Stack and Heap memory

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Overview

Stack and Heap

- Memory model used so far is a simplification.
- Actually two places in memory that variables can go.
- The stack and the heap.
- Both are just regions of the same physical memory.
- Are managed differently.

The stack

- When program is run, block of memory is allocated.
- Called the stack.
- Each program has it's own stack.
- Each instance.
- As variables created and functions called they are put on the stack.
- When variables are destroyed/functions complete they are removed from the stack.
- Has limited size.
- Recursive functions can fill the stack if not careful.

```c
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   int result = a+b;
   return result;
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int sub( int a, int b )
{
   int result = a-b;
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int main()
{
   int var1 = 42;
   int var2 = 1;
   add(var1,var2);
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}
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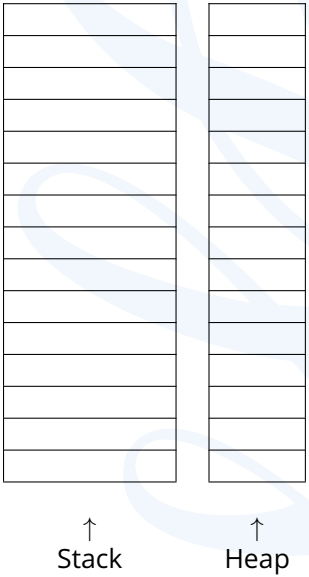

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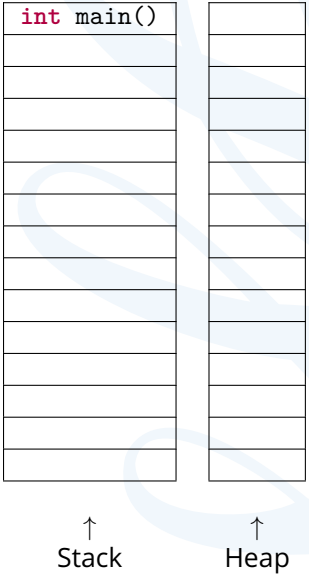

A

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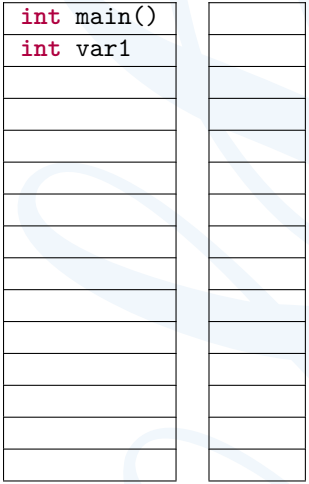

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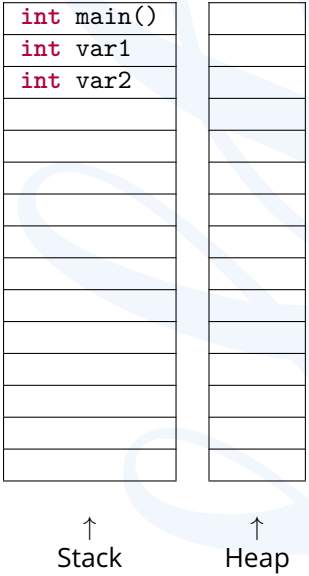

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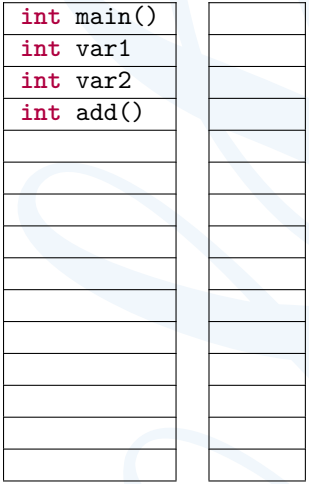

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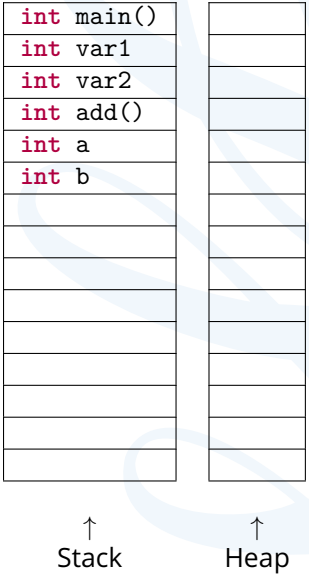

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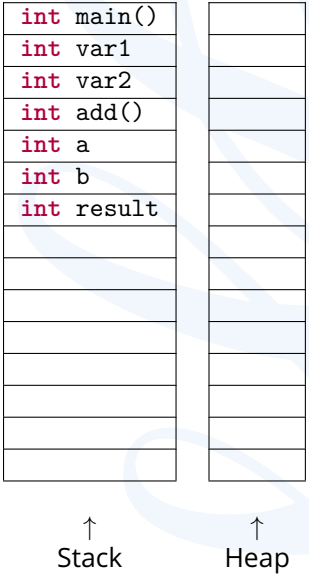

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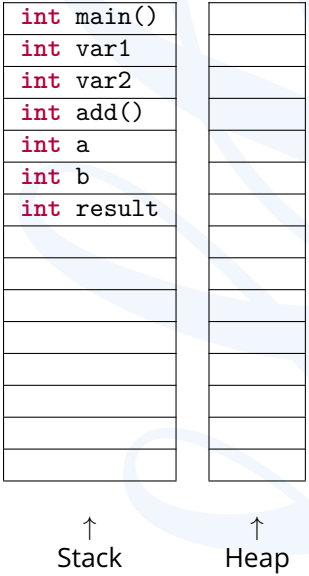

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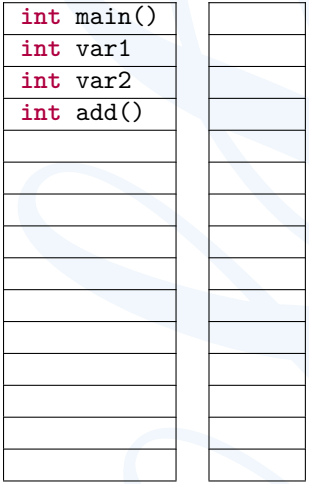

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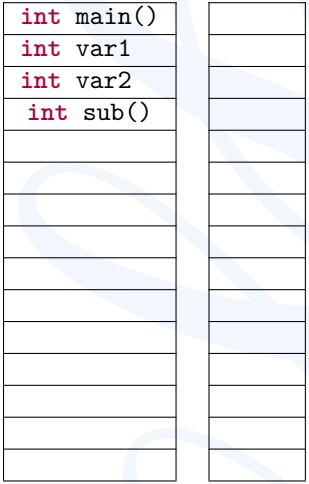

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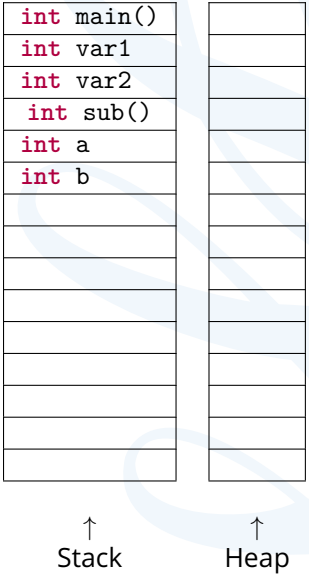

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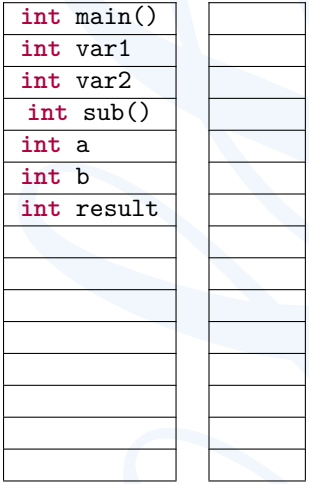

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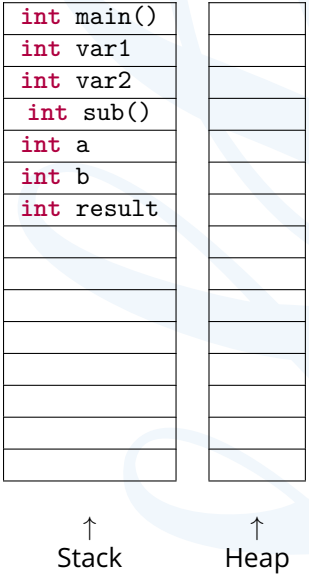

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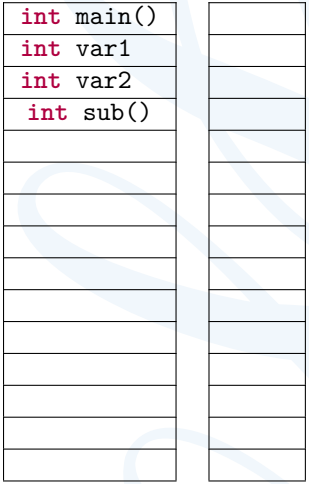

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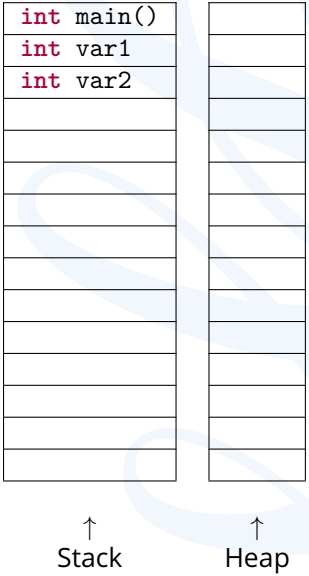

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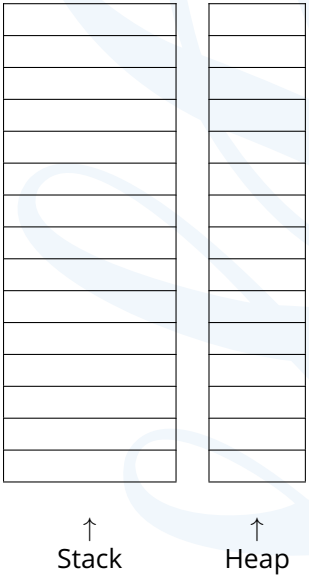

The Heap

- Shared memory between all running programs.
- Very big in comparison to the stack.
- Dangerous, must remember to deallocate our memory.
- Memory leaks.

A

```
int main()
{
  int variable = 42;
  int *pointer1;
  pointer1 = new int[6];

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  pointer2 = new int[3];

  delete [] pointer1;
  return 0;
}
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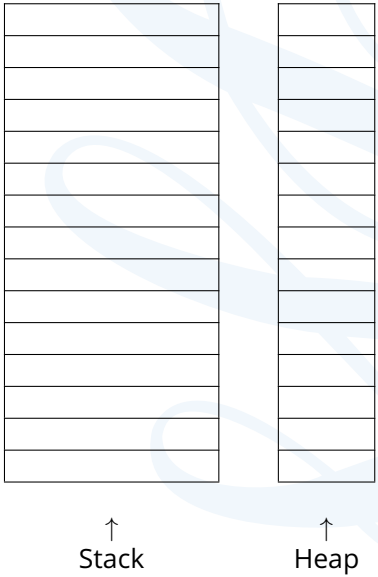

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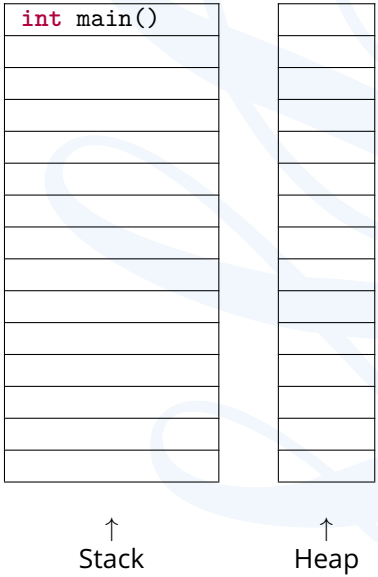

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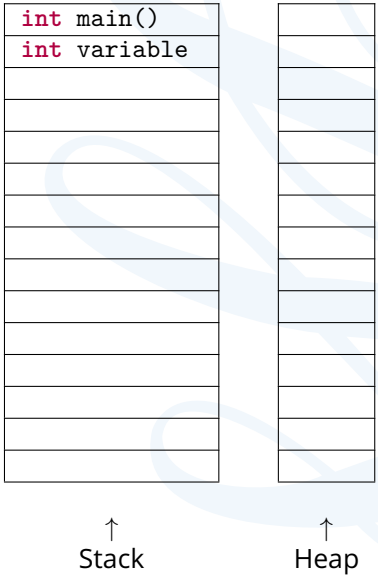

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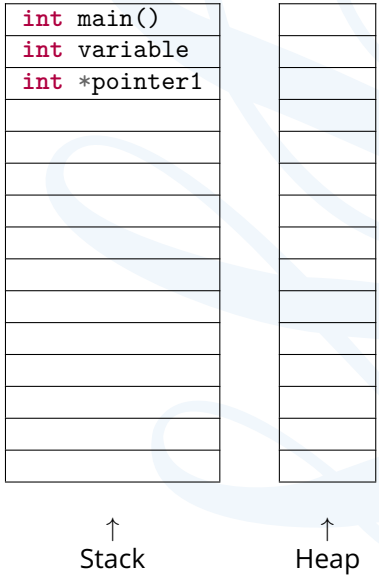

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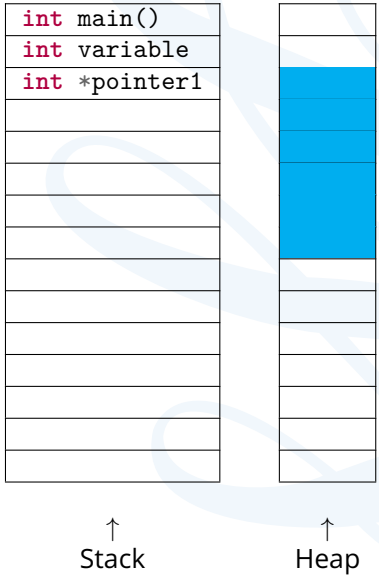

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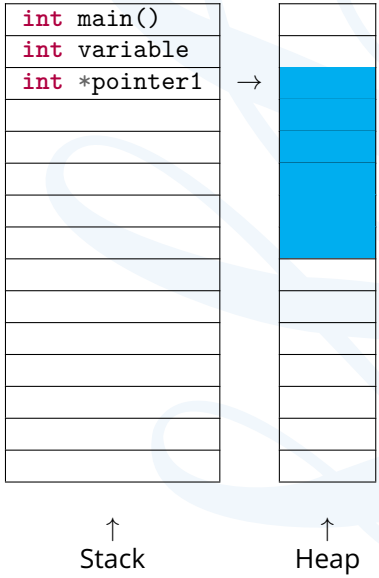

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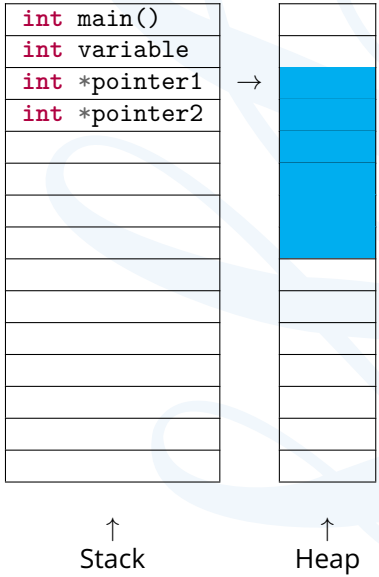

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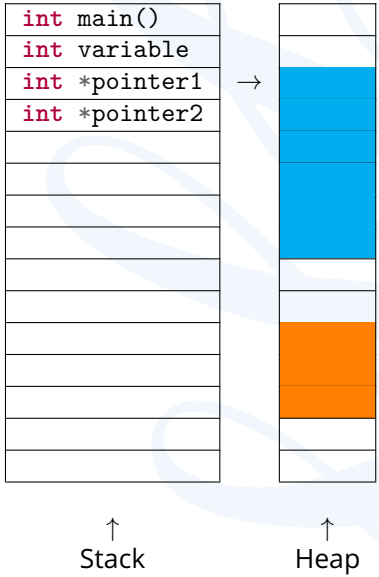

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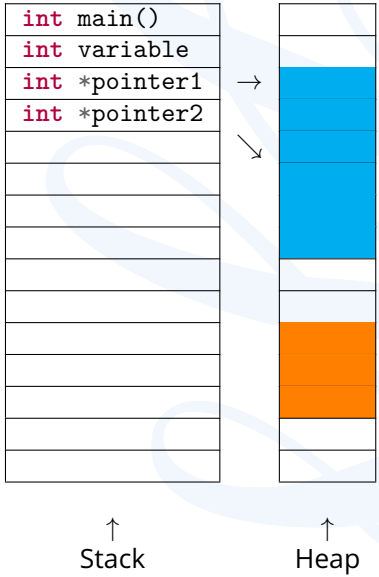

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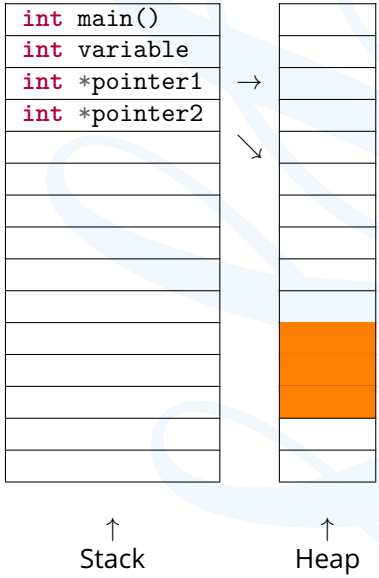

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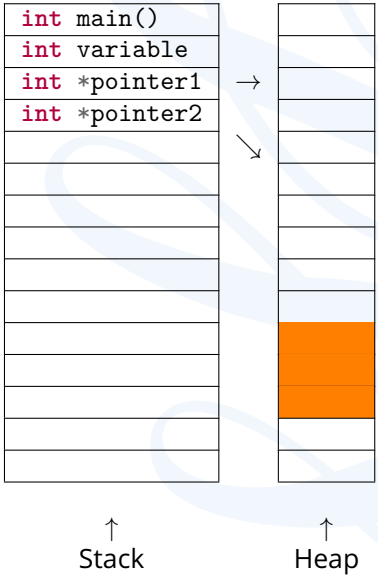

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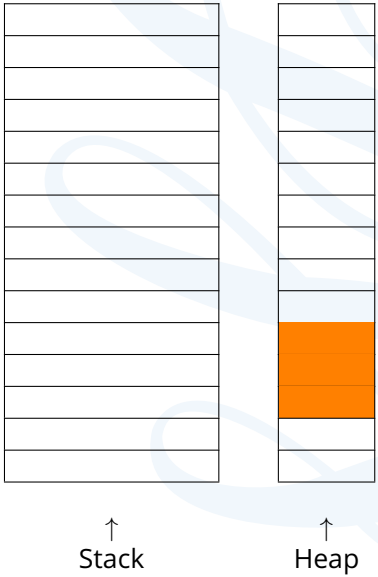

Differences

Stack

- Fast - processors typically have special instructions for dealing with stacks quickly.
- Contiguous - everything in one block, easier to know where to put next variable/function.
- Small - limited size.
- Trying too variables will fill stack and cause “stack overflow”.

Heap

- Huge - relative to the stack.
- Dangerous - must remember to deallocate otherwise have memory leaks.

The End