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CS 341:Programming Language Design And Implementation

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Homework	2
Due	Noon, Sept. 17th
Policy	Individual work only, no late submissions
Assignment	digital copy of drawn memory diagrams
Submission	gradescope

1 Reading

In *A Tour of C++*, read chapter 1. Most of you already know C and some C++, so 80-90% of this is review and you should be able to skim through the material. However, section 1.4.2 introduces the auto keyword, section 1.7 introduces range-for and the reference operator &. But the most interesting sections may be 1.9.1 and 1.9.2 regarding assignment and initialization. In particular, pay close attention to the diagrams.

2 Exercises: pointers vs. references

A very subtle but important distinction in modern C++ is the difference between a pointer and a reference. Pointers are a C concept, while references are a modern C++ concept. References were added to C++ to provide the efficiency of pointers, while reducing the possibility for error. A reference

1. Cannot be NULL (in C++, NULL is gone and nullptr denotes a null pointer value)
2. Always points to a memory location
3. Cannot be modified to point to a different memory location

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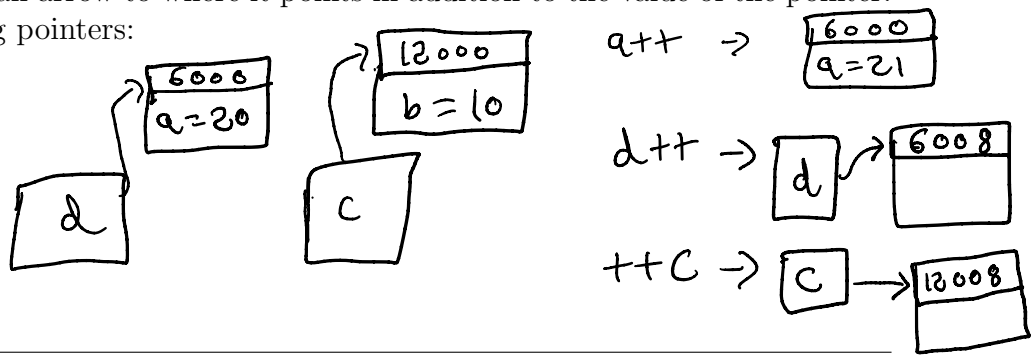
Exercise #1

Using the below code, suppose the variable a lives at memory address 6000, and b lives at the memory address 12000. The size of a long long integer is 8 bytes. After execution of the above code, draw boxes for each of the 4 variables a, b, c and d, and show their integer values. For c and d, draw an arrow to where it points in addition to the value of the pointer.

Here's some code using pointers:

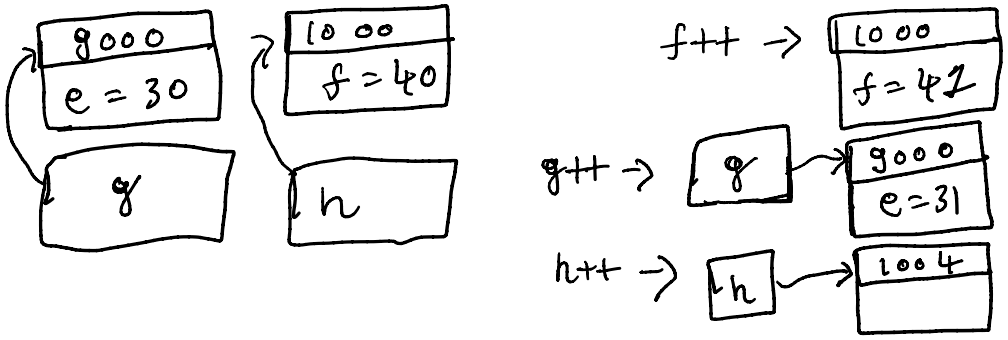
```
long long a = 20;
long long b = 10;
long long* c = &b;
long long* d = &a;
a++;
d++;
++c;
```



Exercise #2

Suppose the variable e lives at memory address 9000, and f lives at the memory address 1000. The size of an integer is 4 bytes. Consider the state at the end of the execution of the below code. Draw boxes for each of the 4 variables e, f, g and h, and show their integer values. For g and h, draw an arrow to where it points in addition to the value stored in the reference location.

```
int e = 30;
int f = 40;
int& g = e;
int* h = &f;
f++;
g++;
h++;
```

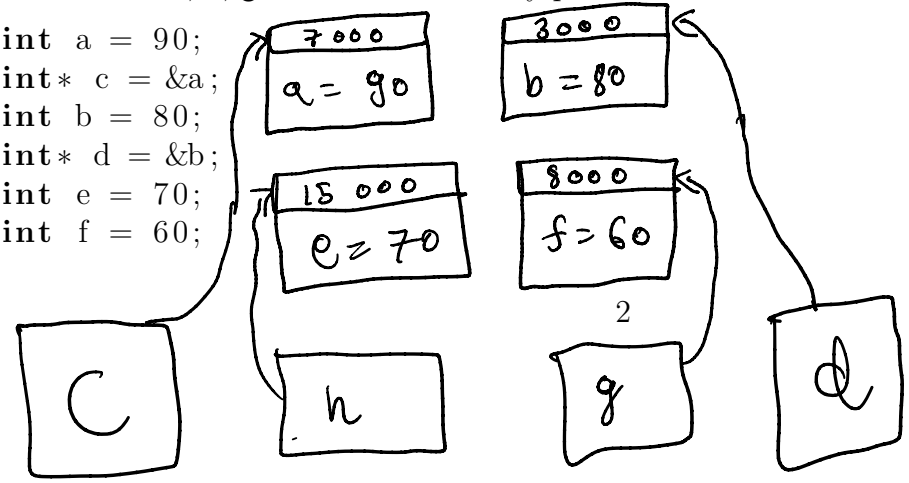


Exercise #3

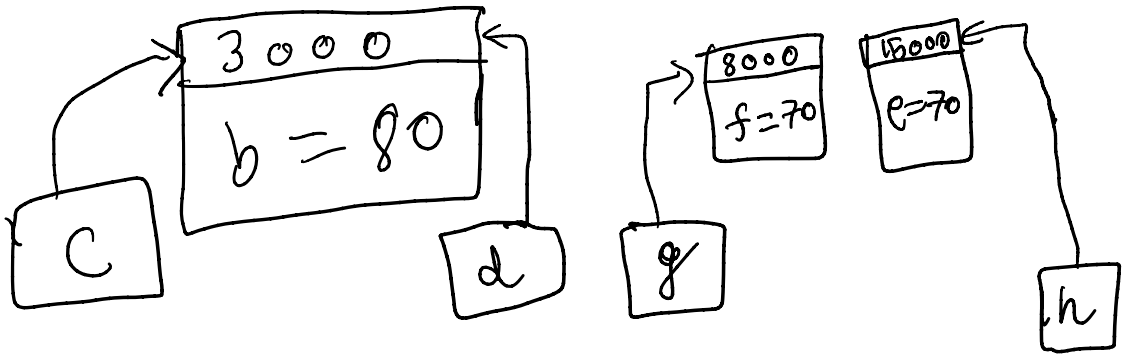
Consider the state after the execution of the below code.

Draw boxes for each of 8 variables, showing the contents of each box. Assume a lives at memory address 7000, b lives at 3000, e lives at 15000, and f lives at 8000. In addition, draw arrows from c, d, g and h to where they point.

```
int a = 90;
int* c = &a;
int b = 80;
int* d = &b;
int e = 70;
int f = 60;
```



```
int& g = f;
int& h = e;
c = d;
g = h;
```



Electronic Submission

Before submission, make sure your name appears somewhere on your paper / electronic document. If your answer is hand-written please submit a photo, otherwise submit your electronic document. When you are ready to submit, login to Blackboard, find Assessments in the left hand side, then follow the link to Gradescope (or navigate to Gradescope directly), and then submit your image to "Homework 2". You may submit as many times as you want, but we grade only the last submission.

Policy

All work is to be done individually — group work is not allowed. While we encourage you to talk to your peers and learn from them, this interaction must be superficial with regards to all work submitted for grading. This means you *cannot* work in teams, you cannot work side-by-side, you cannot submit someone else's work (partial or complete) as your own. The University's policy is available here:

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