# ESc 101: Fundamentals of Computing

Lecture 19

Feb 15, 2010

# Outline

# scanf

- `scanf` is a function that reads values from keyboard.
- The number and type of values to be read is specified by the first argument of `scanf` which is a constant string like in `printf`.
- Since parameters are passed in C by value, how are the values read and stored in parameter variables by `scanf`?
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# Memory Address

- A variable is a name for a memory location.
- Recall that this is done for ease of use, as representing a memory location by its address is tricky.
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# Recall: Call-by-Value

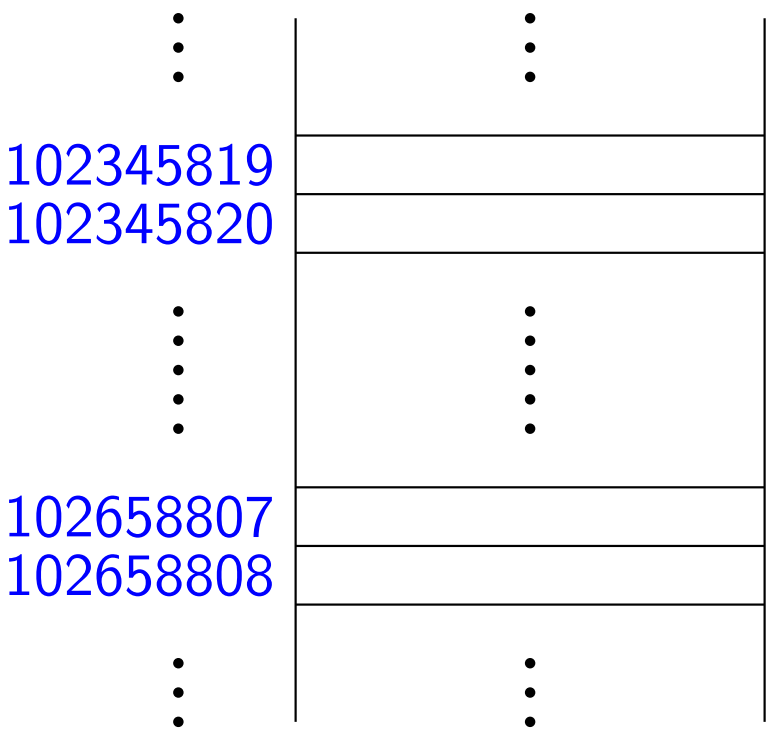
In a function call, only the value stored in an argument is passed to the corresponding parameter of the function. Example:

```
void foo( int y )
{
    y = 20; /* function sets y to 20 */
}

main()
{
    int x;

    x = 10; /* x = 10 here */
    foo(x);
    printf("%d", x); /* x = 10 here too */
}
```

# Recall: Call-by-Value

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PROGRAM

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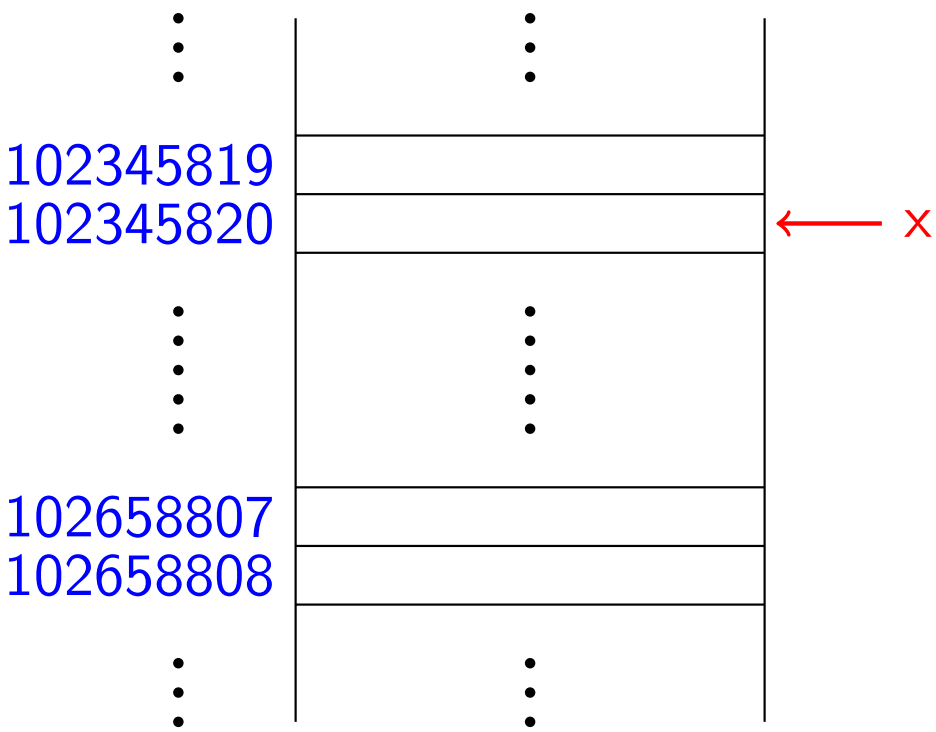


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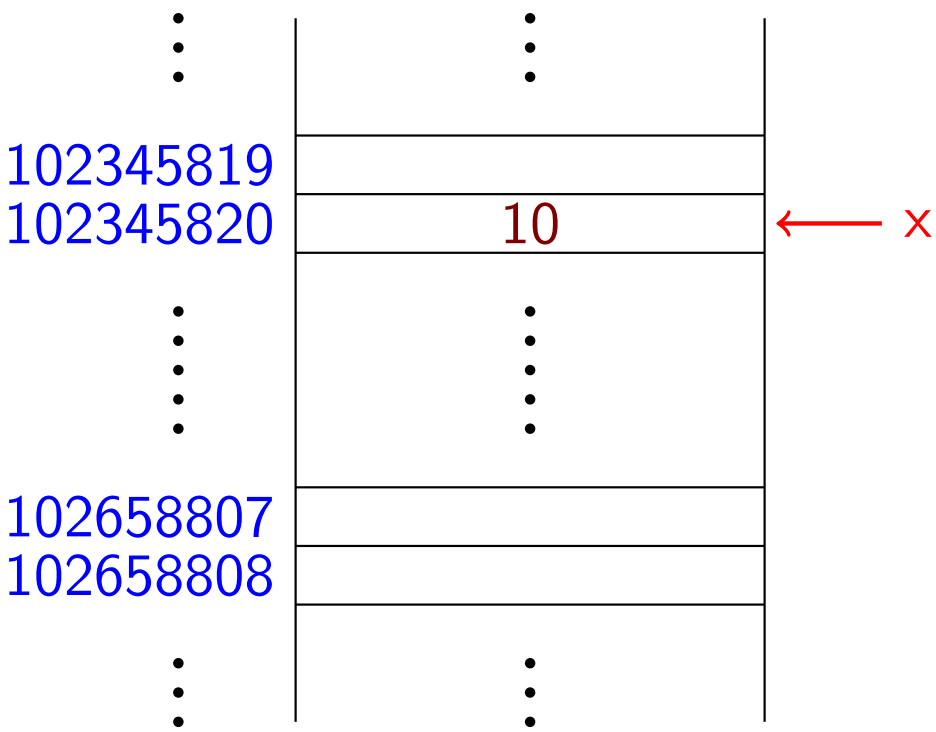


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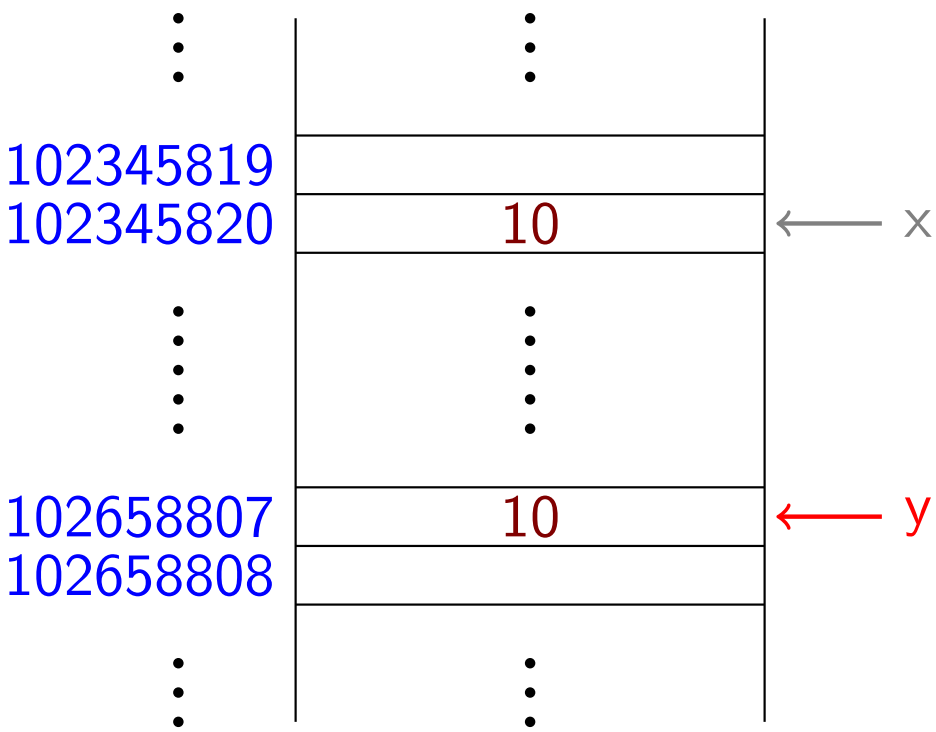


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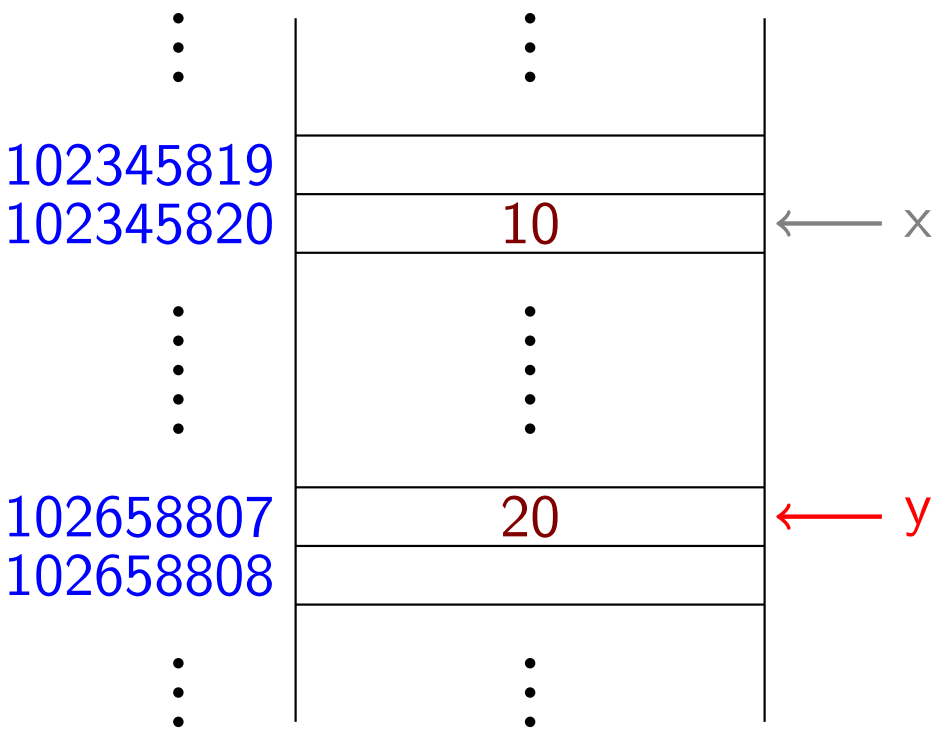


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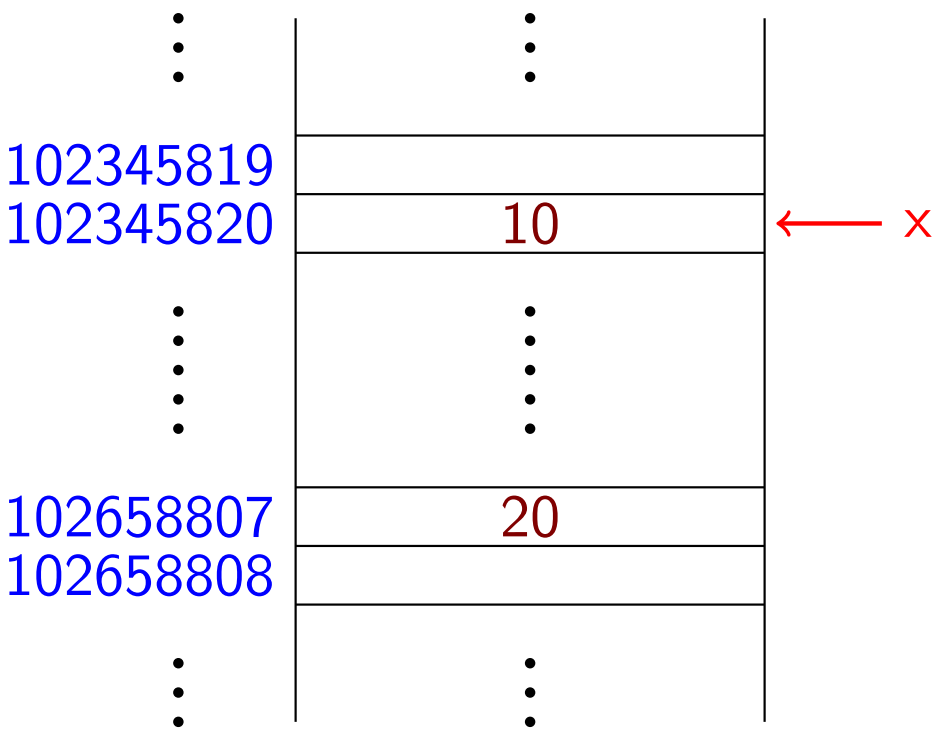


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# Getting Around Call-by-Value

- Suppose that instead of value of `x`, we pass the address of `x` to the function `foo`.
- Then the address of variable `x` of `main` will be available inside `foo` – as the value of variable `y`.
- Suppose also that we can say the following inside `foo`:
  - store 20 in the memory location whose address is stored in variable `y`
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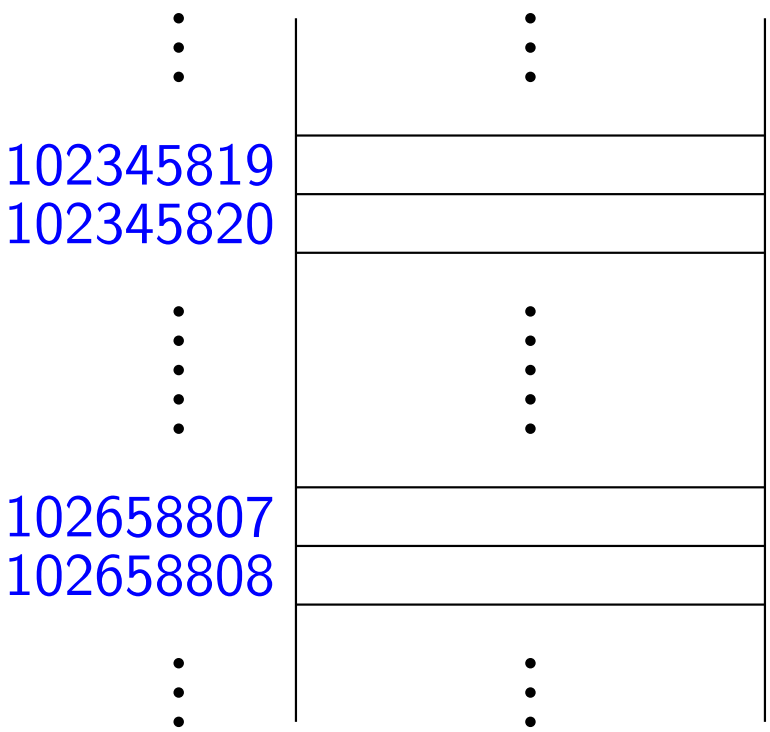


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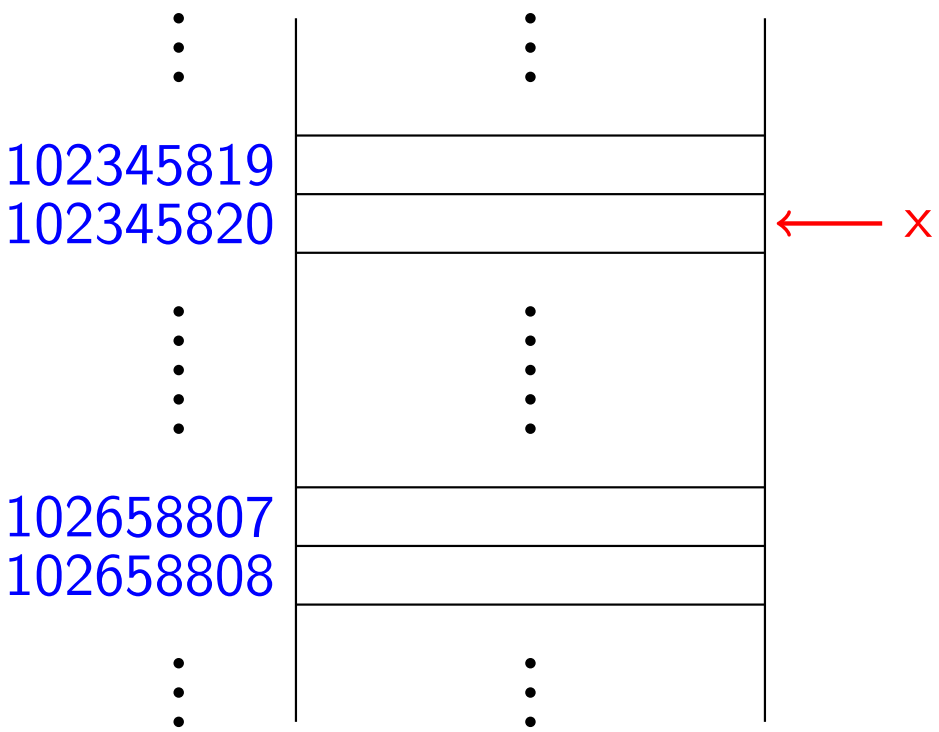


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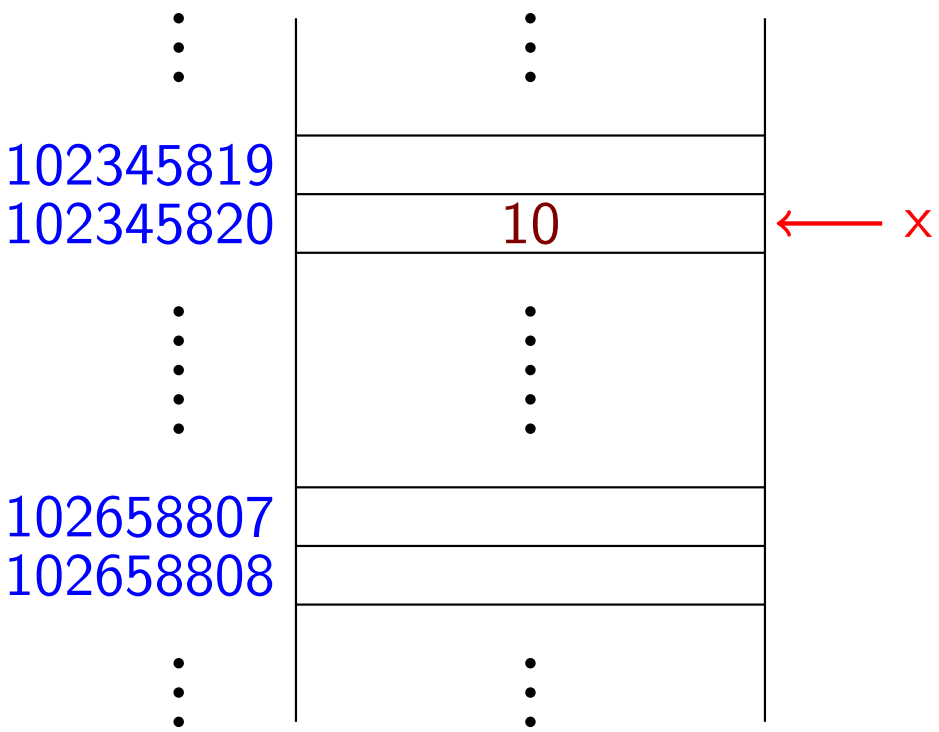


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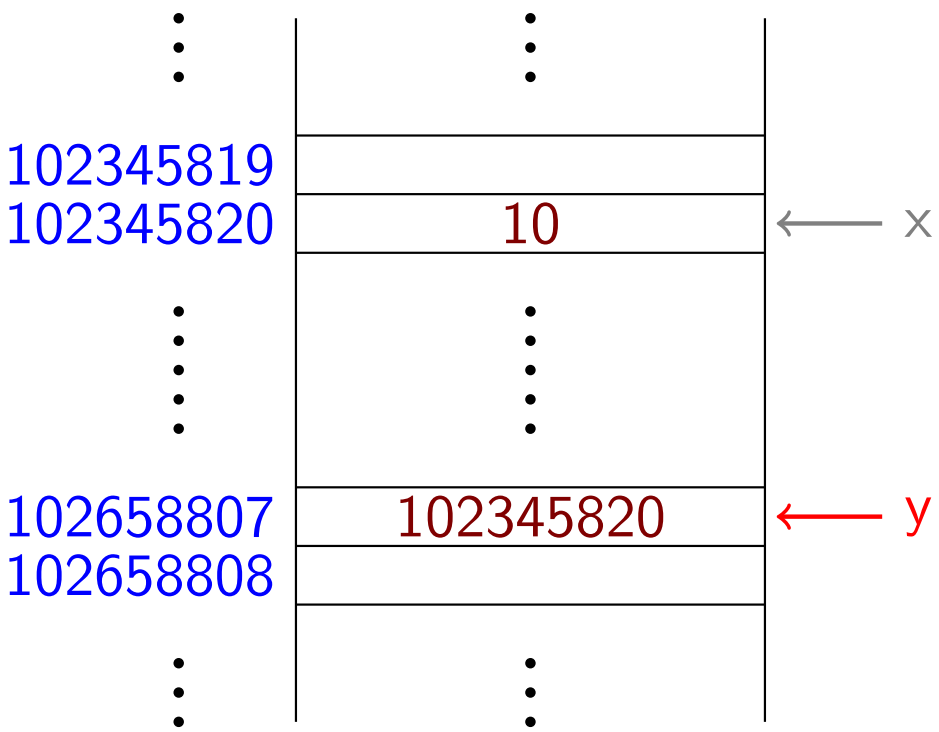


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**MEMORY** **PROGRAM**

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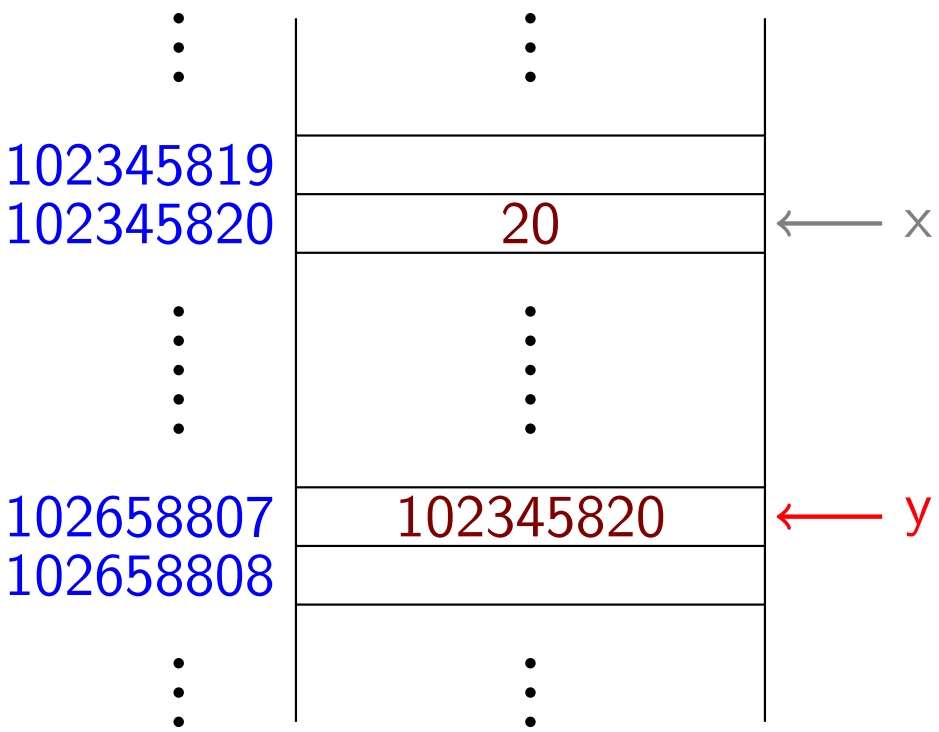


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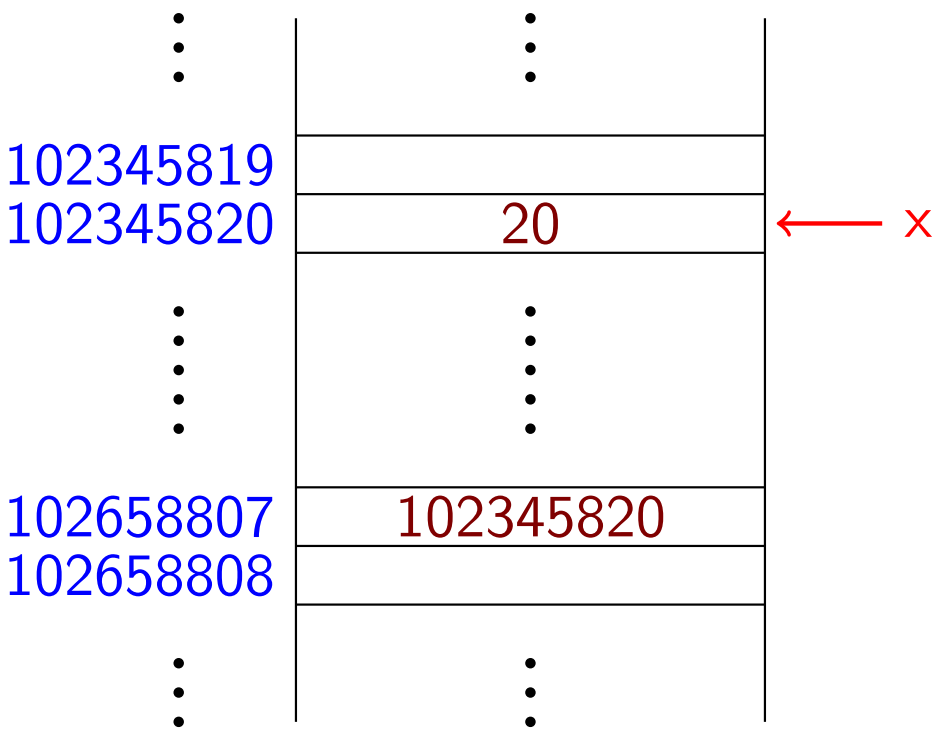


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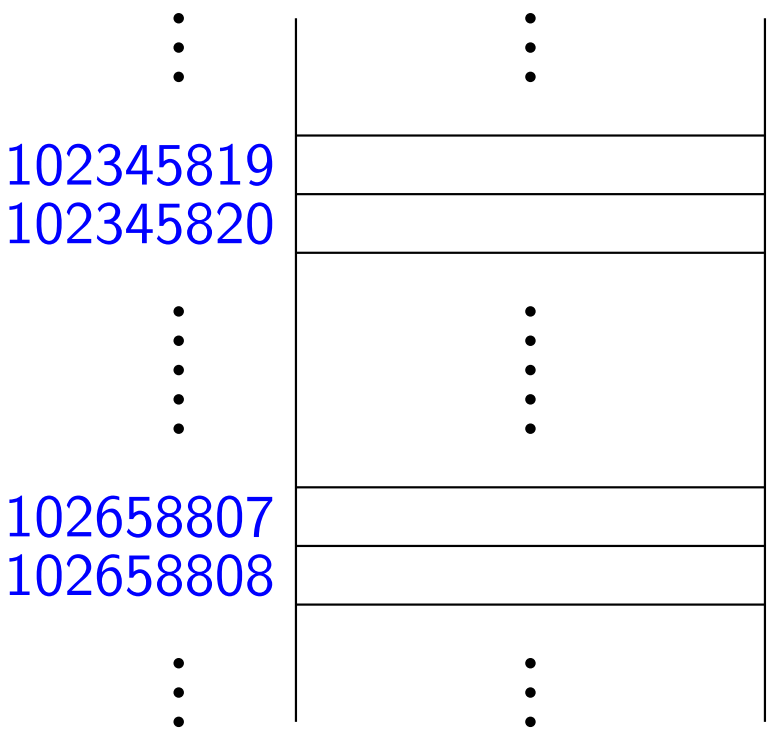


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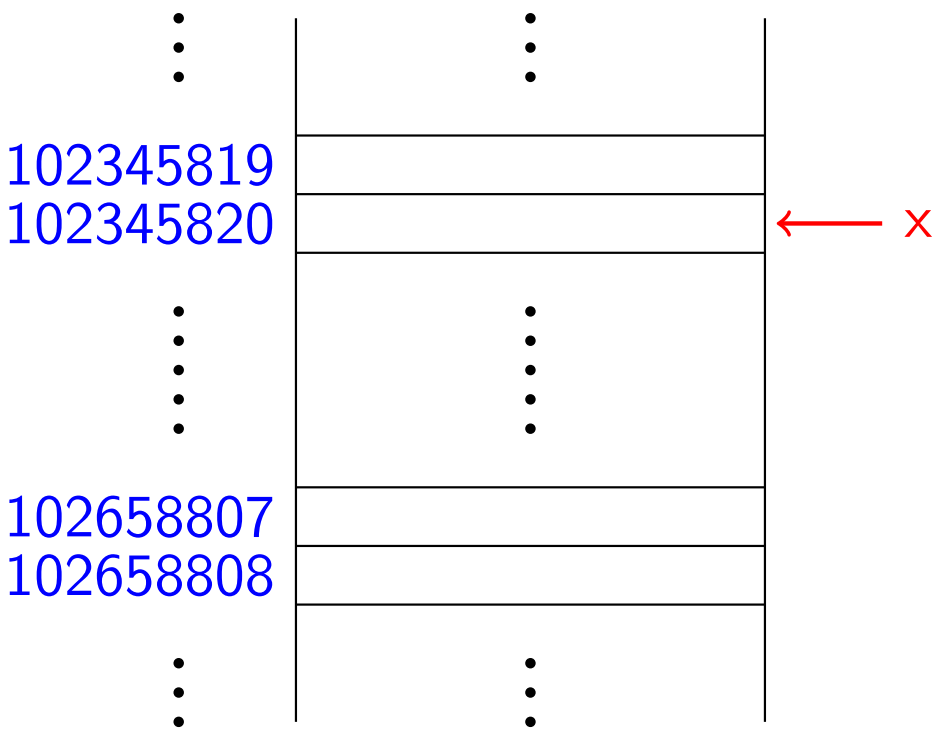


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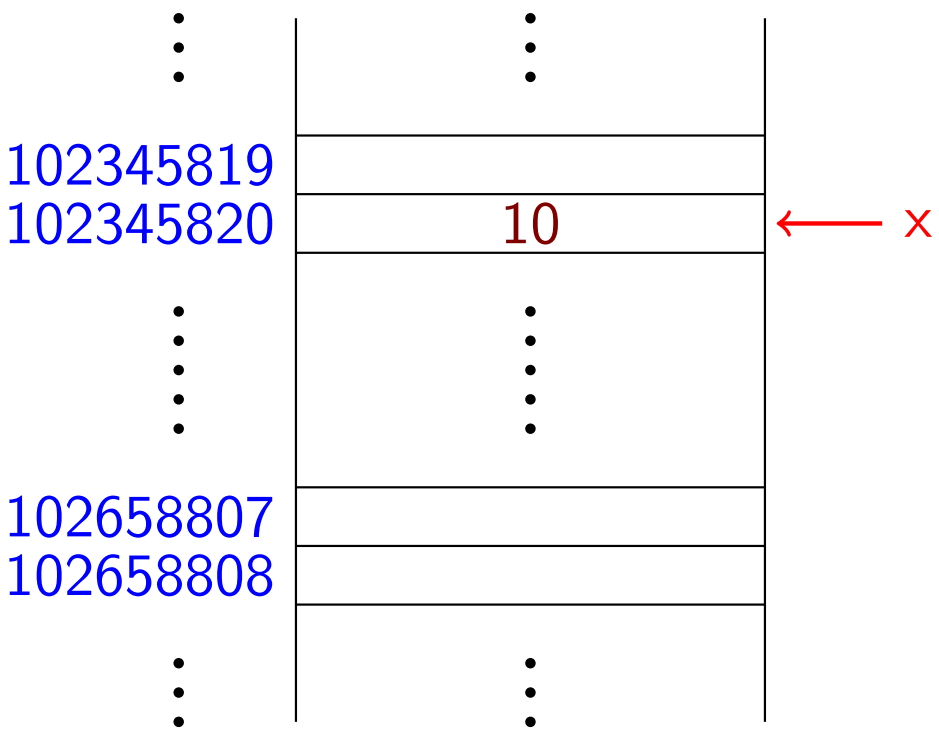


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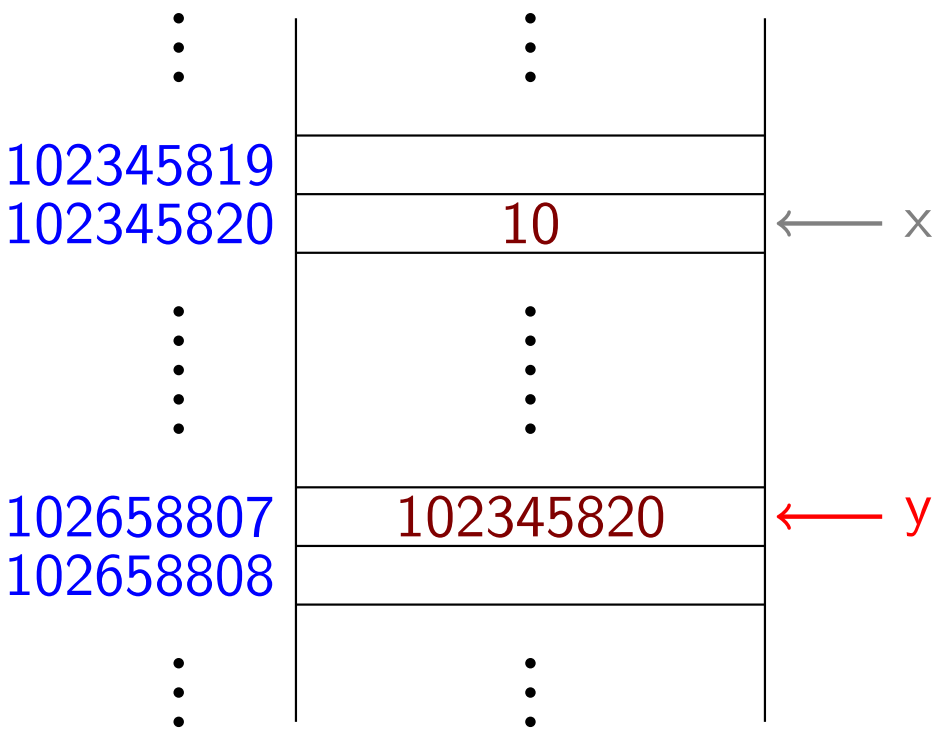


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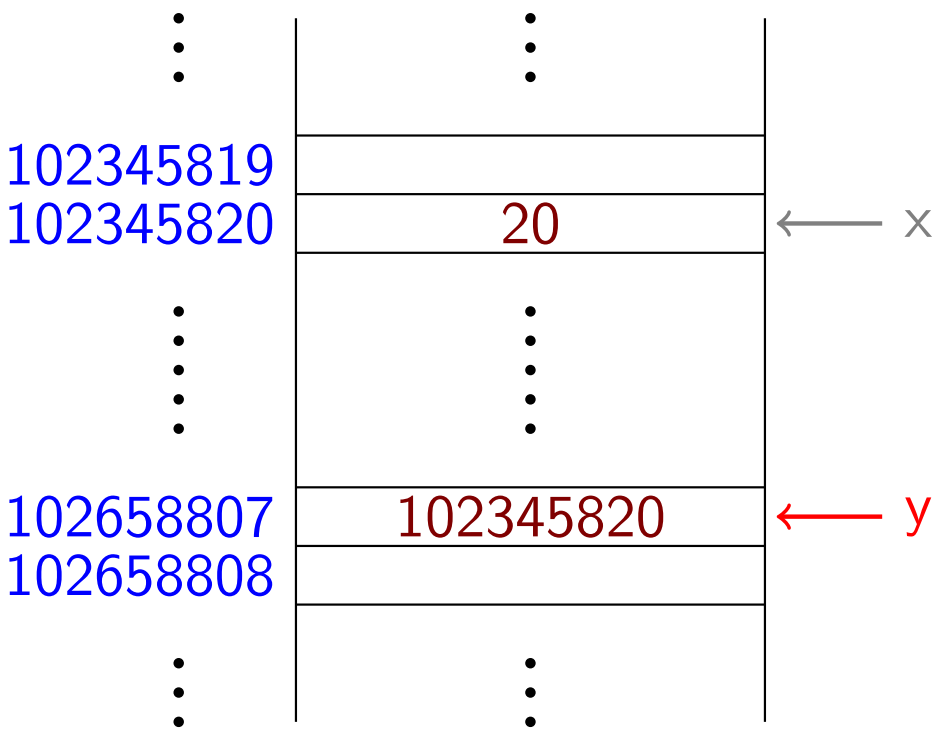


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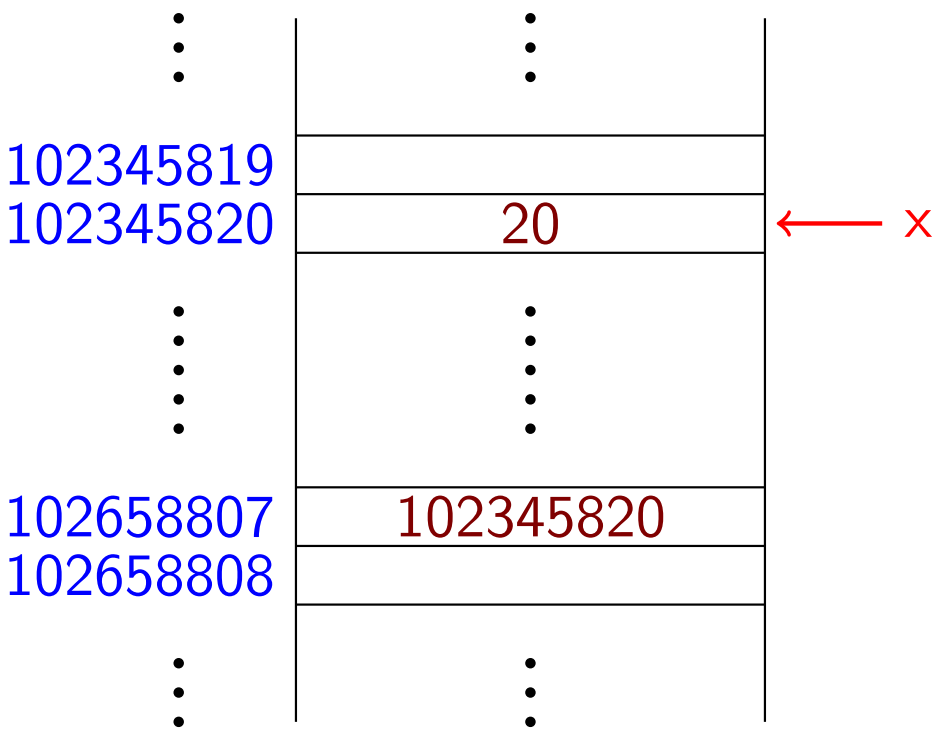


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- Variable `y` stores a number.
- However, a special meaning is attached to this number: this number is the address of a memory location that stores an `int`.
- The type of `y` is denoted by `(int *)`.
- Variable `y` is also called a pointer:
  - It points to the location of variable `x` of `main`.
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# Resolving the Anomaly for Arrays

- Declaration
  `int z[3]`
  reserves 3 memory locations (each of 4 bytes).
- These are named `z[0]` to `z[2]`.
- In addition to this, another memory location is reserved!
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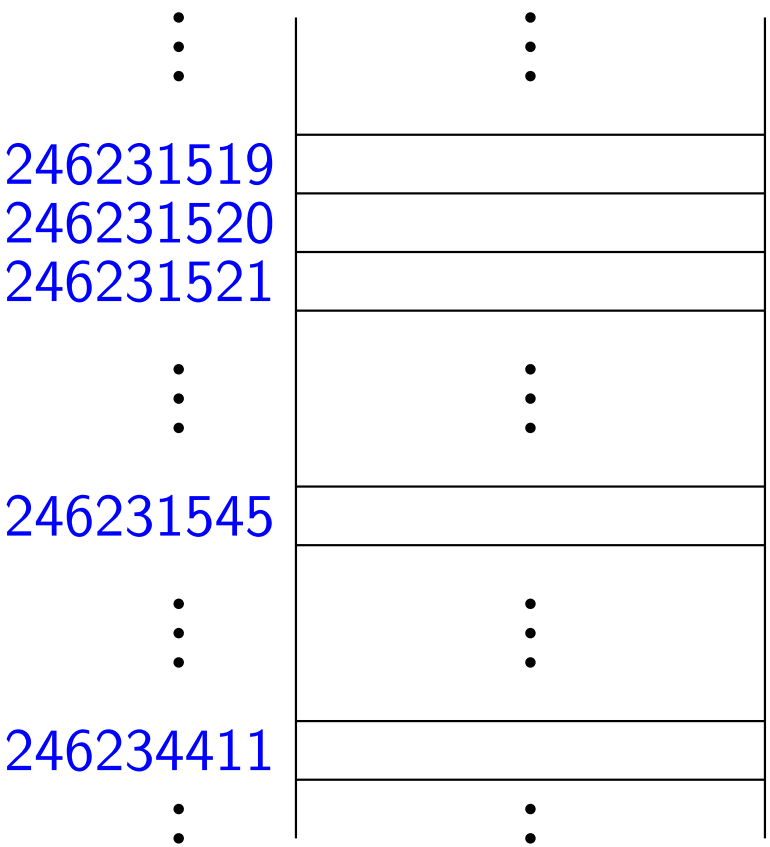


MEMORY

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void foo( int y[] ) {
   for (int i=0;i<3;i++)
      y[i] = y[i] + i;
}
main() {
   int z[3];
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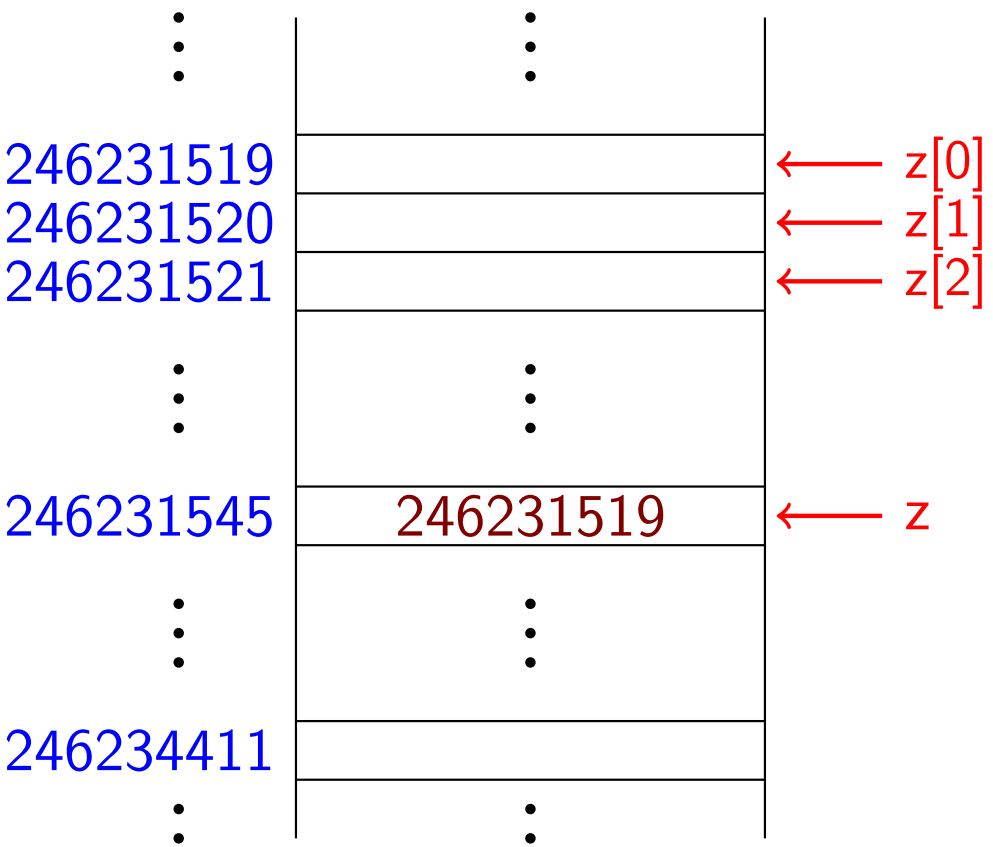
      z[i] = 0;
   foo(z);
   /* do something */
}
```

PROGRAM

# Example

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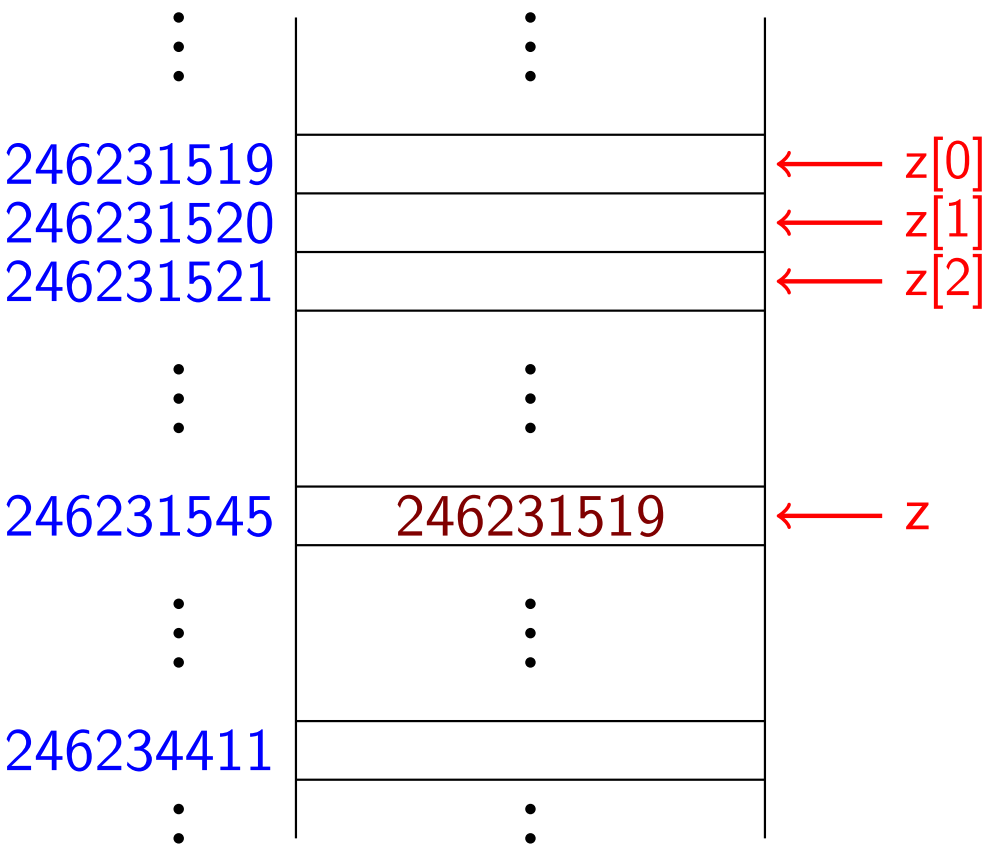


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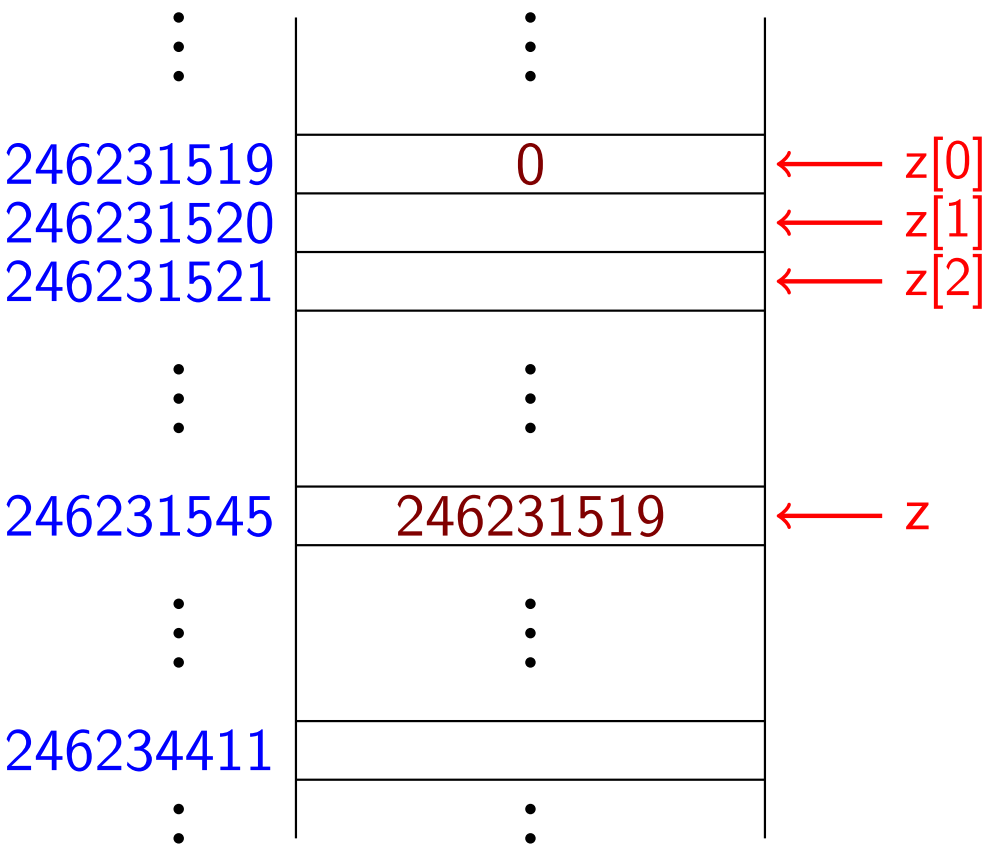


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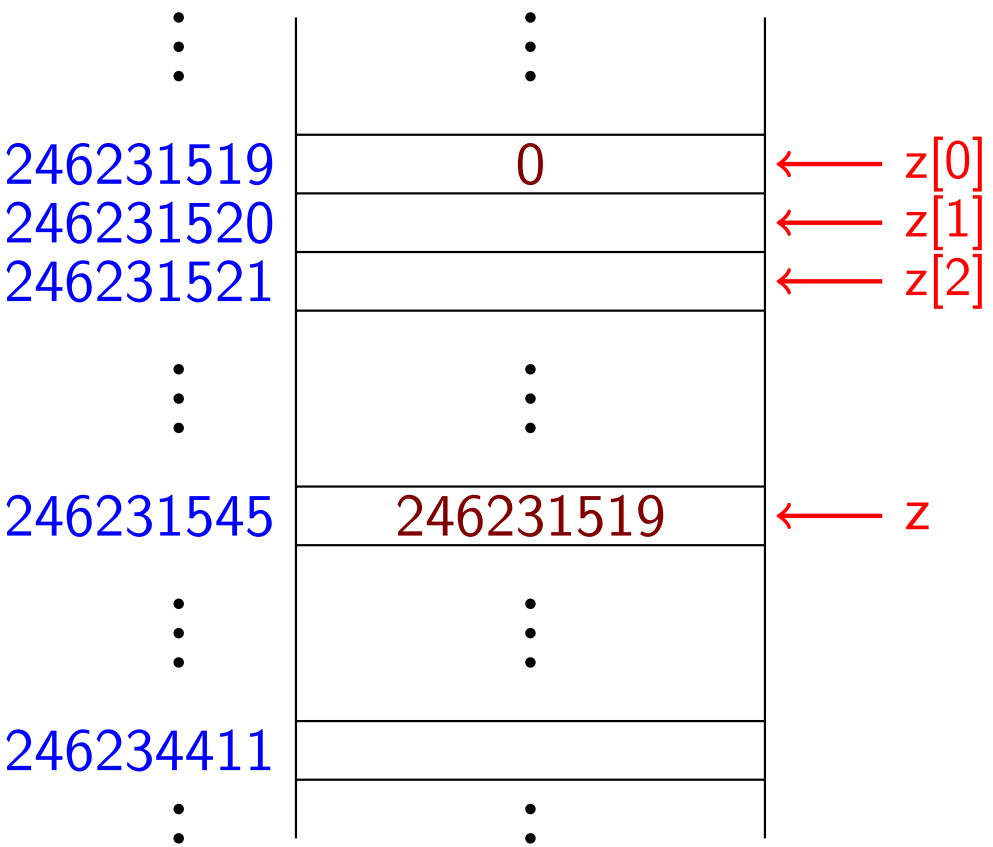


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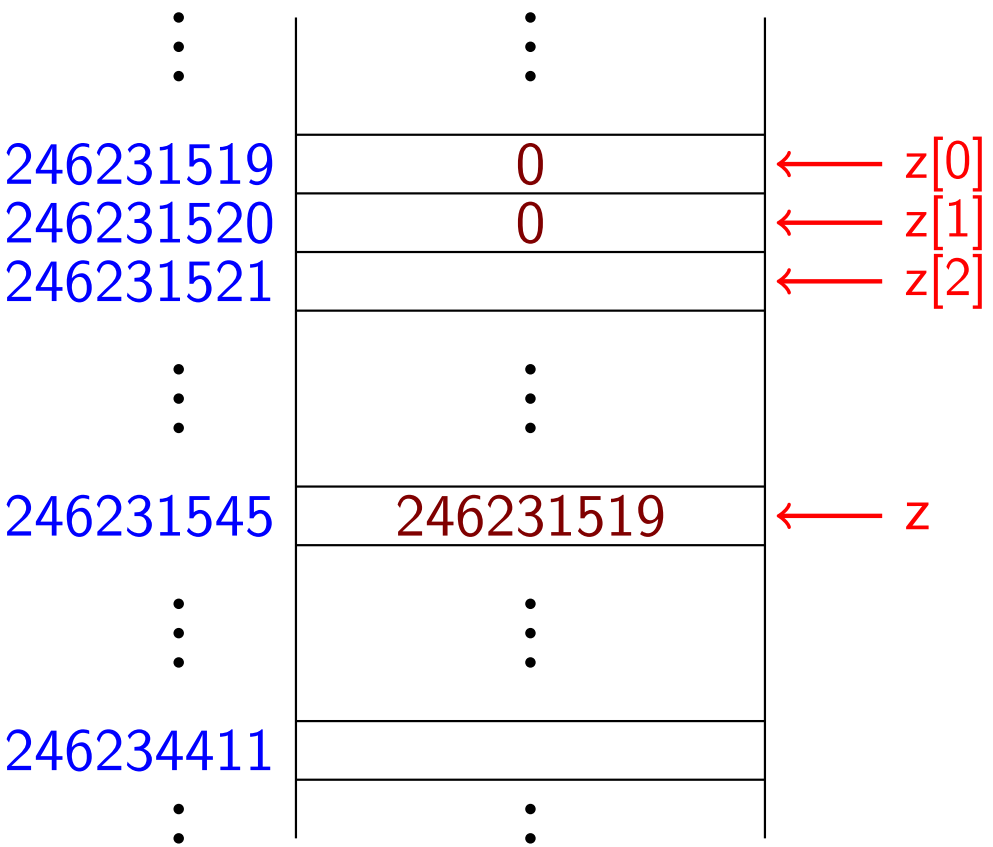
**PROGRAM**

# Example




```
void foo( int y[] ) {
   for (int i=0;i<3;i++)
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main() {
   int z[3];
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      z[i] = 0;
   foo(z);
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PROGRAM

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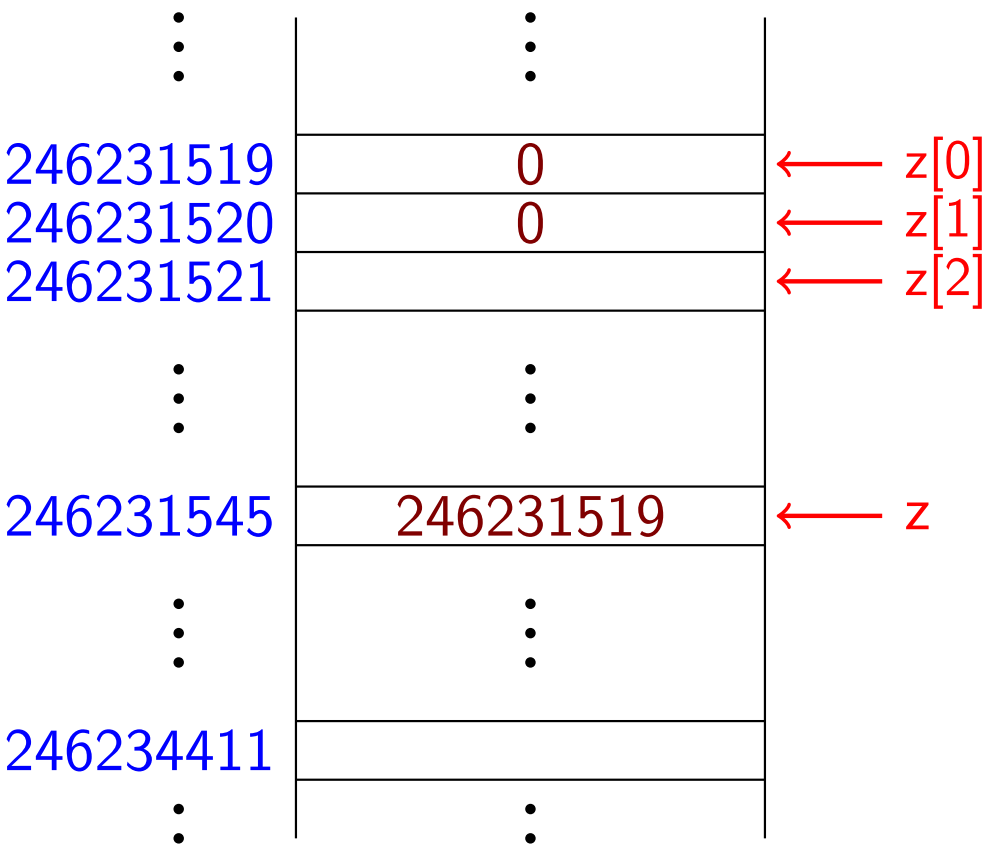


MEMORY

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PROGRAM

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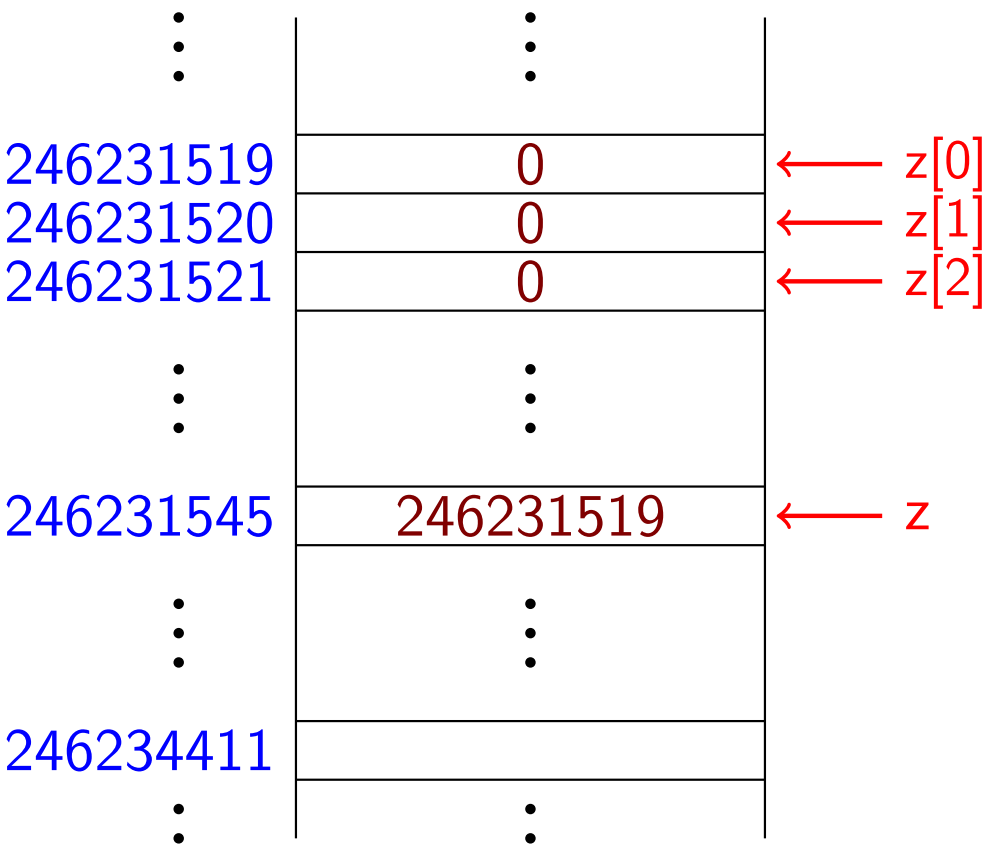


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**MEMORY**

**PROGRAM**

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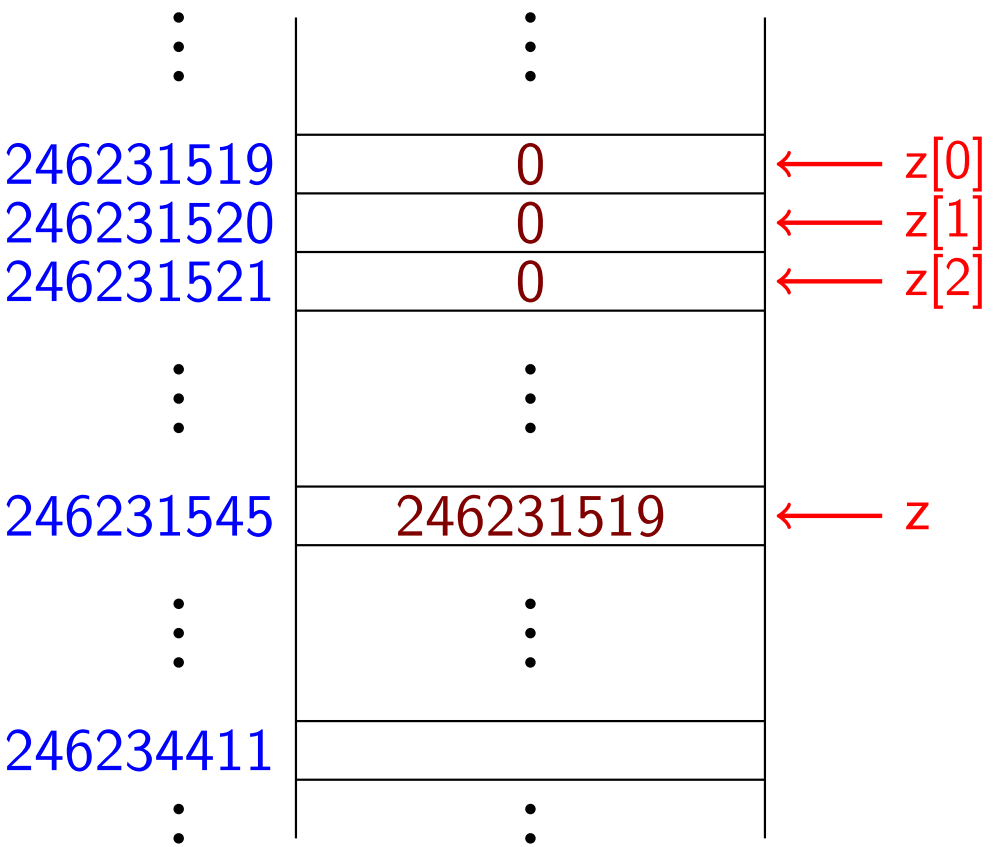


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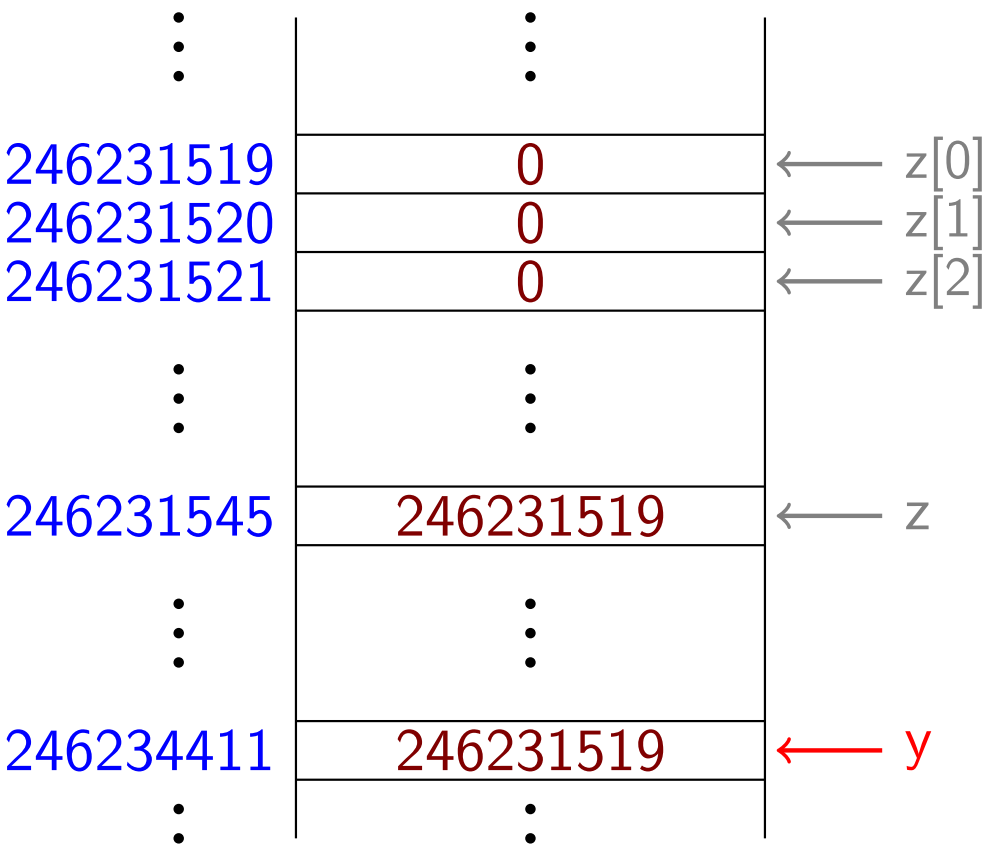
**MEMORY**

**PROGRAM**

# Example

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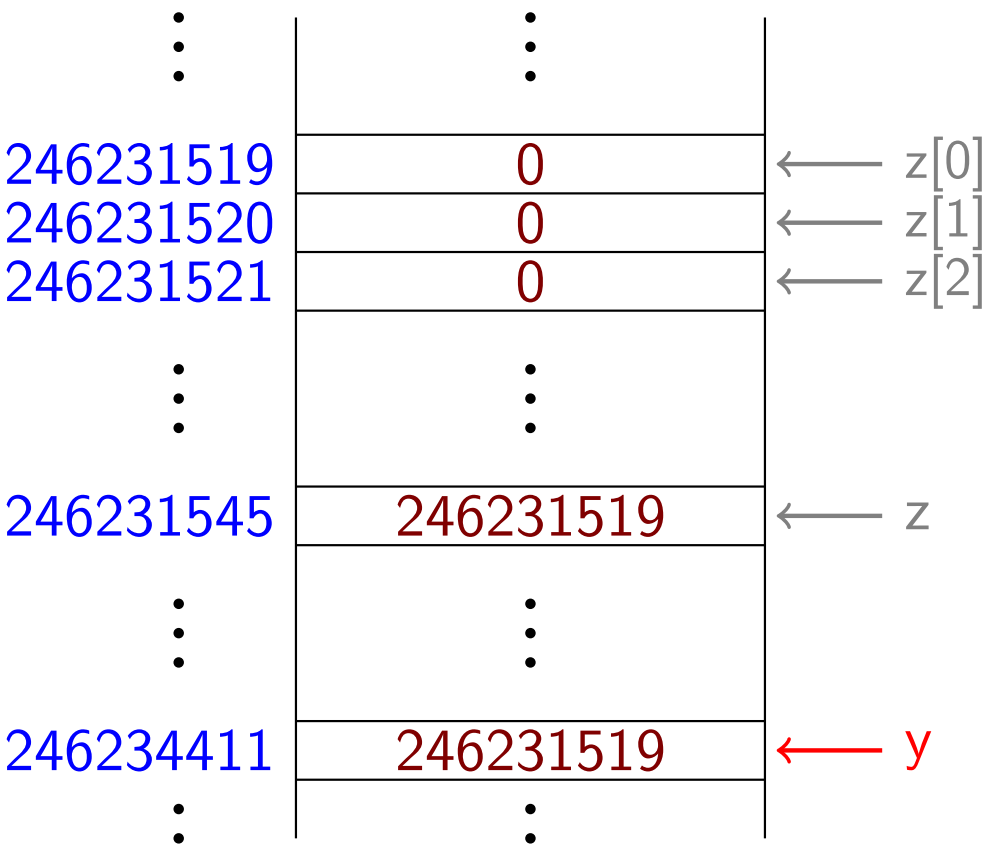
**MEMORY** **PROGRAM**

# Example

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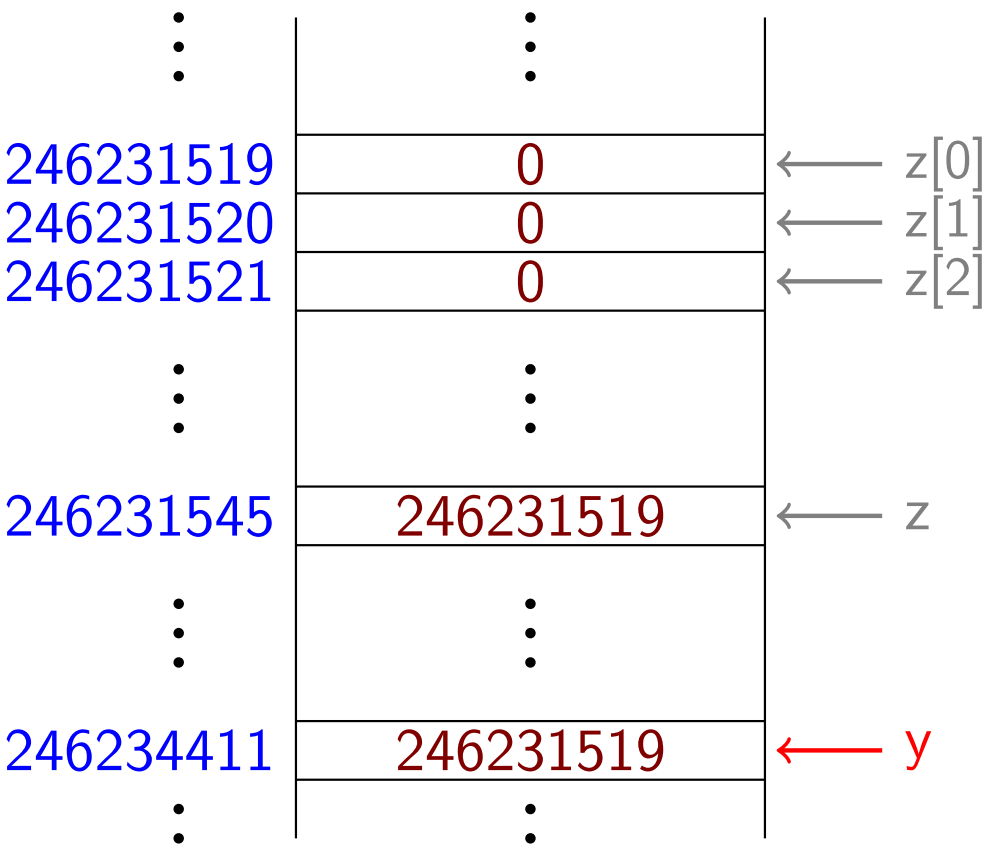
**MEMORY** **PROGRAM**

# Example

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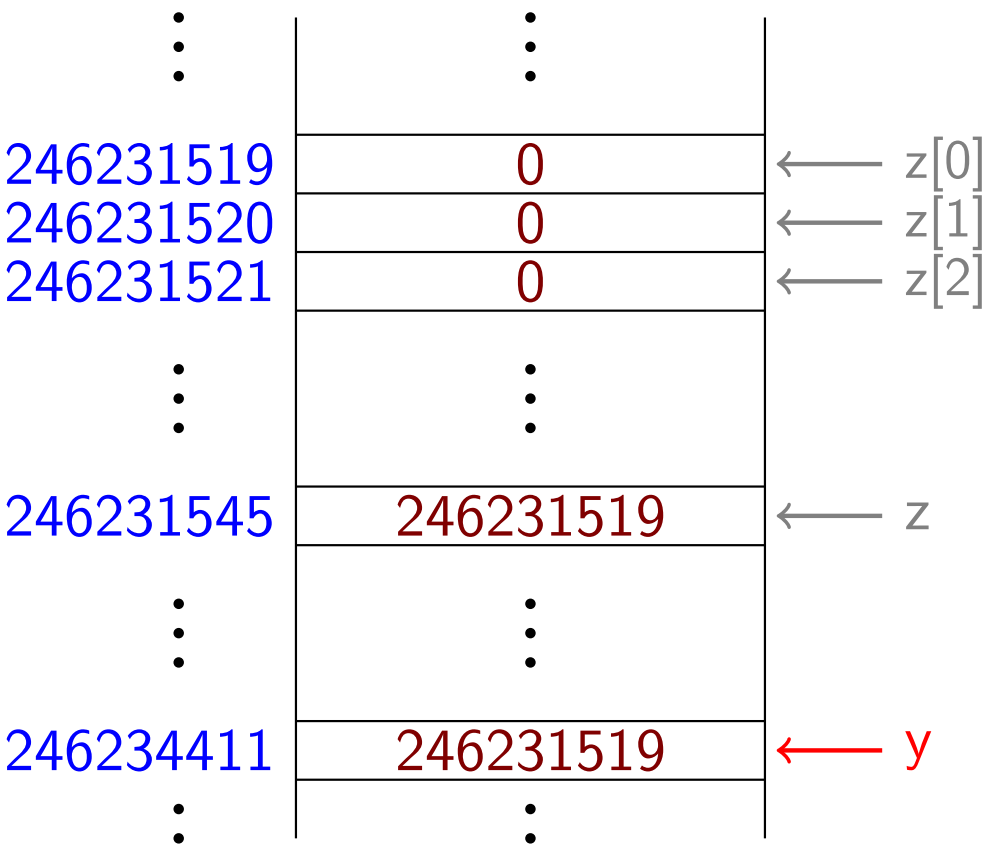
**MEMORY** **PROGRAM**

# Example

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**MEMORY** **PROGRAM**

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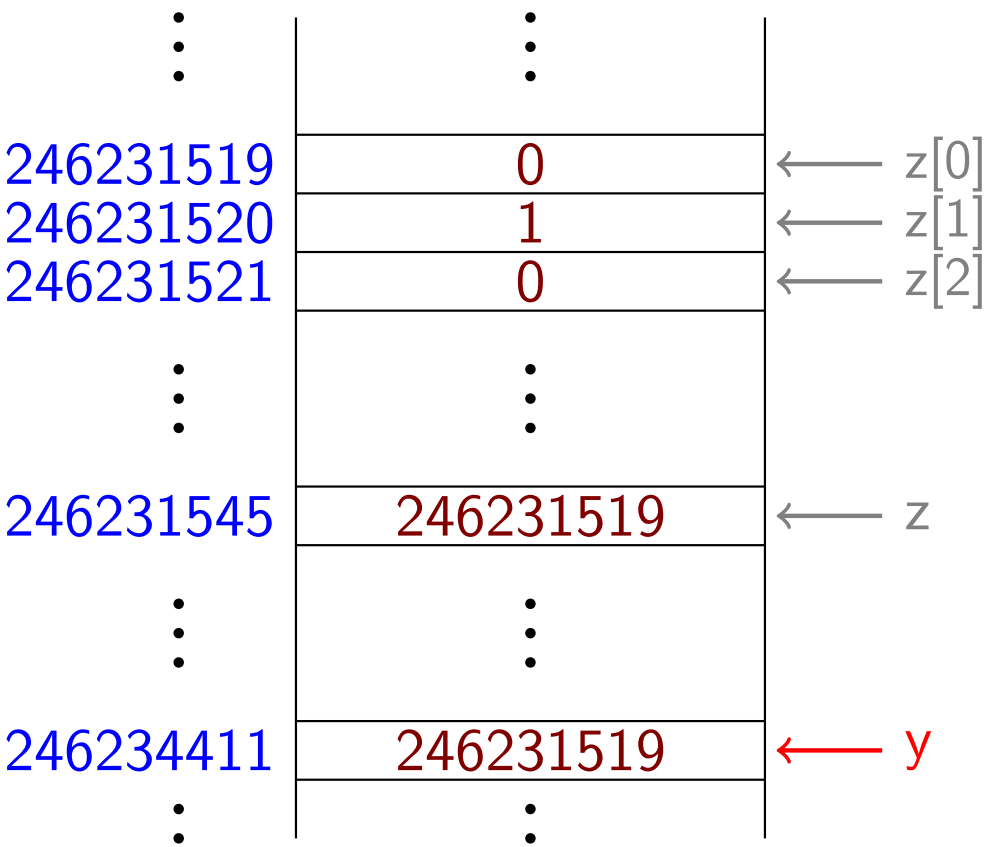


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**PROGRAM**

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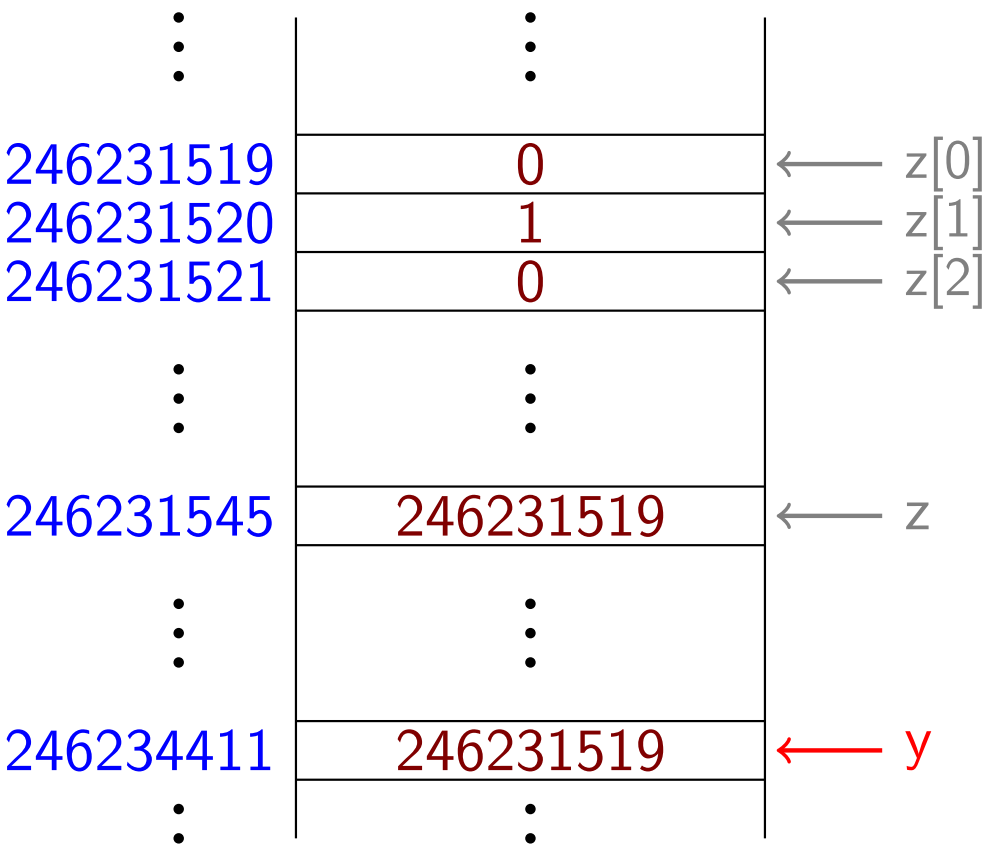


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**PROGRAM**

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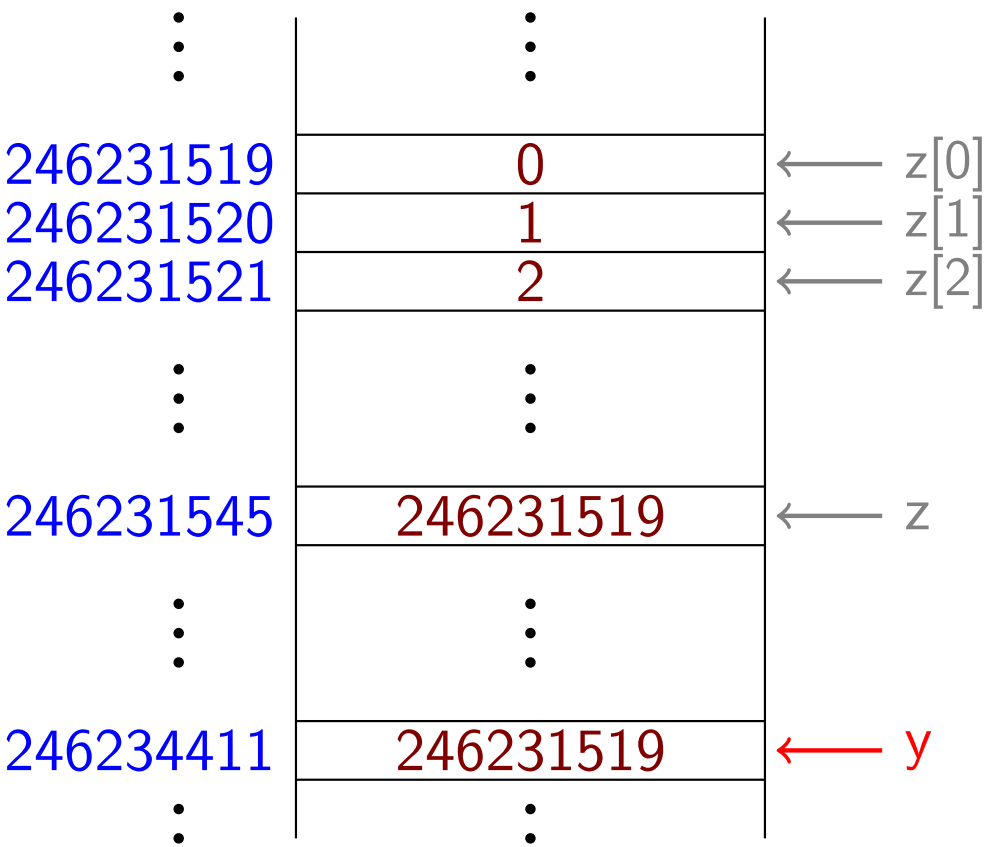


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PROGRAM

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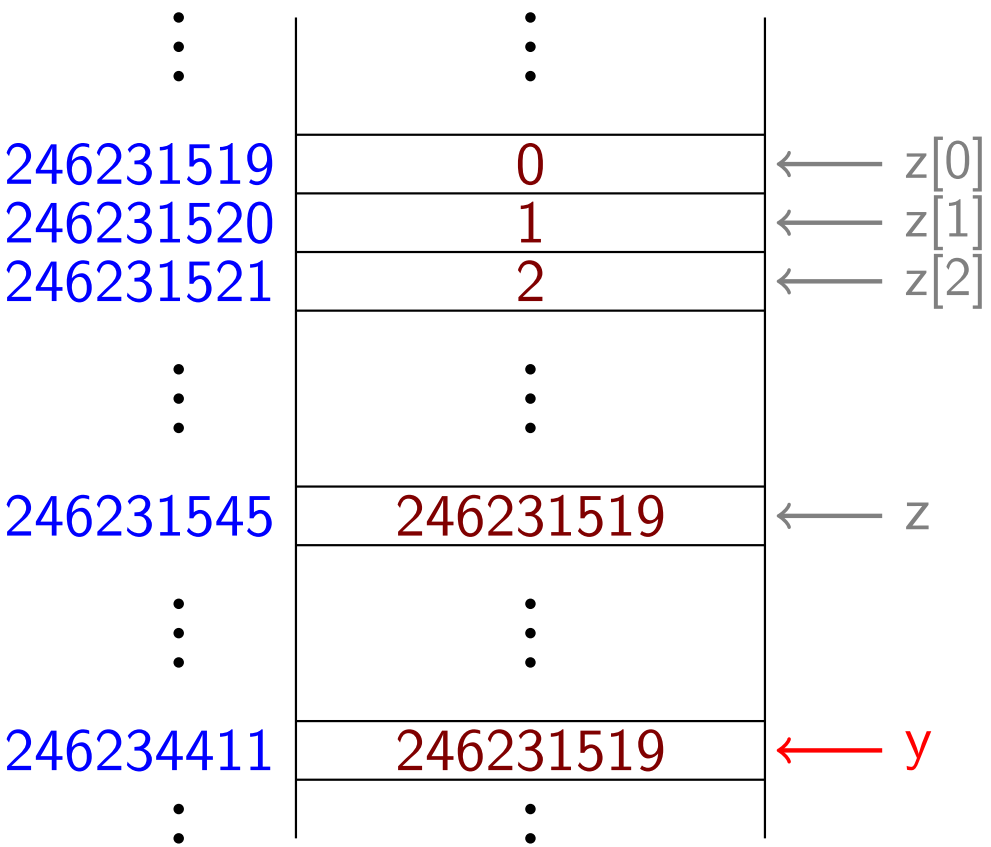


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**PROGRAM**

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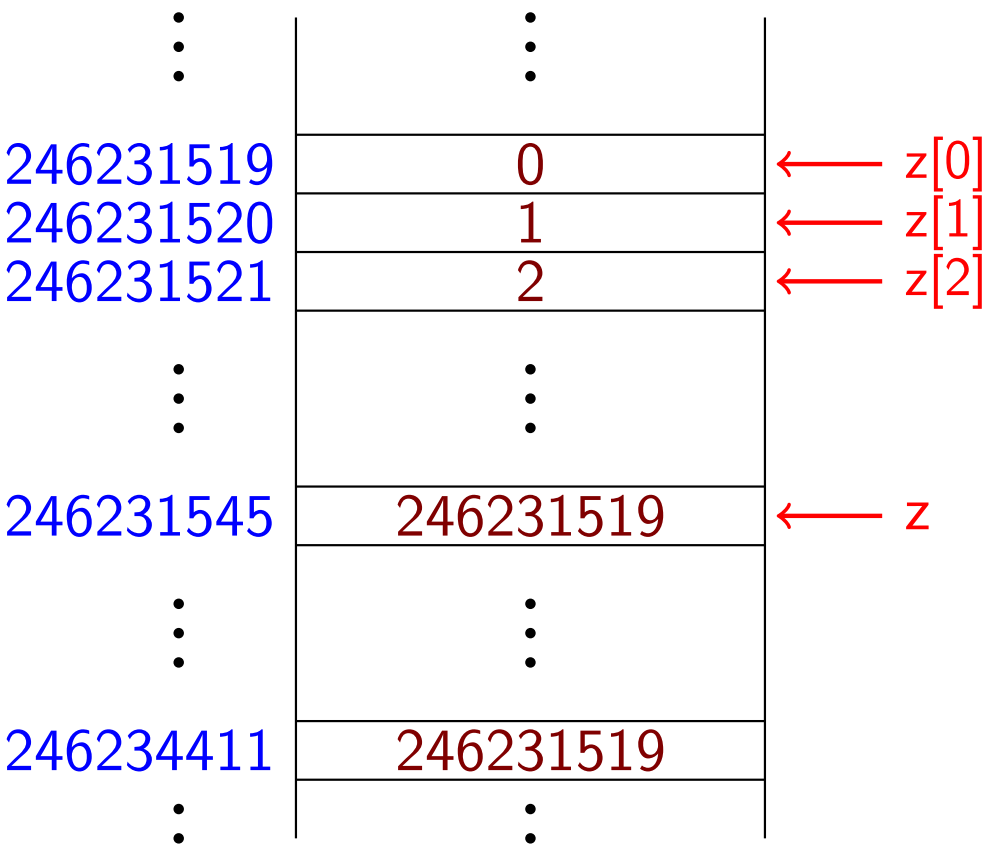


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**MEMORY** **PROGRAM**