CS 3

Introduction to Software Design

Design Patterns

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You should care about them because...

- You could come up with these solutions on your own, but you shouldn't have to!
- Programming languages do not build in solutions to every problem

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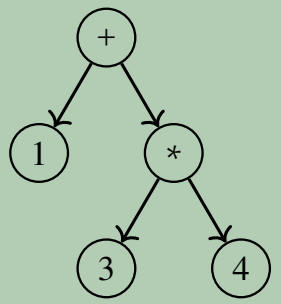

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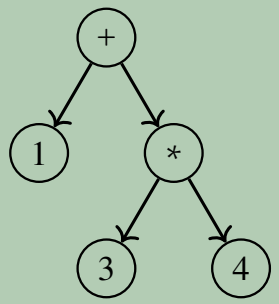


```
1  class Expression { }
2  class BinaryExpression { }
3  class AdditionExpression extends BinaryExpression {
4     Expression left, right;
5  }
6  class MultiplicationExpression extends BinaryExpression {
7     Expression left, right;
8  }
9  class NumberExpression extends Expression {
10    int value;
11 }
```

Problem (Inheritance)

We want to be able to model a relationship across types (e.g., a `BinaryExpression` **is a subtype of** `Expression`).

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Solution (Casting Structs)

If two structs have the same ***beginning layout****, the larger one can be cast to the smaller one. (What?)*

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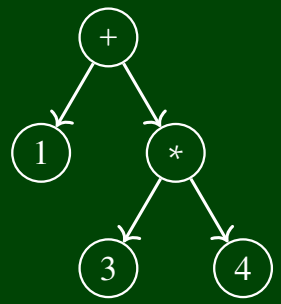
Example

```
1  struct Int {
2     int i;
3  };
4
5  struct IntAndDouble {
6     int i;
7     double d;
8  };
9
10 struct DoubleAndInt {
11    double d;
12    int i;
13 };
```

Modelling Subclassing via Structs and Enums




```
 1 enum expression_type_t {
 2    NUMBER_EXPRESSION,
 3    ADDITION_EXPRESSION,
 4    MULTIPLICATION_EXPRESSION
 5 };
 6 struct expression {
 7    expression_type_t type;
 8 };
 9 struct binary_expression {
10    expression_type_t type;
11    expression *left, *right;
12 };
13 struct number_expression {
14    expression_type_t type;
15    int value;
16 };
```

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A header file is really just a listing of types and functions defined by the corresponding C file. We can use it as a specification for what the implementation should do.

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Example

You've seen many of these, but here's the AST example from the previous slide.

Problem (Encapsulation)

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You've seen this plenty of times. (Most notably, you've done this with `list_t`.)

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Example

- `void swap(int *a, int *b)`
- `void divrem(int *quotient, int *remainder)`
- `void eat(char **buf, char *token)`

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