First name (color-in initial)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	section (9,10,11, 12,1 or 2)	first name initial	last name initial
Last name (color-in initial)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z			

H04: Due Tuesday, 01.20 in Lab

More on Functions, Scope (Savitch Ch 4.4-4.5)
Assigned: Mon 01.12 Total Points: 50

MAY ONLY BE TURNED IN IN THE LECTURE/LAB LISTED ABOVE AS THE DUE DATE,
or offered in person, for in person grading, during instructor or TAs office hours.
See the course syllabus at https://foo.cs.ucsb.edu/16wiki/index.php/W15:Syllabus for more details.

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(1) (10 pts) Fill in the information below. Also, fill in the A-Z header by

- **coloring in** the first letter of your first and last name (as it appears in Gauchospace),
- writing **either 9,10,11,12,1 or 2** to indicate your **discussion section (lab)** meeting time
- writing your **first and last initial** in large capital letters.

All of this helps us to manage the avalanche of paper that results from the daily homework.

name:	
umail address:	@umail.ucsb.edu

If you collaborated with AT MOST one other person on this homework, write his/her name below. She/he should also have your name on his/her paper.

Reading: *Read Sections 4.4 and 4.5 (If you don't have a copy of the textbook, there is one on reserve at the library.)*

Then, answer the following questions. Be sure to check both sides.

2. (10 pts) Section 4.4 discusses the "black box" analogy as it relates to functions. Display 4.7 on page 206 shows two different implementations of the function `new_balance`, and the author says they are "black box equivalent". In your own words (not just copying words out of the textbook), explain what it means for two functions to be "black box equivalent". I really mean it when I say "in your own words". Read the textbook, understand the material, then put the textbook down and write **your answer** out of the understanding **in your HEAD**. Don't just copy words from the textbook—copying words is not a useful learning activity.

3. (10 pts) The programming tip on page 208 about nested loops makes the point that if you have nested loops, as in Display 3.15 (which is back in Chapter 3 on pages 160-161), it may be a good place to apply a function. In the example, the explicitly nested loop of Display 3.15 is replaced with an "implied" nested loop by factoring out the code for `get_one_total` into a separate function. Re-read the nested loop section on pages 160-161, and read the text and code on pages 208-211. You will need this understanding to complete the problem below.

   Now, your job. Below are two C++ functions definitions. On the left, `boxOfStars` is a function that returns a string that when printed, yields a box of stars of width w and height h. On the right `lineOfStars` is a function that returns a string that when printed, yields a string containing a sequence of stars of length `len`, without a new line character.

   Your job: following the example from the textbook write a new definition of `boxOfStars` that does NOT contain an explicitly nested loop, by using a call to the function definition on the right. If you visit the online version of this homework, the following link takes you to a dbgr.cc page where you can try your answer before copying it onto your homework paper:

   W15:Homework:H04:dbgr.cc

```
string boxOfStars(int w, int h) {
   string result = "";
   for (int i=0; i<h; i++) {
      for (int j=0; j<w; j++) {
          result += "*";
      }
      result += "\n";
   }
   return result;
}
```

```
string lineOfStars(int len) {
   string result = "";
   for (int j=0; j<len; j++) {
      result += "*";
   }
   return result;
}
```

4. (10 pts) Consider the ORIGINAL version of `boxOfStars` that has a nested loop above. Suppose that we made a mistake in the inner loop variable in the boxOfStars function, and instead of `for (int j=0; j<width; j++)` we wrote `for (int j=0; j<width; i++)` (note the mistake—incrementing `i` as in Ivan in this loop header instead of `j` as in Jill.) What would happen, and why?

5. (10 pts) Now, again, consider the example `boxOfStars` above as re-written by you to use the `lineOfStars` function. Suppose that we changed the loop variable in the lineOfStars function from `j` (as in "Jill") to `i` (as in "Ivan"). Would there be any problem with that? If so, what? If not, explain why not. Hint: read section 4.5 about "scope", and make reference to "scope" in your answer. The "black box" analogy may also be a useful concept here.