed_print.cpp` that takes an array of strings as input and prints them, one per line, in a rectangular frame. For example the array `{"Hello", "World", "in", "a", "frame"}` gets printed as:

```
*********
* Hello *
* World *
* in    *
* a     *
* frame *
*********
```

8. Write a program `translate.cpp` that translates a text to `Pig Latin` and back. English is translated to Pig Latin by taking the first letter of every word, moving it to the end of the word and adding 'ay'. `"The quick brown fox"` becomes `"Hetay uickqay rownbay oxfay"`.

9. *Treasure Hunt:* Do you like treasure hunts? In this problem you are to write a program to explore the below array for a treasure.

```
+------------------------+
| 34 | 21 | 32 | 41 | 25 |
+----+----+----+----+-----|
| 14 | 42 | 43 | 14 | 31 |
+----+----+----+----+-----|
| 54 | 45 | 52 | 42 | 23 |
+----+----+----+----+-----|
| 33 | 15 | 51 | 31 | 35 |
+----+----+----+----+-----|
| 21 | 52 | 33 | 13 | 23 |
+------------------------+
```

The values in the array are clues. Each cell contains an integer between 11 and 55; for each value the ten's digit represents the row number and the unit's digit represents the column number of the cell containing the next clue. Starting in the upper left corner (at 1,1), use the clues to guide your search of the array. (The first three clues are 11, 34, 42). The treasure is a cell whose value is the same as its coordinates.

Your program should output the cells it visits during its search, and a message indicating where you found the treasure.