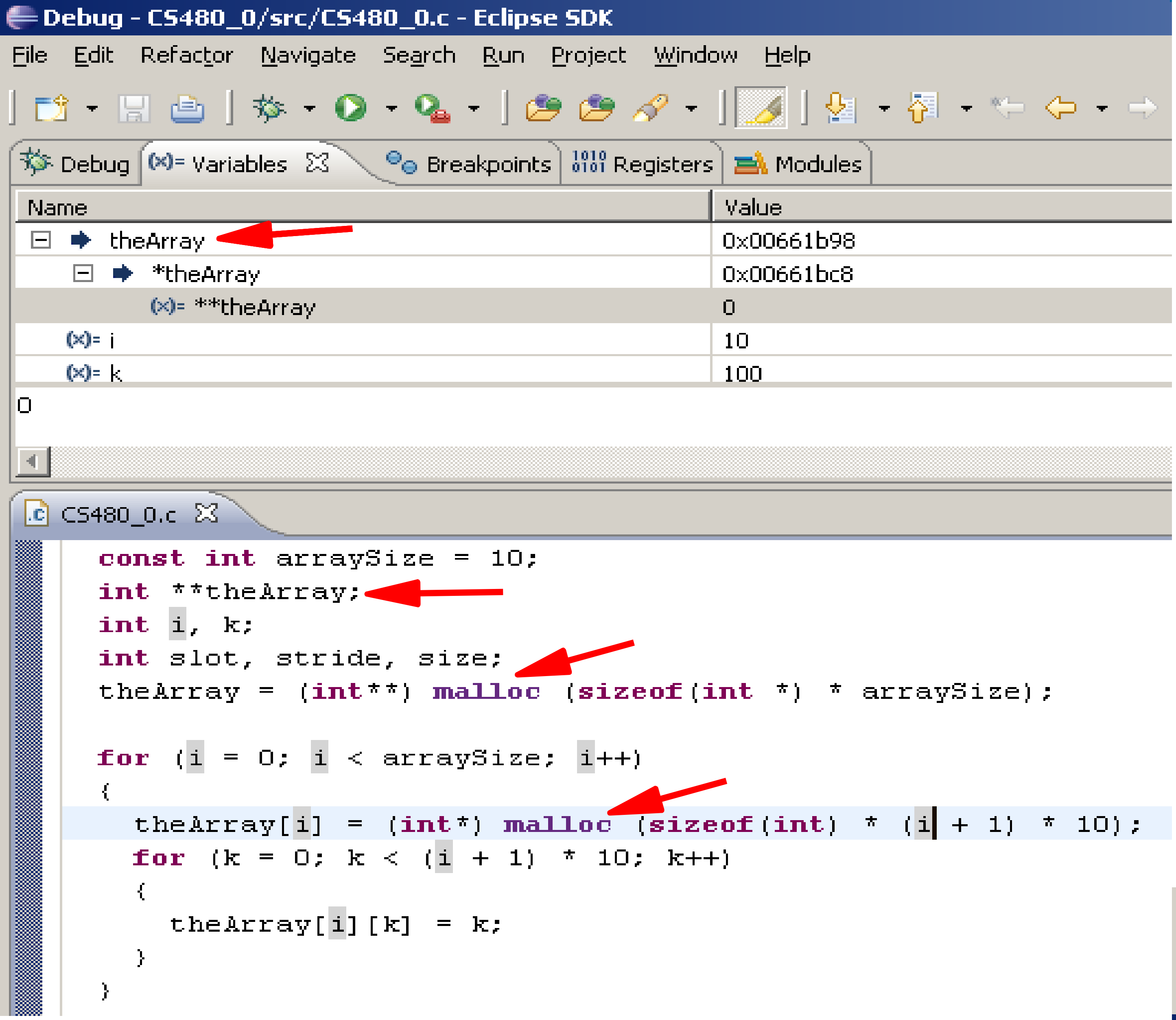
# CS480

# Hash Tables, Dynamic Memory & the Eclipse Debugger

February 1, 2013


Debug - CS480_0/src/CS480_0.c - Eclipse SDK
File Edit Refactor Navigate Search Run Project Window Help
Debug
Variables
Breakpoints
Registers
Modules
CS480_0.c

| Name | Value |
|---|---|
| theArray | 0x00661b98 |
| *theArray | 0x00661bc8 |
| **theArray | 0 |
| i | 10 |
| k | 100 |

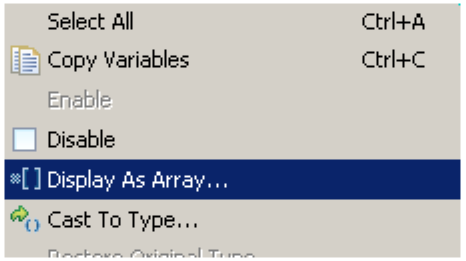
```
0
```

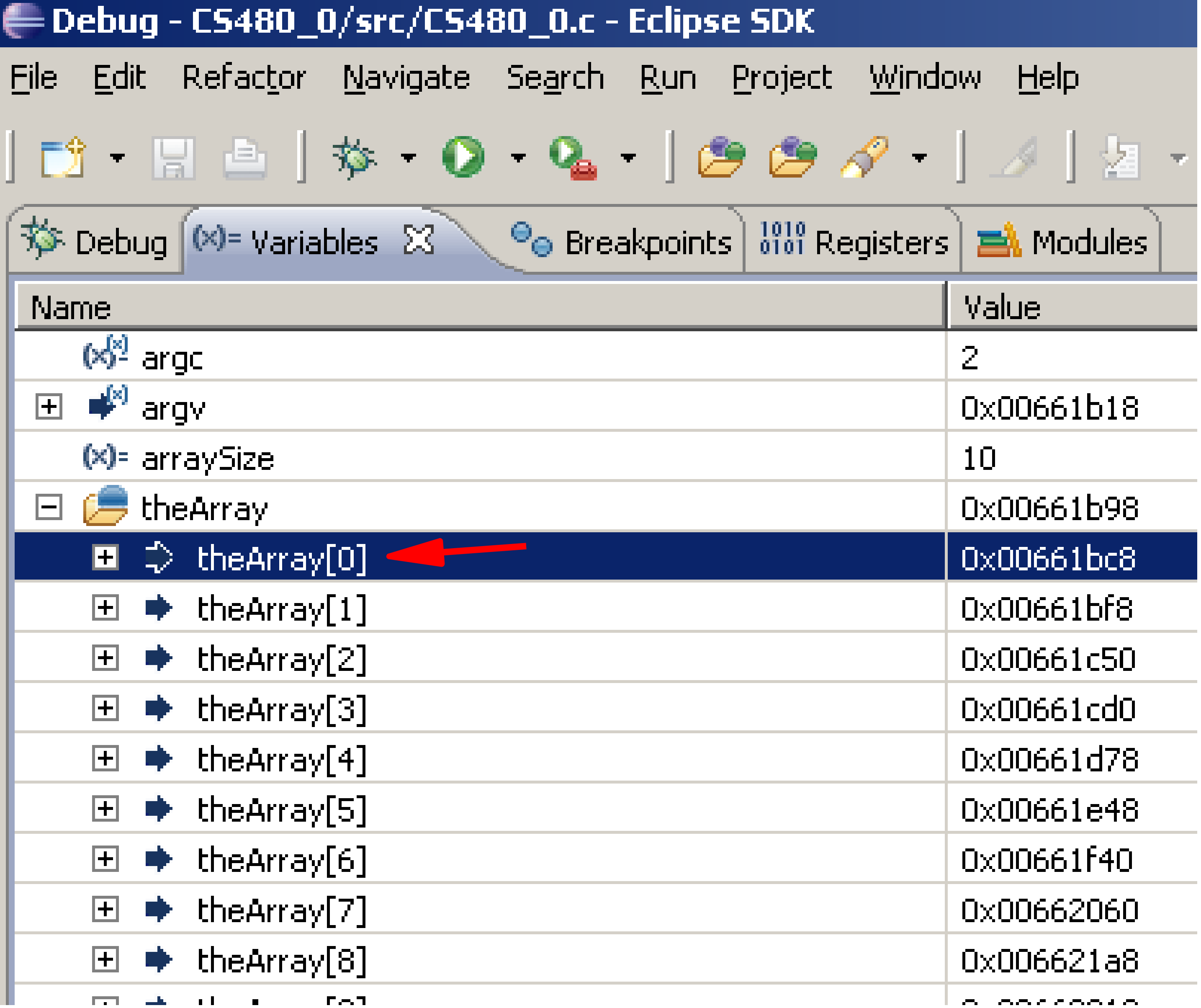
```
const int arraySize = 10;
int **theArray;
int i, k;
int slot, stride, size;
theArray = (int**) malloc (sizeof(int *) * arraySize);

for (i = 0; i < arraySize; i++)
{
  theArray[i] = (int*) malloc (sizeof(int) * (i + 1) * 10);
  for (k = 0; k < (i + 1) * 10; k++)
  {
    theArray[i][k] = k;
  }
}
```

Notice the array declaration and mallocs. The array is not shown properly in the variable listing.

Right click on the array variable and select Display as Array

You must specify the size.

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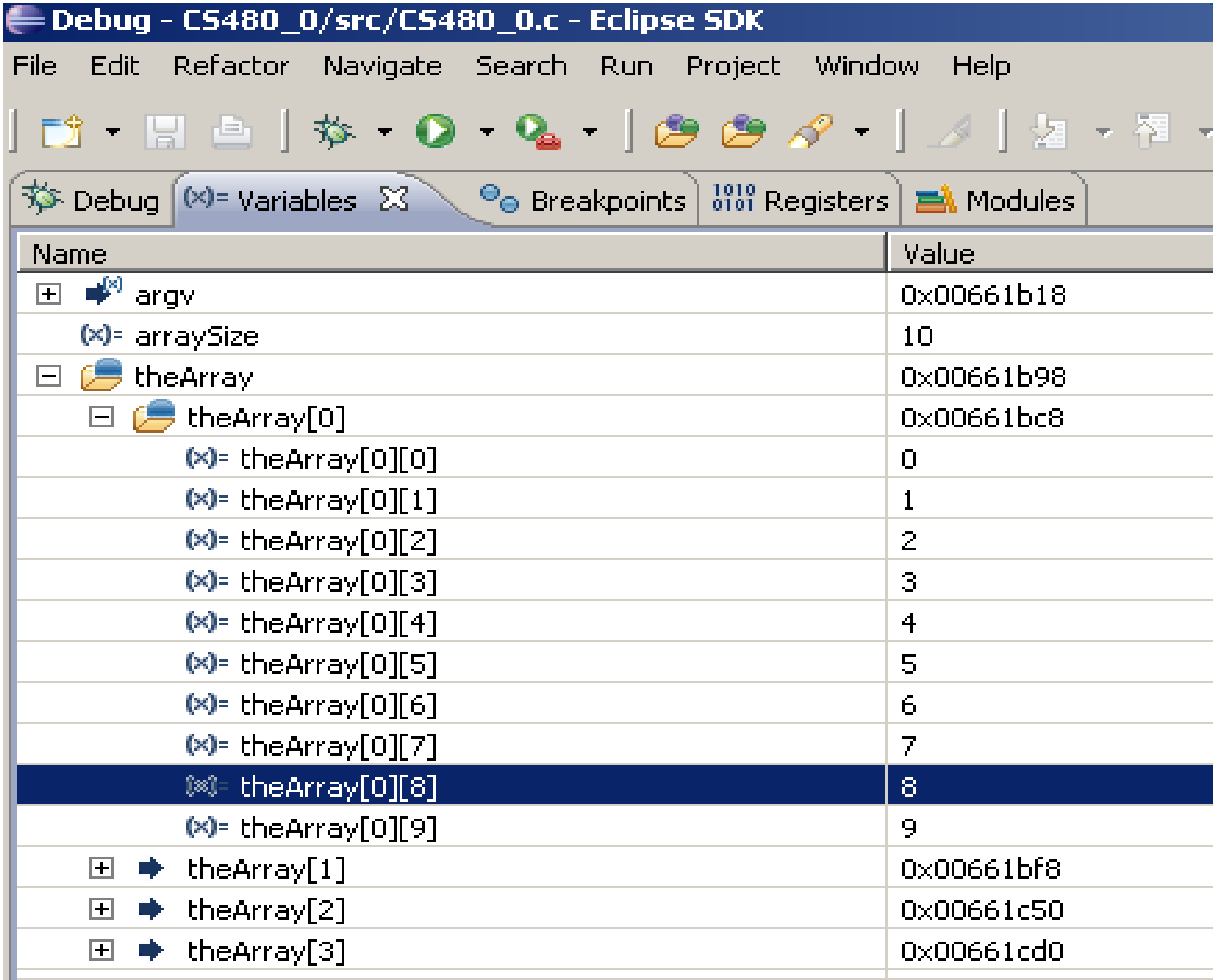
Debug
Variables
Breakpoints
Registers
Modules

| Name | Value |
|---|---|
| argc | 2 |
| argv | 0x00661b18 |
| arraySize | 10 |
| theArray | 0x00661b98 |
| theArray[0] | 0x00661bc8 |
| theArray[1] | 0x00661bf8 |
| theArray[2] | 0x00661c50 |
| theArray[3] | 0x00661cd0 |
| theArray[4] | 0x00661d78 |
| theArray[5] | 0x00661e48 |
| theArray[6] | 0x00661f40 |
| theArray[7] | 0x00662060 |
| theArray[8] | 0x006621a8 |

Now the first dimension of the array is shown.

Right click on theArray[0] and repeat the above process.


Debug - CS480_0/src/CS480_0.c - Eclipse SDK
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Debug
Variables
Breakpoints
Registers
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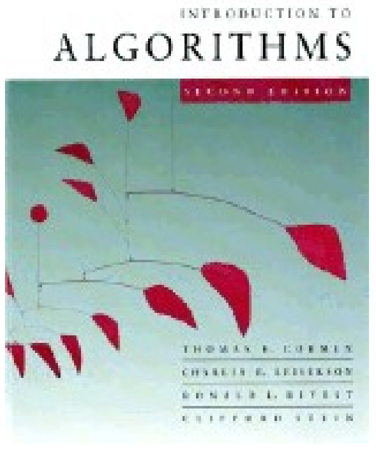
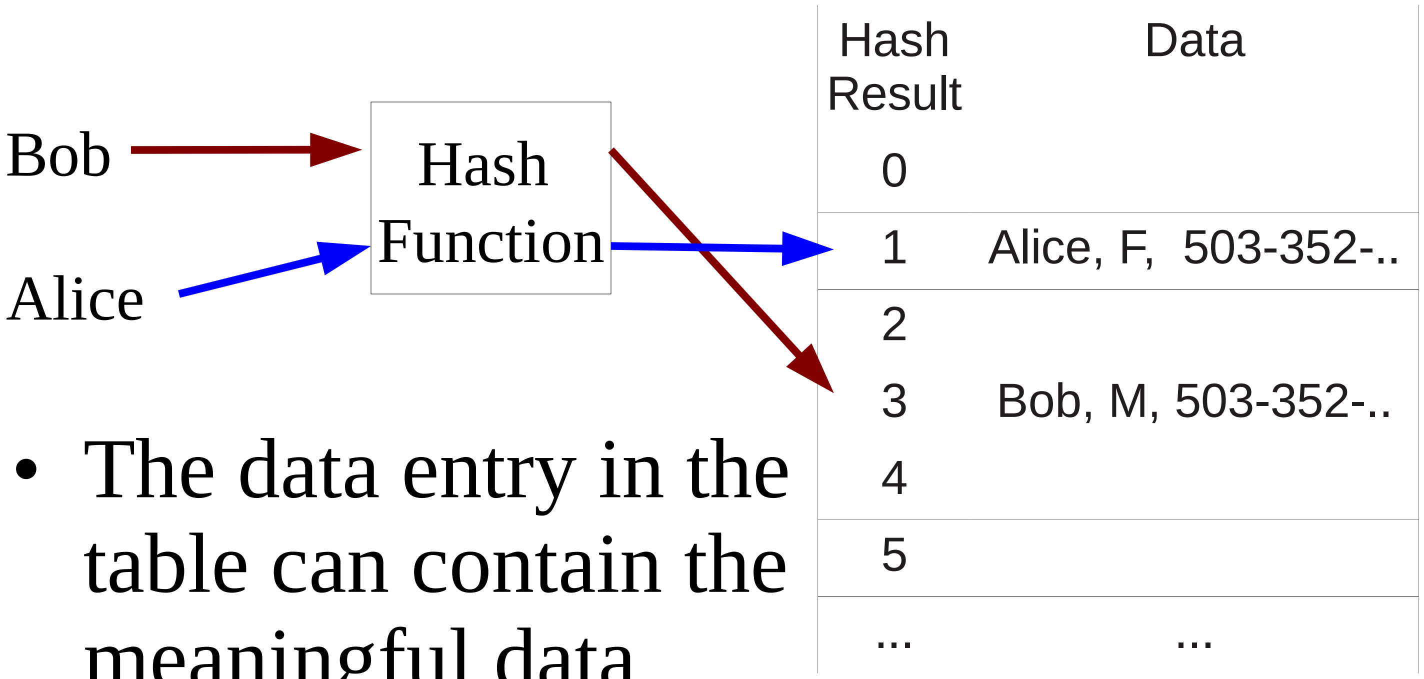
```
Name                    Value
argv                    0x00661b18
arraySize               10
theArray                0x00661b98
  theArray[0]           0x00661bc8
    theArray[0][0]      0
    theArray[0][1]      1
    theArray[0][2]      2
    theArray[0][3]      3
    theArray[0][4]      4
    theArray[0][5]      5
    theArray[0][6]      6
    theArray[0][7]      7
    theArray[0][8]      8
    theArray[0][9]      9
  theArray[1]           0x00661bf8
  theArray[2]           0x00661c50
  theArray[3]           0x00661cd0
```

# Hash Tables!

- Turn data into a numeric key
  - Hash function
- Use that key to index into a table





| Hash Result | Data |
|---|---|
| 0 | |
| 1 | Alice, F, 503-352-.. |
| 2 | |
| 3 | Bob, M, 503-352-.. |
| 4 | |
| 5 | |
| ... | ... |

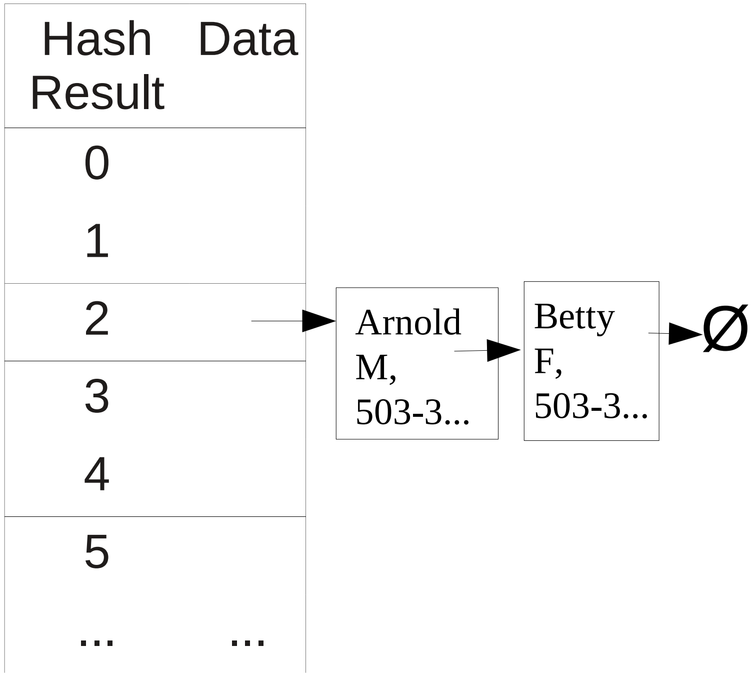
Cormen,
Leiserson,
Rivest
ISBN-13: 978-0262032933

- The data entry in the table can contain the meaningful data

http://en.wikipedia.org/wiki/Hash_tables

# Hash Function

- Good hash function: spread data across the table (hash results) evenly
  - Few collisions
- Many good algorithms available
  - Check CLR
- Collision
  - Two pieces of data produce the same hash value
  - Resolve by *chaining*
    - Have table *data* entry point to linked list



# /*

- How does gcc handle:

```
int *pInteger;
int value  =4;
pInteger = &value;

printf(“%d”, 8/*pInteger);
```