

Dynamic Memory

Part 2

+ Review Example Array allocation

```
int* allocateIntArray(int x, int y) {
    int* oneDimArray = new int[x];
    for (int i = 0; i < x; ++i) {
        oneDimArray[i] = y;
    }
    return oneDimArray;
}

int *arrayOne = allocateIntArray(5,1);
delete [] arrayOne;
arrayOne = allocateIntArray(3,7);
```

+ 2D Array allocation

```
int* allocateIntArray(int x, int y, int z) {
    int** twoDimArray = new int*[x];
    for (int i = 0; i < x; ++i) {
        twoDimArray[i] = new int[y];
        for (int j = 0; j < y; ++j)
            twoDimArray[i][j] = z;
    }
    return twoDimArray;
}
```

+ 2D Array deallocation

```
void release2DIntArray(int x, int** arr) {
    for (int i = 0; i < x; ++i) {
        delete [] arr[i];
    }
    delete arr;
}

int** theBestArray = allocateIntArray(10,4,100);
cout << theBestArray[9][3] << endl;
release2DIntArray(10,theBestArray);
```

+ Breaking News!



David Cooper
@cooplogic



Fire trucks still at 3rd and Market from this morning...

2:28 PM · 9 Apr 2014



+ const and pointers

- passing a pointer is useful if you don't want to make a copy of the whole structure, however, you may still want to prevent the user from changing the value

- In this case you can use const:

```
int add(const int* array, int aSize,
        int factor) {
    array[1] = 10; // this won't compile
    int result = 0;
    for (int i = 0; i < aSize; ++i) {
        result += array[i];
    }
    return factor * result;
}
```

+ Pointer arithmetic

- `double* x = new double[100];`
- `x[10] == *(x+10);` // value at index ten of x is equivalent to value-at x+10
- How would you get the 50th value in x using pointer arithmetic?
- How would you set the 4th value of x to the 99th value of x;
- How would you swap the first and last value of x using pointer arithmetic?



+ Smart Pointers

- Unique pointers
 - only one pointer at a time to an object.
- Shared Pointers
 - multiple pointers to an object



+ Words from the Wise



David Cooper
@cooplogic

Follow

#Mavericks breaks #mspowerpoint's choose image... functionality. Workaround: copy/paste

6:43 AM - 24 Oct 2013



+ `unique_ptr`

```
#include<memory>

auto intArrPtr = make_unique<Object>();

or:

unique_ptr<Object> objectPtr(new Object());
```

+ `unique_ptr` with C-style arrays (not recommended)

```
#include<memory>

auto intArrPtr = make_unique<int[]>(10);

or:

unique_ptr<Object> objectPtr(new int[10]);
```

+ Beyoncé Giselle Knowles-Carter: Childhood and Early Life

- Born September 4, 1981 in Houston, Texas
- She is the daughter of Mathew Knowles and Tina. His father was a sales manager while her mother worked as a hairdresser and salon owner.
- She attended St. Mary's Elementary School where she also learned to dance. She loved singing from a young age.
- She enrolled in Parker Elementary School, a music magnet school in 1990 and also attended the High School for the Performing and Visual Arts before moving on to the Alief Elsik High School.
- She auditioned for an all-girl entertainment group when she was eight. She was selected along with Kelly Rowland and LaTavia Roberson and put in a group called Girl's Tyme with three other girls. The group performed in several talent shows and later bagged a contract with Columbia Records.

+ Beyoncé Giselle Knowles-Carter: Career, part 1

- The girls changed the name of the group to Destiny's Child in 1993 and released their self-titled debut album in 1997. The album had the song 'No, No, No' which became their first major hit.
- Their second album, 'The Writing's on the Wall' was out in 1999. It spawned the group's first No. 1 single, 'Jumpin' Jumpin' and also the super hit songs 'Bills, Bills, Bills' and 'Say My Name'. The album sold more than 8 million copies worldwide.
- Their third album, 'Survivor' was even a bigger success than its predecessors. The album debuted at number one on the Billboard 200 and earned the group several Grammy Award nominations. The singles 'Survivor' and 'Bootylicious' became very popular.
- Motivated by the success of her girls' group, Beyonce embarked on a solo career with her debut solo album, 'Dangerously in Love' in 2003. The songs included uptempos and ballads inspired by R&B and soul genres with elements of hip hop and Arabic music. The album was a huge hit which established her as a solo star.

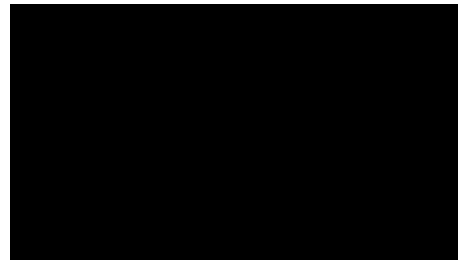
+ Beyoncé Giselle Knowles-Carter: Career, part 2

- She released her next album, 'B'Day' on her 28th birthday, 4 September, 2006. The music style of the album is borrowed from a range of styles like funk, hip hop and R&B that were popular during the 1970s-80s. The album was reviewed very positively.
- She featured in a combination of slow and midtempo pop and R&B ballads, and more upbeat electropop and Europop genres in her next album 'I Am... Sasha Fierce' in 2008. The album sold over eight million copies worldwide. She embarked on the 'I Am... World Tour' in March 2009 which consisted of 108 shows.
- In bringing out her album '4' in 2011, she also served as the executive producer and co-writer. She attempted to bring traditional R&B back to contemporary music. The album was very well received by music critics.
- In addition to her music career she has also appeared in several movies like 'Carmen: A Hip Hopera' (2001), 'The Pink Panther' (2006), 'Obsessed' (2009), and 'Epic' (2013).

+ Beyoncé Giselle Knowles-Carter: Achievements, Personal Life, Trivia

- She has won 17 Grammy Awards from 46 nominations, becoming the third most honored woman in Grammy History. Her most recent Grammy win is for Best Traditional R&B Performance for the song 'Love on Top' in 2013.
- She is the recipient of nine BET Awards from 30 nominations including the one for Best Female R&B Artist in 2011.
- She married singer Jay-Z in 2008 and gave birth to her first child, a daughter, in 2012.
- She along with Rowland founded the Survivor Foundation in 2005 to provide transitional housing for victims of Hurricane Katrina in 2005.
- A species of Australian horse fly was named 'Scaptia beyoncea' in her honour by the research scientist Bryan Lessard in 2012.

+ BEY IS BAE



+ unique_ptr move, not copy

```
#include<memory>

auto p1 = make_unique<int>(10);

unique_ptr<int> p2 = p1; // Error: does not compile
unique_ptr<int> p3 = move(p1); // okay!

In function returns move happens automatically!
```

+ The right way

```
unique_ptr<int[]> test3(unique_ptr<int[]> x,
                        int size) {
    cout << size << endl;
    for (int i = 0; i < size; ++i) {
        x[i] = i;
    }
    return x;
}

auto uPtr = make_unique<int[]>(10);
uPtr = test3(move(uPtr), 10);
cout << uPtr[4] << endl;
```



+ The wrong way

```
void test3(unique_ptr<int[]> x,
          int size) {
    cout << size << endl;
    for (int i = 0; i < size; ++i) {
        x[i] = i;
    }
}

auto uPtr = make_unique<int[]>(10);
test3(move(uPtr), 10);
cout << uPtr[4] << endl; // seg fault!!!
```

+ shared_ptr

- Can't be used with C-style arrays [].

```
shared_ptr<Object>
objectPtr(new Object());
```

or:

```
auto objectPtr =
make_shared<Object>();
```

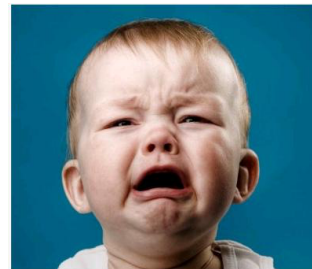


+ The right way

```
void test4(shared_ptr<int> x,
          int size) {
    for (int i = 0; i < size; ++i) {
        (*x) += (*x);
    }
    cout << (*x) << endl;
}

auto uPtr = make_shared<int>(10);
test4(uPtr, 10);
cout << *uPtr << endl; // NO seg fault!!!
```

+ Say "WAAAAAHHHHHHH!!!!!!!"



+ shared_ptr copy smart ptr not *

```
Object* temp = new Object(); // first clue, bad idea.
shared_ptr<Object> objectPtr(temp);

not this:
shared_ptr<Object> objectPtrTwo(temp); // 2nd tracker
// causes double delete

instead, do this:
shared_ptr<Object> objectPtrTwo(objectPtr);
```

+ Let's code some examples with three types of pointers

- LinkedList class

