Functions, Variables and Memory

- Each function has its own memory space
  - Including `main`
  - All variables and parameters declared in a function refer to memory *allocated* in that space
  - When a function ends, its variables are deallocated

```
double sum_three( double x, double y, double z )
{
      double sum;
      sum = x + y + z;
      return sum;
}
…
sum = sum_three( 5, 6, 7 );
```

Functions, Variables and Memory

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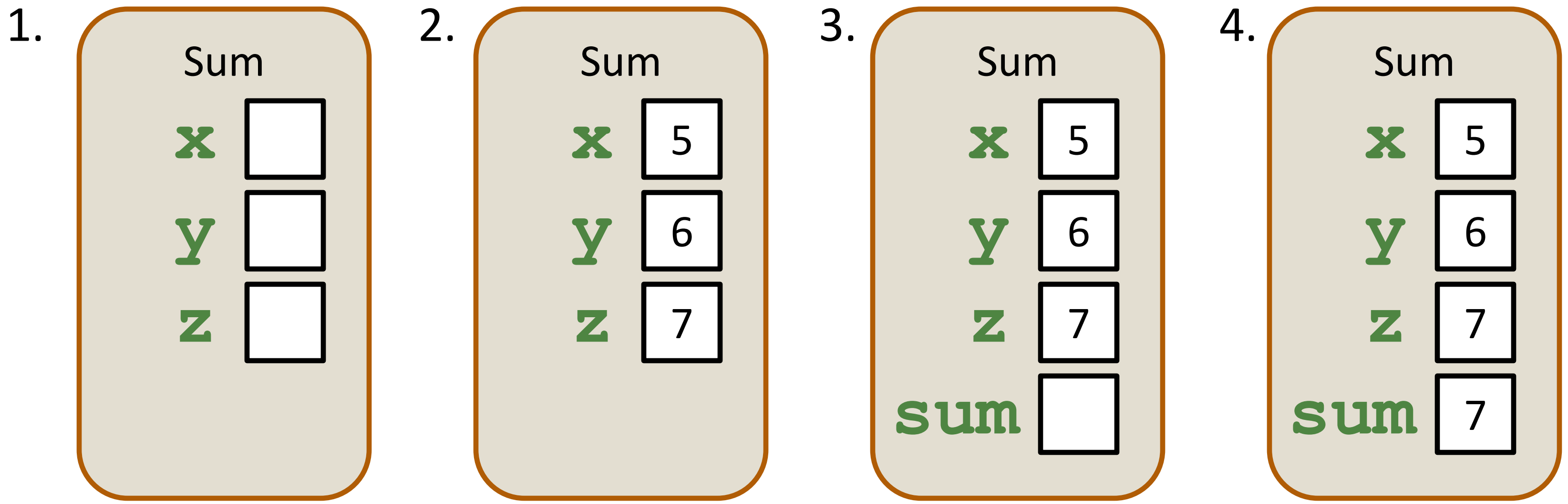
```

1. Allocate memory for formal parameters
2. Assign actual parameter values
3. Allocate memory for declared variable sum
4. Calculate the sum
5. Return the sum (all memory de-allocated)



Functions, Variables and Memory

- Functions cannot use variables declared in another function
  - They are *out of scope*
- Variables with the same name in different functions do not refer to the same memory

Pass by Value

- By default, parameters are passed to a function *by value*
  - The value of the actual parameters are copied into the space allocated for the formal parameters
  - Each formal parameter has its own copy of the data in the function memory space
- Inside the function
  - Parameters passed by value are used to manipulate the data stored in the function memory space

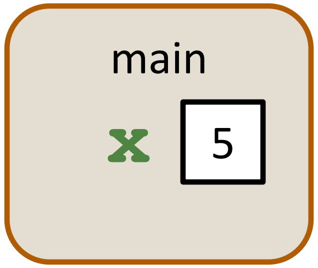
Value Parameters

- For value parameters:
  - Copy the value of the corresponding actual parameter
  - Manipulate that copy in the function’s memory space

```
int add_one( int value )
{
   value = value + 1;
   return value;
}

int main()
{
   int x = 5;
   add_one( x );
   cout << x << endl;

   return 0;
}
```



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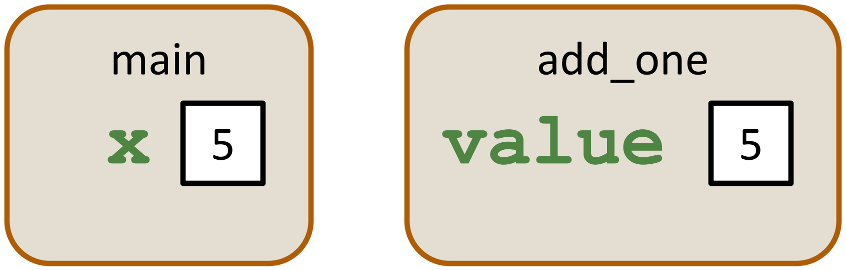

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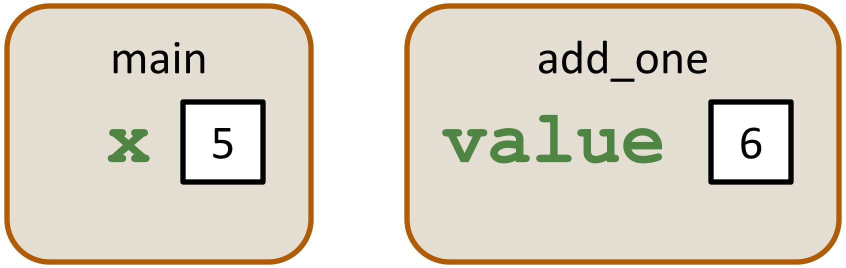

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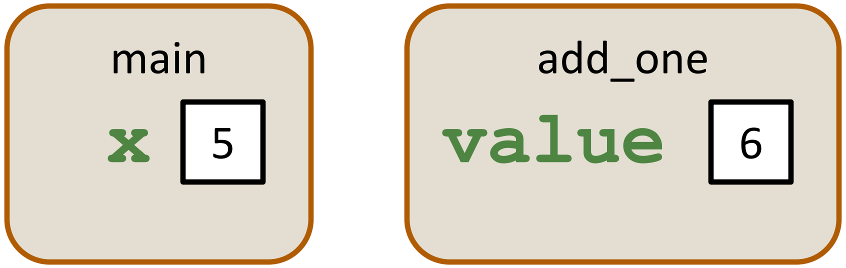

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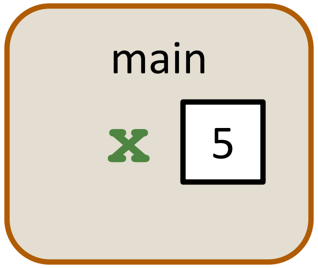

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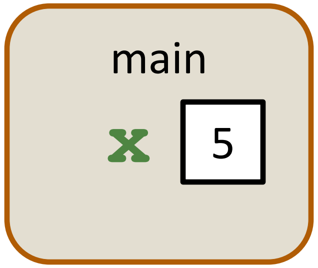

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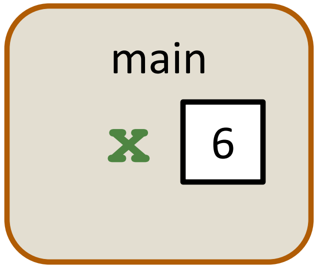

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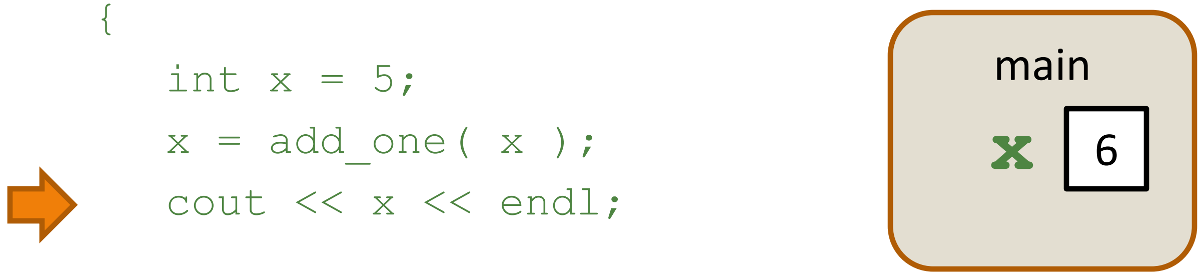

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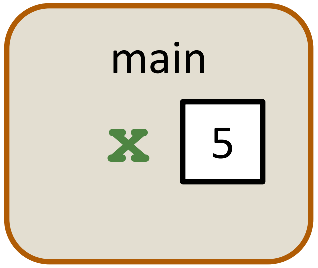

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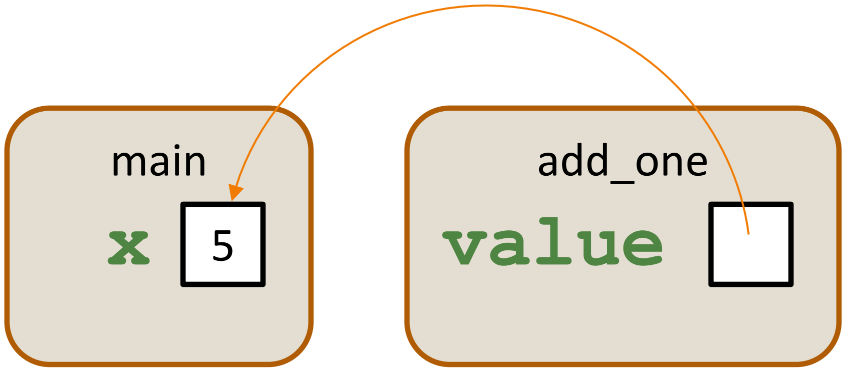

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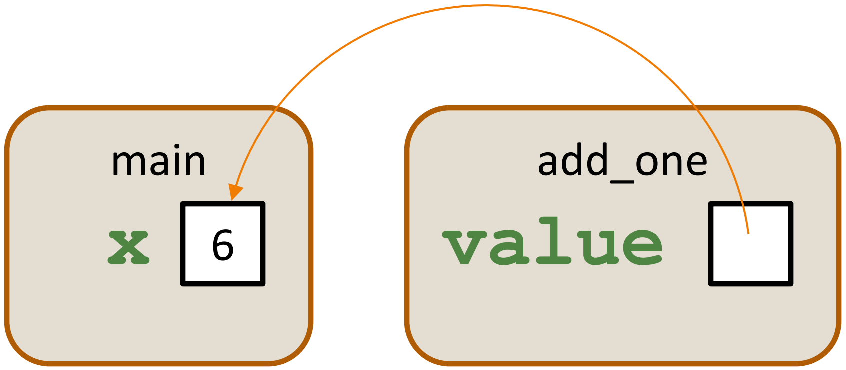

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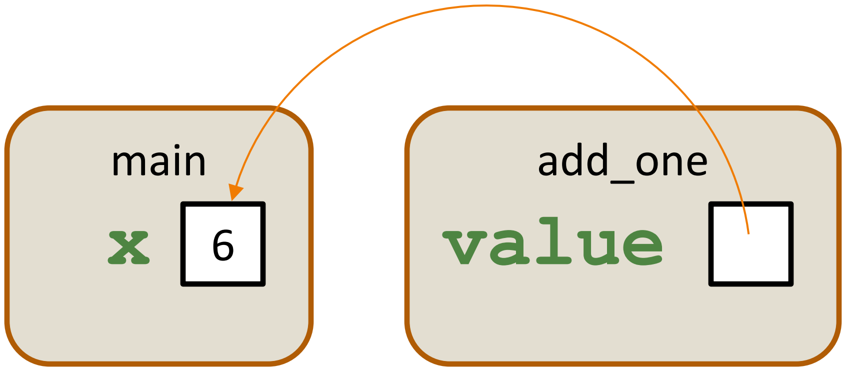

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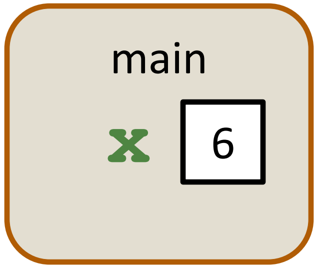

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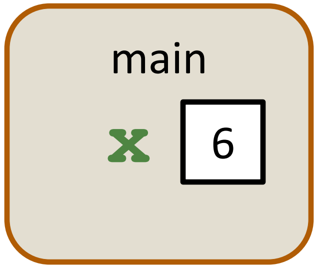

Exercise

- What are the values of num1 and num2 after this code executes?

```
void aFunction( int a, int &b )
{
   b = a * 2;
   a = b + 1;
   b = a;
}

int main()
{
   int num1 = 3;
   int num2 = 4;
   aFunction( num1, num2 );

   return 0;
}
```