CSCI 2270
Data Structures and Algorithms
Lecture 19

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Office hours: ECCS 112/128
Wed 11:30am-1:30pm
Thurs 9am-11am

Administrivia

Exam grading in process

HW2 graded

HW3 part 2 will be graded soon

HW4 will post by tomorrow lunchtime

Engineering is closed for the FE exam Saturday, 5 am – 7pm

David Baird's help hours are moved to Sunday

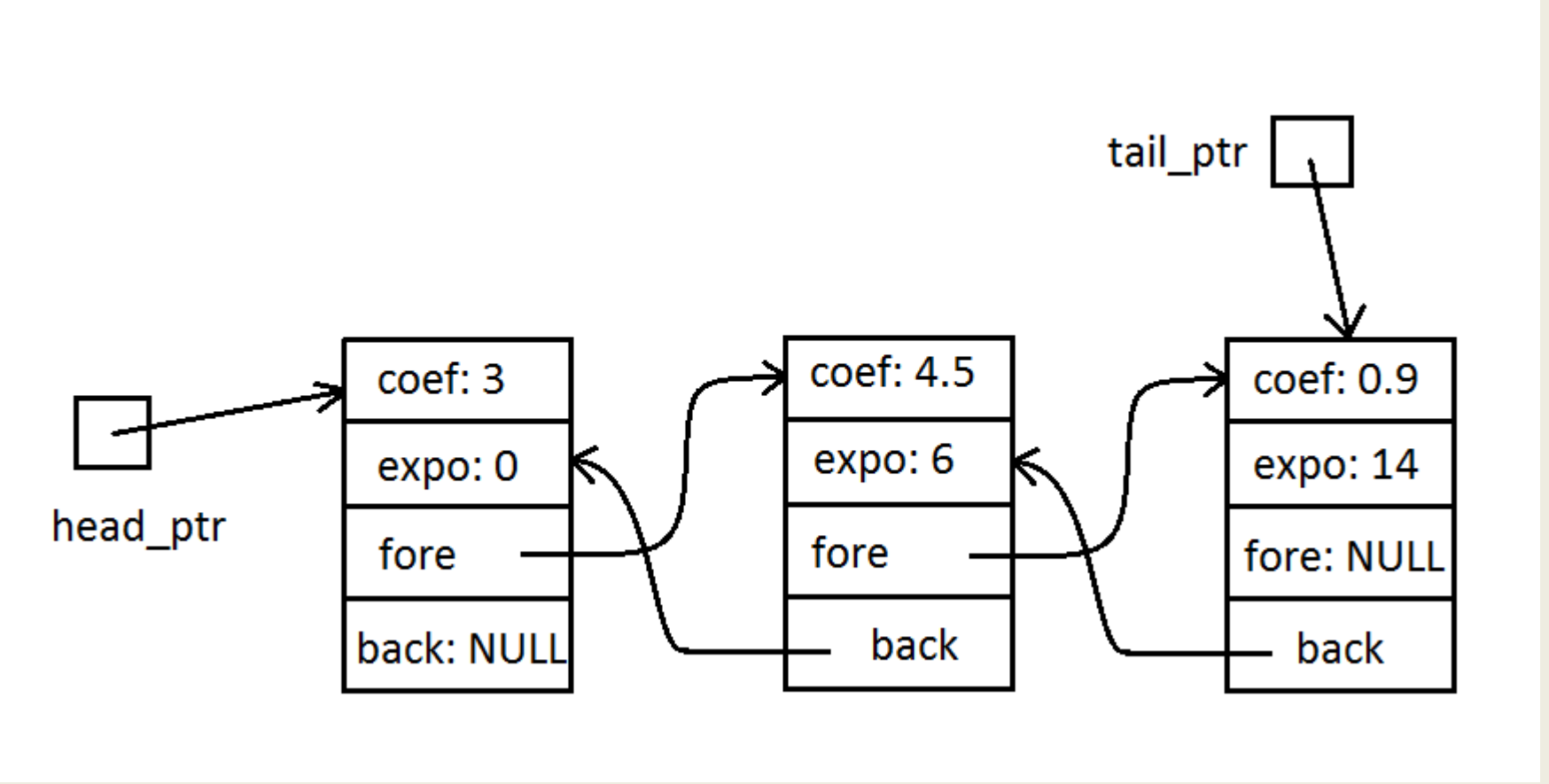
(Tell David congratulations if you see him; he just got into the Masters program in computer science. Selah!)

Doubly linked list Node class

Linked lists depend on a Node class; ours will be called polynode

```
private:
   double  coef_field;                  // coefficient for power of x
   unsigned int exponent_field;         // the power of x
   polynode* link_fore;                 // next node in the list
   polynode* link_back;                 // previous node in the list
```

Doubly linked list Node class



Doubly linked list efficiencies

Double links let us zoom backwards through the list

Along with head_ptr, we keep a pointer to the LAST node in the list (tail_ptr)

And we keep a pointer to the most recently touched node in the list (recent_ptr)

Having this makes our list a little faster

Polynomial as DLL

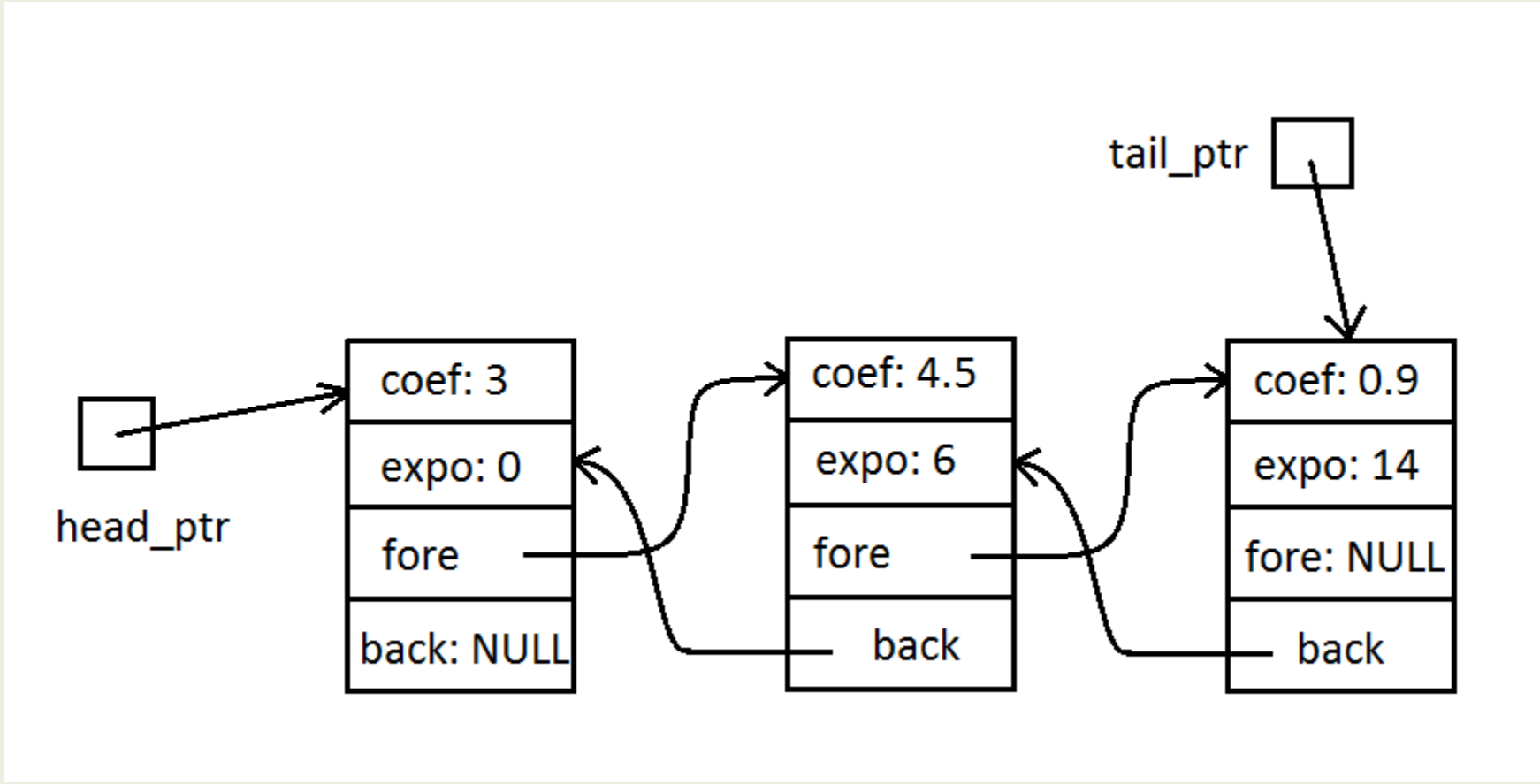
Every polynomial makes a node for the x^0 term

even if its coefficient is zero

so, no empty lists

After that, each polynomial stores non-zero coefficients of higher powers of x, in order of increasing exponents

Polynomial as DLL



p = 3*x^0 + 4.5*x^6 + 0.9*x^14

Memory operations

Default constructor (single node polynomial)

Copy constructor (deep copy, please)

Operator = (deep copy, please)

Destructor (clear helper function)

Output operations

Operator <<

Changing coefficients

assign_coef(coef, exponent)

add_to_coef(coef, exponent)

Changing the node we're looking at

next_term(exponent)

prev_term(exponent)

Adding, subtracting, multiplying, etc...

(8 + 7x + 3x^2) + (4 + 5x + 4x^5) = …

(8 + 7x + 3x^2) - (4 + 5x + 4x^5) = …

(8 + 7x + 3x^2) * (4 + 5x + 4x^5) = …

Derivative of (8 + 7x + 3x^2) = …

Evaluate (8 + 7 + 3x^2), for x == 8.7

Extra credit: root finding with Newton's method

Start with initial guess for x_0

Update $x_{n+1} = x_n - f(x_n)/f'(x_n)$ (note: f'(x) is the derivative)

Stop when $f(x_n)$ is close to 0; x_n is your root

Does not always find a solution…

Watch out for one problem that will trip you up if you forget it