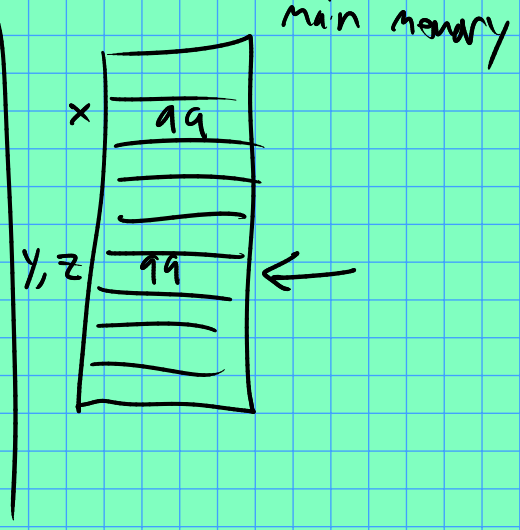
Quick illustration for by-value vs. by-reference.

```
void f(int x) { x++; }
void g(int& y) { y++; }

int main() {
    int z = 99;
    f(z);
    g(z);
```



Up until now, all the programs we've written use a fixed # of variables (+ memory) and this value was known at <u>compile time</u>.

Here's a problem that requires an arbitrary amount of memory:

Reverse a list of integers given on std input.

```
echo 9 8 17 ... 14 ... 45 | ./reverse
```

No fixed # of int variables will suffice for all cases.

One solution: vectors. They give you an expandable container of any type.

Ex:

C++

```
vector<int> V;
```

datatype of V.

```
V.push_back(5);
V.push_back(10);
   ⋮
V.push_back(347);
```

pictures