Stack and Heap memory

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Overview

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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.

A

```c
⇒   int add( int a, int b)
    {
⇒       int result = a+b;
⇒       return result;
    }

⇒   int sub( int a, int b )
    {
⇒       int result = a-b;
⇒       return result;
    }

⇒   int main()
    {
⇒       int var1 = 42;
⇒       int var2 = 1;
⇒       add(var1,var2);
⇒       sub(var1,var2);
⇒       return 0;
    }
```

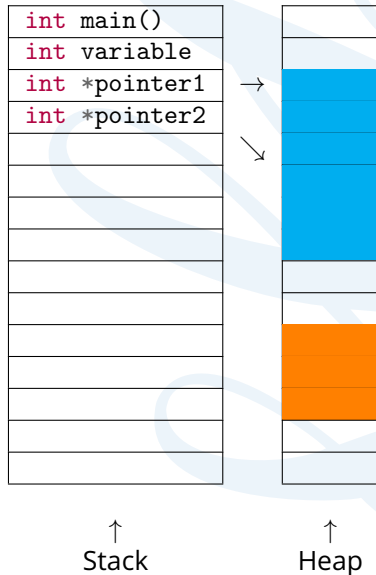| int main() |
| int var1 |
| int var2 |
| int add() |
| int a |
| int b |
| int result |
| |
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↑
Stack

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Heap
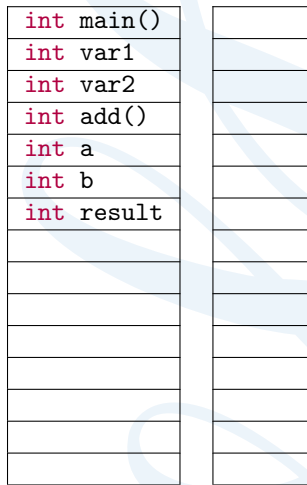
The Heap

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

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

⇒        int *pointer2;
⇒        pointer2 = new int[3];

⇒        delete [] pointer1;
⇒        return 0;
     }
```


Stack

Heap

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