CS 101: Computer Programming and Utilization

19-Programming with Classes

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What does this program do?

```
class poly {
   private:
    float coefs[10];  int degree;
   public:
    void read();
    void print();
};
int main() {
  poly p; double point;
  p.read();
  p.print();
}
```

```
void poly::read() {
   cin >> degree;
    for (int i=0;i<=degree;i++)
     cin >> coefs[i];
}
void poly::print() {
   cout << coefs[0];
   for (int i=1;i<=degree;i++)
      cout << " + " << coefs[i] <<
" x^" << i ;
   cout << endl;
}
```

Recall: Class = Struct + ?

- Constructor(s)
  - How to set up the initial configuration
  - Perhaps allocate memory
- Destructors
  - Release resources and clean up state
- Methods (functions)
  - Change the state of the struct members in clean, controlled ways
  - Methods are like functions except they have access to the invisible variable “this” (more on this later)
- Access control: public, protected, private
- Inheritance (extending classes)

Activity: Adding a method to a class

Add a function 'eval' to the class poly that will evaluate the value of the polynomial at a given point and output that value.

Think: Write the pseudo-code for eval().

Pair: Write the C++ function for eval(). Modify main().

Share: Compare with demo18-poly.cpp.

Further Discussion: demo18-poly-constructor.cpp

- What is the need for constructors?

Newton-Raphson: Finding root of poly

Recall the Newton-Raphson method for finding root of a polynomial in one variable.

- Given a function f defined over real x, and its derivative f ', begin with a guess x0 for a root of f.
- Get a better approximation x1:

  $x1 = x0 - f(x0) / f'(x0)$
- Repeat the process until a sufficiently accurate values is reached.

Activity

Think: Add a function 'diff' to the class poly that will return its derivative as → poly 'q'.

Pair: Modify the main() program to find the root of the given polynomial, using Newton-Raphson method.

Share: Compare with demo18-poly-NR-1.cpp.

Use of 'this' pointer: (Not discussed in class; see lab12)

- What is need for 'this' pointer?
  - this → eval(x)
- demo18-poly-NR-2.cpp

Notes

Newton-Raphson Method:

- en.wikipedia.org/wiki/Newton's_method
- www.mathresource.iitb.ac.in/applet/NewtonRaphson/

Classes

- www.cplusplus.com/doc/tutorial/classes/

'this' pointer

- www.tutorialspoint.com/cplusplus/cpp_this_pointer.htm