MSD Script

Generated by Doxygen 1.10.0

Chapter 1

MSDScript

Author

Xiyao Xu

Second Author (if applicable)

Date

02-06-2024

Chapter 2

Hierarchical Index

2.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

Chapter 3

Class Index

3.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 4

File Index

4.1 File List

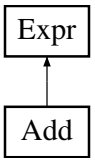
Here is a list of all documented files with brief descriptions:

Chapter 5

Class Documentation

5.1 Add Class Reference

Inheritance diagram for Add:



Public Member Functions

- **Add** (Expr *lhs, Expr *rhs)
- int interp () const override
- bool has_variable () const override
- Expr * subst (const std::string &varName, const Expr *replacement) const override
- bool equals (const Expr *other) const override
- void print (std::ostream &os) const override
- void pretty_print (std::ostream &os) const override
- void pretty_print_at (std::ostream &os, precedence_t prec) const override

Public Member Functions inherited from Expr

- std::string **to_string** () const

5.1.1 Member Function Documentation

5.1.1.1 equals()

```
bool Add::equals (
            const Expr * other ) const  [override], [virtual]
```

Implements Expr.

5.1.1.2 has_variable()

```
bool Add::has_variable ( ) const  [override], [virtual]
```

Implements Expr.

5.1.1.3 interp()

```
int Add::interp ( ) const  [override], [virtual]
```

Implements Expr.

5.1.1.4 pretty_print()

```
void Add::pretty_print (
            std::ostream & os ) const  [override], [virtual]
```

Reimplemented from Expr.

5.1.1.5 pretty_print_at()

```
void Add::pretty_print_at (
            std::ostream & os,
            precedence_t prec ) const  [override], [virtual]
```

Reimplemented from Expr.

5.1.1.6 print()

```
void Add::print (
            std::ostream & os ) const  [override], [virtual]
```

Implements Expr.

5.1.1.7 subst()

```
Expr * Add::subst (
            const std::string & varName,
            const Expr * replacement ) const  [override], [virtual]
```

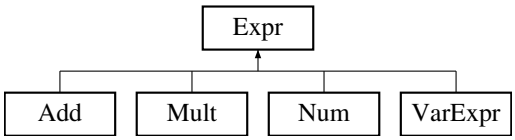
Implements Expr.

The documentation for this class was generated from the following files:

- /Users/xxy/Desktop/hw4/expr.h
- /Users/xxy/Desktop/hw4/expr.cpp

5.2 Expr Class Reference

Inheritance diagram for Expr:



Public Member Functions

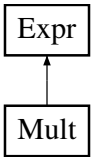
- virtual int **interp** () const =0
- virtual bool **has_variable** () const =0
- virtual Expr ∗ **subst** (const std::string &varName, const Expr ∗replacement) const =0
- virtual bool **equals** (const Expr ∗other) const =0
- virtual void **print** (std::ostream &os) const =0
- std::string **to_string** () const
- virtual void **pretty_print** (std::ostream &os) const
- virtual void **pretty_print_at** (std::ostream &os, precedence_t prec) const

The documentation for this class was generated from the following files:

- /Users/xxy/Desktop/hw4/expr.h
- /Users/xxy/Desktop/hw4/expr.cpp

5.3 Mult Class Reference

Inheritance diagram for Mult:



Public Member Functions

- **Mult** (Expr ∗lhs, Expr ∗rhs)
- int interp () const override
- bool has_variable () const override
- Expr ∗ subst (const std::string &varName, const Expr ∗replacement) const override
- bool equals (const Expr ∗other) const override
- void print (std::ostream &os) const override
- void pretty_print (std::ostream &os) const override
- void pretty_print_at (std::ostream &os, precedence_t prec) const override

Public Member Functions inherited from Expr

- std::string **to_string** () const

5.3.1 Member Function Documentation

5.3.1.1 equals()

```
bool Mult::equals (
            const Expr * other ) const  [override], [virtual]
```

Implements Expr.

5.3.1.2 has_variable()

```
bool Mult::has_variable ( ) const  [override], [virtual]
```

Implements Expr.

5.3.1.3 interp()

```
int Mult::interp ( ) const  [override], [virtual]
```

Implements Expr.

5.3.1.4 pretty_print()

```
void Mult::pretty_print (
            std::ostream & os ) const  [override], [virtual]
```

Reimplemented from Expr.

5.3.1.5 pretty_print_at()

```
void Mult::pretty_print_at (
            std::ostream & os,
            precedence_t prec ) const  [override], [virtual]
```

Reimplemented from Expr.

5.3.1.6 print()

```
void Mult::print (
            std::ostream & os ) const  [override], [virtual]
```

Implements Expr.

5.3.1.7 subst()

```
Expr * Mult::subst (
            const std::string & varName,
            const Expr * replacement ) const  [override], [virtual]
```

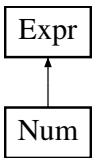
Implements Expr.

The documentation for this class was generated from the following files:

- /Users/xxy/Desktop/hw4/expr.h
- /Users/xxy/Desktop/hw4/expr.cpp

5.4 Num Class Reference

Inheritance diagram for Num:



Public Member Functions

- **Num** (int value)
- int interp () const override
- bool has_variable () const override
- Expr * subst (const std::string &varName, const Expr *replacement) const override
- bool equals (const Expr *other) const override
- void print (std::ostream &os) const override
- void pretty_print (std::ostream &os) const override

Public Member Functions inherited from Expr

- std::string **to_string** () const
- virtual void **pretty_print_at** (std::ostream &os, precedence_t prec) const

5.4.1 Member Function Documentation

5.4.1.1 equals()

```
bool Num::equals (
            const Expr * other ) const  [override], [virtual]
```

Implements Expr.

5.4.1.2 has_variable()

```
bool Num::has_variable ( ) const  [override], [virtual]
```

Implements Expr.

5.4.1.3 interp()

```
int Num::interp ( ) const  [override], [virtual]
```

Implements Expr.

5.4.1.4 pretty_print()

```
void Num::pretty_print (
            std::ostream & os ) const  [override], [virtual]
```

Reimplemented from Expr.

5.4.1.5 print()

```
void Num::print (
            std::ostream & os ) const  [override], [virtual]
```

Implements Expr.

5.4.1.6 subst()

```
Expr * Num::subst (
            const std::string & varName,
            const Expr * replacement ) const  [override], [virtual]
```

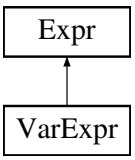
Implements Expr.

The documentation for this class was generated from the following files:

- /Users/xxy/Desktop/hw4/expr.h
- /Users/xxy/Desktop/hw4/expr.cpp

5.5 VarExpr Class Reference

Inheritance diagram for VarExpr:



Public Member Functions

- **VarExpr** (const std::string &name)
- int interp () const override
- bool has_variable () const override
- Expr * subst (const std::string &varName, const Expr *replacement) const override
- bool equals (const Expr *other) const override
- void print (std::ostream &os) const override

Public Member Functions inherited from Expr

- std::string **to_string** () const
- virtual void **pretty_print** (std::ostream &os) const
- virtual void **pretty_print_at** (std::ostream &os, precedence_t prec) const

5.5.1 Member Function Documentation

5.5.1.1 equals()

```
bool VarExpr::equals (
            const Expr * other ) const  [override], [virtual]
```

Implements Expr.

5.5.1.2 has_variable()

```
bool VarExpr::has_variable ( ) const  [override], [virtual]
```

Implements Expr.

5.5.1.3 interp()

```
int VarExpr::interp ( ) const  [override], [virtual]
```

Implements Expr.

5.5.1.4 print()

```
void VarExpr::print (
            std::ostream & os ) const  [override], [virtual]
```

Implements Expr.

5.5.1.5 subst()

```
Expr * VarExpr::subst (
            const std::string & varName,
            const Expr * replacement ) const  [override], [virtual]
```

Implements Expr.

The documentation for this class was generated from the following files:

- /Users/xxy/Desktop/hw4/expr.h
- /Users/xxy/Desktop/hw4/expr.cpp

Chapter 6

File Documentation

6.1 /Users/xxy/Desktop/hw4/cmdline.h

```
00001 #ifndef CMDLINE_H        // If the macro CMDLINE_H is not defined yet, proceed with the following
      code.
00002 #define CMDLINE_H        // Define the macro CMDLINE_H to prevent this header file from being included
      multiple times.
00003
00004 // Declare the use_arguments function, which takes an integer argc and an array of character pointers
      argv as parameters.
00005 void use_arguments(int argc, char* argv[]);
00006
00007 #endif                   // End of preprocessor directive, matching the start of #ifndef.
```

6.2 /Users/xxy/Desktop/hw4/expr.h

```
00001 #ifndef EXPR_H
00002 #define EXPR_H
00003
00004 #include <string>
00005 #include <sstream>
00006 #include <iostream>
00007 #include <stdexcept>
00008
00009 // Define an enumeration for precedence levels of expressions. This is useful for pretty printing
      expressions with correct parentheses.
00010 typedef enum {
00011     prec_none,      // No precedence, default level
00012     prec_add,       // Precedence of addition, lower than multiplication
00013     prec_mult       // Precedence of multiplication, higher than addition
00014 } precedence_t;
00015
00016 // Base class for all expression types. It declares the interface that all expressions must implement.
00017 class Expr {
00018 public:
00019     virtual ~Expr() {} // Virtual destructor to ensure proper cleanup of derived class objects through
      base class pointers.
00020
00021     // Evaluate the expression and return its value as an integer.
00022     virtual int interp() const = 0;
00023     // Return true if the expression contains a variable, false otherwise.
00024     virtual bool has_variable() const = 0;
00025     // Replace occurrences of a variable with another expression and return the new expression.
00026     virtual Expr* subst(const std::string& varName, const Expr* replacement) const = 0;
00027     // Check if this expression is equal to another expression.
00028     virtual bool equals(const Expr* other) const = 0;
00029
00030     // Print the expression to an output stream.
00031     virtual void print(std::ostream &os) const = 0;
00032     // Convert the expression to a string and return it.
00033     std::string to_string() const;
00034
00035     // Default implementation of pretty printing. Can be overridden in derived classes for custom
      behavior.
00036     virtual void pretty_print(std::ostream &os) const { print(os); }
00037     // Auxiliary method for pretty_print, allowing for precedence-aware printing.
00038     virtual void pretty_print_at(std::ostream &os, precedence_t prec) const { pretty_print(os); }
```

```
00039 };
00040
00041 // Represents numeric literals in expressions.
00042 class Num : public Expr {
00043     int value; // The numeric value of this literal.
00044 public:
00045     Num(int value) : value(value) {}
00046
00047     // Implementations of virtual methods from Expr.
00048     int interp() const override;
00049     bool has_variable() const override;
00050     Expr* subst(const std::string& varName, const Expr* replacement) const override;
00051     bool equals(const Expr* other) const override;
00052
00053     // Methods to print and pretty print the numeric literal.
00054     void print(std::ostream &os) const override;
00055     void pretty_print(std::ostream &os) const override;
00056 };
00057
00058 // Represents addition operations between two expressions.
00059 class Add : public Expr {
00060     Expr* lhs; // Left-hand side expression
00061     Expr* rhs; // Right-hand side expression
00062 public:
00063     Add(Expr* lhs, Expr* rhs) : lhs(lhs), rhs(rhs) {}
00064     ~Add(); // Destructor to clean up dynamically allocated expressions.
00065
00066     // Implementations of virtual methods from Expr.
00067     int interp() const override;
00068     bool has_variable() const override;
00069     Expr* subst(const std::string& varName, const Expr* replacement) const override;
00070     bool equals(const Expr* other) const override;
00071
00072     // Methods to print and pretty print the addition expression, with precedence handling.
00073     void print(std::ostream &os) const override;
00074     void pretty_print(std::ostream &os) const override;
00075     void pretty_print_at(std::ostream &os, precedence_t prec) const override;
00076 };
00077
00078 // Represents multiplication operations between two expressions.
00079 class Mult : public Expr {
00080     Expr* lhs; // Left-hand side expression
00081     Expr* rhs; // Right-hand side expression
00082 public:
00083     Mult(Expr* lhs, Expr* rhs) : lhs(lhs), rhs(rhs) {}
00084     ~Mult(); // Destructor to clean up dynamically allocated expressions.
00085
00086     // Implementations of virtual methods from Expr.
00087     int interp() const override;
00088     bool has_variable() const override;
00089     Expr* subst(const std::string& varName, const Expr* replacement) const override;
00090     bool equals(const Expr* other) const override;
00091
00092     // Methods to print and pretty print the multiplication expression, with precedence handling.
00093     void print(std::ostream &os) const override;
00094     void pretty_print(std::ostream &os) const override;
00095     void pretty_print_at(std::ostream &os, precedence_t prec) const override;
00096 };
00097
00098 // Represents variable expressions in the expression tree.
00099 class VarExpr : public Expr {
00100     std::string name; // The name of the variable.
00101 public:
00102     VarExpr(const std::string& name) : name(name) {}
00103
00104     // Implementations of virtual methods from Expr.
00105     int interp() const override; // Throws an exception because variables cannot be interpreted
      without a value.
00106     bool has_variable() const override;
00107     Expr* subst(const std::string& varName, const Expr* replacement) const override;
00108     bool equals(const Expr* other) const override;
00109
00110     // Print the variable's name.
00111     void print(std::ostream &os) const override;
00112 };
00113
00114 #endif // EXPR_H
```

Index