Today's announcements

- HW0 hard copy due NOW
- If you are not registered: if you want to get in the class, put your UIN on your HW0 submission.

- MP1, deadline extension, due on 02/02, 11:59pm

- MP2, E/C due 02/02, 11:59pm
- MP2, due on 02/09, 11:59pm

- lab_debug due on Sunday, Jan 01/31, 11:59pm

Variables and memory in C++

Stack memory

loc	name	value	type

Pointers - Intro

```
int x;
int * p;
```

How do we assign to p?

p =

p =

_____ operator: &

_____ operator: *

Stack memory

loc	name	value	type
a20	x	5	int
a40	p		int *

Pointer variables and dynamic memory allocation:

```
int * p;
```

Stack memory

loc	name	type	value
a40	p	int *	

Heap memory

loc	name	type	value

Youtube: pointer binky c++

https://www.youtube.com/watch?v=6pmWojisM_E

Examples

```
using namespace std;

int main() {

    int x = 5;
  int * p;

  cout << &x << endl;


}
```

```
using namespace std;

int main() {

    int x = 5;
  int * p;
  *p = 37;

  cout << &x << endl;


}
```

```
using namespace std;

int main() {

    int * p;
  *p = 37;

}
```

```
int *p, *q;
p = new int;
q = p;
*q = 8;
cout << *p;
q = new int;
*q = 9;
p = NULL;
delete q;
q = NULL;
```

What is output?_____

Do you like this?_____

Do you like this?_____

Memory leak:

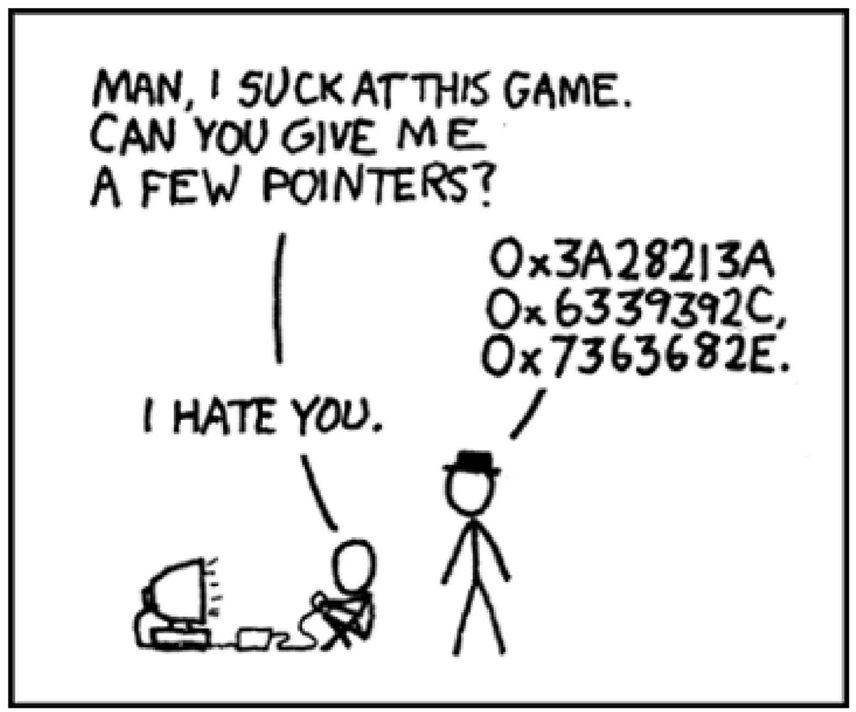
Deleting a null pointer:

Dereferencing a null pointer:

Fun and games with pointers:

```
int * p, * q;
p = new int;
q = p;
delete p;
… // some random stuff
cout << *q;
```

Do you like this?_____



Fun and games with pointers:

```
int * p; int x;

p = x;
```

Do you like this?_____

What kind of error?

Compiler Runtime

```
int * p;  int x;
```

Variable `p` can be given a target (pointee) in two ways. Write an example of each.

Use the letters S and H in a meaningful way to tell where the pointee exists in memory.

```
int * p;

*p = 37;

p = NULL;

*p = 73;
```

Do you like this?_____

What kind of error?

Compiler Runtime

```
int * p, * q;

p = new int;

q = p;

delete p;

… // some random stuff

cout << *q;
```

Do you like this?_____

Which of the following snippets are buggy?

```
int *p, *q;
p = new int;
q = p;
*q = 8;
q = new int;
*q = 9;
p = NULL;
```

```
int *p, *q;
p = new int;
q = p;
*q = 8;
delete q;
*p = 12;
p = NULL;
```

```
int *p;
int x = 5;
p = &x;
delete x;
p = NULL;
```

```
int *p;
int x = 5;
*p = x;
```

Pointer Fun

```
#include <iostream>
using namespace std;

int main()
{
   int *p, *q;
   p = new int;
   *p = 40;
   q = p;
   delete p;

   cout << *p << endl;

   cout << *q << endl;

   cout << *p << endl;

   return 0;
}
```

What is the output?

_____

_____

_____

How would you fix it?

Pointer Fun

```
#include <iostream>
using namespace std;

int main()
{
   int *p, *q;
   p = new int;
   *p = 40;
   q = new int;
   q = p;

   cout << *p << endl;

   cout << *q << endl;

   return 0;
}
```

What is the output?

_____

_____

How would you fix it?

Pointer Fun

```
#include <iostream>
using namespace std;

int main()
{
   int *p, *q, *r, *s;
   p = new int;
   *p = 3;
   q = p;
   r = &*q;

   cout << *p << endl;

   cout << *q << endl;

   cout << *r << endl;


   return 0;
}
```

What is the output?

How would you fix it?