

Summer 2017.

# Aid Management Application (AMA)

When disaster hits an area, the most important thing is to be able provide the people affected with what they need as quickly and as efficiently possible.

Your job for this project is to prepare an application that manages the list of goods needed to be shipped to the area. The application should be able to keep track of the quantity of items needed, the quantity on hand, and store them in a file for future use.

The types of goods needed to be shipped in this situation are divided into two categories;

- Non-Perishable products, such as blankets and tents, that have no expiry date, we refer to these type of products as AMA\_product.
- Perishable products, such as food and medicine, that have an expiry date, we refer to these products as AMA\_Perishable.

To accomplish this task you need to create several classes to encapsulate the problem and provide a solution for this application.

## CLASSES TO BE DEVELOPED

The classes needed for this application are:

### Date

A class to be used to hold the expiry date of the perishable items.

### ErrorMessage

A class to keep track of the errors occurring during data entry and user interaction.

### Streamable

This interface (a class with “only” pure virtual functions) enforces the classes that inherit from it to be *streamable*. Any class derived from “Streamable” can read from or write to the console, or can be saved to or loaded from a text file.

Using this class the list of items can be saved into a file and retrieved later, and individual item specifications can be displayed on screen or read from keyboard.

### Product

A class inherited from Streamable, containing general information about an item, like the name, Stock Keeping Unit (SKU), price etc.

### AMA\_Product

A class for non-perishable items that is inherited from the “Product” class and implements the requirements of the “Streamable” class (i.e. implements the pure virtual methods of the Streamable class)

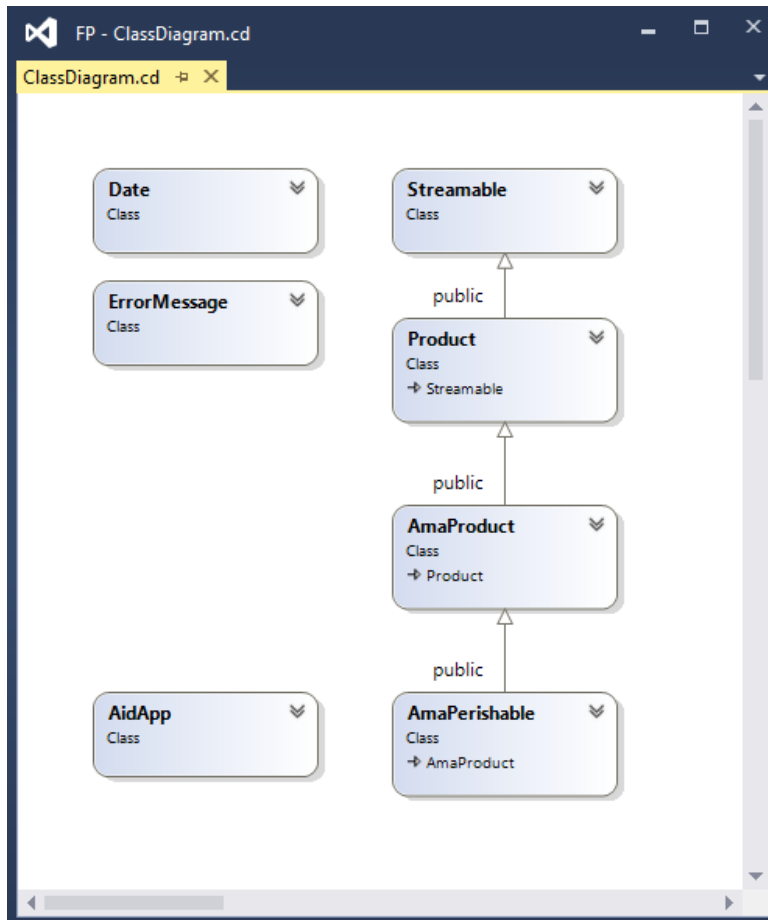
### AMA\_Perishable

A class inherited from the “AMA\_Product” that provides expiry date for Perishable items.

### AidApp

The main application class that is essentially the manager class for the NFI and Perishable items. This class provides the user with a user-interface to list, add and update the items saved in a data file.

## PROJECT CLASS DIAGRAM



## PROJECT DEVELOPMENT PROCESS

The Development process of the project is divided into 6 milestones and therefore six deliverables. Shortly before the due date of each deliverable a tester program and a script will

be provided to you to test and submit each of the deliverables. The approximate schedule for deliverables is as follows

- Due: Kickoff (KO) + 33 days
  - The Date class. Due: Jul 8<sup>th</sup>, 5 days
  - The ErrorMessage class Due: Jul 11<sup>th</sup>, 3 days
  - The Streamable class Due: Jul 12<sup>th</sup>, 1 day
  - The Product class Due: Jul 18<sup>th</sup>, 6 days
  - The AMA product classes Due: Jul 27<sup>th</sup>, 9 days
  - The AidApp class. Due: Aug 5<sup>th</sup>, 9 days

## GENERAL PROJECT SUBMISSION

This is the first of several milestones and in order to complete the whole project, all milestones must be completed and assembled for the final submission.

Note that at the end of the semester you **MUST submit a fully functional project to pass this subject**. If you fail to do so you will fail the subject. If your project is not completed by the end of the semester and your total average, without the project's mark, is above %50, your professor may give you an "INC" (incomplete mark) for the subject. With the release of your transcript you will receive a new due date to complete your project for a maximum mark of "49%" and your total mark for the subject will be calculated accordingly.

## FILE STRUCTURE OF THE PROJECT

Each class will have its own header file and cpp file. The names of these files should be the same as the class name.

Example: Class **Date** has two files: **Date.h** and **Date.cpp**

In addition to header files for each class, create a header file called "general.h" that will hold the general defined values for the project, such as:

<code>TAX (0.13)</code>	The tax value for the NFI items
<code>MAX_SKU_LEN (7)</code>	The maximum size of a SKU
<code>DISPLAY_LINES (10)</code>	Product lines to display before each pause
<code>MIN_YEAR (2000)</code>	The min and max for year to be used for date validation
<code>MAX_YEAR (2030)</code>	
<code>MAX_NO_RECS (2000)</code>	The maximum number of records in the data file.

This header file should get included were these values are needed.

Note that all the code developed for this application should be in **sict** namespace.

## MILESTONE 1: THE DATE CLASS

The Date class encapsulates a date value in three integers for year, month and day, and is readable by istreams and printable by ostream using the following format for both reading and writing:       YYYY/MM/DD

Complete the implementation of Date class using following information:

### Member Data:

**int** year\_; Holds the year; a four digit integer between MIN\_YEAR and MAX\_YEAR, defined in "general.h"

**int** mon\_; Month of the year, between 1 to 12

**int** day\_; Day of the month, note that in a leap year February is 29 days, (see mday() member function)

**int** readErrorCode\_; This variable holds an error code with which the caller program can reference to find out if the date value is valid, and if not, which part is erroneous. The following possible error values should be defined in the date class header-file as follows:

```
NO_ERROR    0  -- No error the date is valid
CIN_FAILED  1  -- istream failed when entering information
YEAR_ERROR  2  -- Year value is invalid
MON_ERROR   3  -- Month value is invalid
DAY_ERROR   4  -- Day value is invalid
```

### Private Member functions:

**int** value()**const**; (this function is already implemented and provided)  
This function returns a unique integer number based on the date. This value is used to compare two dates. (If the value() of date one is larger than date two, then date one is after/more recent than date two).

**void** errCode(**int** errorCode);  
Sets the readErrorCode\_ member-variable to one of the values mentioned above.

### Constructors:

No argument (default) constructor: sets year\_, mon\_ and day\_ to "0" and readErrorCode\_ to NO\_ERROR.

Three argument constructor: Accepts three arguments to set the values of year\_, mon\_ and day\_ attributes. It also sets the readErrorCode\_ to NO\_ERROR.

## Public member-functions and operators

Comparison Logical operator overloads:

```
bool operator==(const Date& D)const;
bool operator!=(const Date& D)const;
bool operator<(const Date& D)const;
bool operator>(const Date& D)const;
bool operator<=(const Date& D)const;
bool operator>=(const Date& D)const;
```

These operators return the comparison result of the return value of the value() function applied to left and right operands (The Date objects on the left and right side of the operators).

For example operator< returns true if this->value() is less than D.value() or else it returns false.

```
int mdays(int mon)const; (this function is already implemented and
provided)
```

Returns the number of days in a month.

## Accessor or getter member functions:

```
int errCode()const;    Returns the readErrorCode_ value.
bool bad()const;       Returns true if readErrorCode_ is not equal to zero.
```

## IO member-funtions

```
std::istream& read(std::istream& istr);
```

Reads the date in the following format: YYYY?MM?DD (e.g. 2016/03/24 or 2016-03-24) from the console. This function will not prompt the user. If the istream (istr) fails at any point, it will set the readErrorCode\_ to CIN\_FAILED and will NOT clear the istream object. If the numbers are successfully read in, it will validate them to be in range, in the order of year, month and day (see general header-file and mday() method for acceptable ranges for years and days respectively. Month can be between 1 and 12 inclusive). If any of the numbers are not within range, the readErrorCode\_ will be set to the appropriate error code and stop further validation. Irrespective of the result of the process, this function will return the incoming istr argument.

```
std::ostream& write(std::ostream& ostr)const;
```

Writes the date using the ostr argument in the following format: YYYY/MM/DD, then return the ostr.

## Non-member IO operator overloads:

After implementing the Date class, overload the operator<< and operator>> to work with cout to print a Date, and cin to read a Date, from/to the console respectively.

Use the read and write methods and DO NOT use friends for these operator overloads.

Make sure the prototype of the functions are in Date.h.

## Preliminary task

To kick-start the first milestone, clone/download milestone 1 from the repository and implement the Date class.

Compile and test your code using the four tester programs starting from tester number 1 up to 4.

## MILESTONE 1 SUBMISSION

If not on matrix already, upload [general.h](#), [Date.h](#), [Date.cpp](#) and the four testers to your matrix account. Compile and run your code and make sure everything works properly.

Then run the following script from your account: (replace profname.proflastname with your professors Seneca userid)

```
~profname.proflastname/submit 244_ms1 <ENTER>
```

and follow the instructions.

Please note that a successful submission does not guarantee full credit for this workshop.

If the professor is not satisfied with your implementation, your professor may ask you to resubmit. Resubmissions will attract a penalty.

## MILESTONE 2: THE ERRORMESSAGE CLASS

The ErrorMessage class encapsulates an error message in a dynamic C-style string and also is used as a flag for the error state of other classes.

Later in the project, if needed in a class, an ErrorMessage object is created and if an error occurs, the object is set a proper error message.

Then using the **isClear()** method, it can be determined if an error has occurred or not and the object can be printed using **cout** to show the error message to the user.

### Private member variable (attribute):

ErrorMessage has only one private data member (attribute):

```
char* message_;
```

### Constructors:

No Argument Constructor, (default constructor):

```
ErrorMessage();
```

Sets the **message\_** member variable to **nullptr**.

Constructors:

```
ErrorMessage(const char* errorMessage);
```

Sets the **message\_** member variable to **nullptr** and then uses the **message()** setter member function to set the error message to the **errorMessage** argument.

```
ErrorMessage(const ErrorMessage& em) = delete;
```

A deleted copy constructor to prevent an ErrorMessage object to be copied.

### Public member functions and operator overloads (methods):

```
ErrorMessage& operator=(const ErrorMessage& em) = delete;
```

A deleted assignment operator overload to prevent an ErrorMessage object to be assigned to another.

```
ErrorMessage& operator=(const char* errorMessage);
```

Sets the **message\_** to the **errorMessage** argument and returns the current object (\*this) by:

- De-allocating the memory pointed by **message\_**
- Allocating memory to the same length of **errorMessage + 1** and keeping the address in **message\_** data member.
- Copying **errorMessage** c-string into **message\_**.
- Returning \*this.

You can accomplish this by reusing your code and calling the following member functions:

Call **clear()** and then call the setter **message()** function and return \*this.

```
virtual ~ErrorMessage();
```

de-allocates the memory pointed by **message\_**.

```
void clear();
```

de-allocates the memory pointed by `message_` and then sets `message_` to `nullptr`.

**bool isClear()const;**

returns true if `message_` is `nullptr`.

**void message(const char\* value);**

Sets the `message_` of the ErrorMessage object to a new value by:

- de-allocating the memory pointed by `message_`.
- allocating memory to the same length of `value + 1` keeping the address in `message_ data` member.
- copying `value` c-string into `message_`.

**const char\* message()const;**

returns the address kept in `message_`.

## Helper operator overload:

Overload `operator<<` so the ErrorMessage can be printed using `cout`.

If ErrorMessage `isClear`, Nothing should be printed, otherwise the c-string pointed by `message_` is printed.

## MILESTONE 2 SUBMISSION

If not on matrix already, upload [ErrorMessage.h](#), [ErrorMessage.cpp](#) and the tester to your matrix account. Compile and run your code and make sure everything works properly.

Then run the following script from your account: (replace `profname.proflastname` with your professors Seneca userid)

```
~profname.proflastname/submit 244_ms2 <ENTER>
```

and follow the instructions.

Please note that a successful submission does not guarantee full credit for this workshop.

If the professor is not satisfied with your implementation, your professor may ask you to resubmit. Resubmissions will attract a penalty.

## MILESTONE 3: THE STREAMABLE INTERFACE

The Streamable class is provided to enforce inherited classes to implement functions to work with `fstream` and `iostream` objects.

Code the Streamable class in a file called `Streamable.h`.



You do not need the Date or ErrorMessage class for this milestone.

## Pure virtual member functions (methods):

Streamable class, being an interface, has only four pure virtual member functions (methods) with following names:

- 1- `fstream& store(fstream& file, bool addNewLine = true) const`  
 Is a constant member function (does not modify the owner) and receives and returns references of `std::fstream`.  
*In future milestones children of Streamable will implement this method, when they are to be stored in a file.*
- 2- `fstream& load(std::fstream& file)`  
 Receives and returns references of `std::fstream`.  
*In future milestones children of Streamable will implement this method, when they are to be read from a file.*
- 3- `ostream& write(ostream& os, bool linear) const`  
 Is a constant member function and returns a reference of `std::ostream`.  
`write()` receives two arguments: the first is a reference of `std::ostream` and the second is a `bool` argument called `linear`.  
*In future milestones children of Streamable will implement this method when they are to be printed on the screen in two different formats:*  
*Linear: the class information is to be printed in one line*  
*Form: the class information is to be printed in several lines like a form.*
- 4- `istream& read(istream& is)`  
 Returns and receives references of `std::istream`.  
*In future milestones children of Streamable will implement this method when their information is to be received from console.*

As you already know, these functions only exist as prototypes in the class declaration in the header file.

After implementing this class, compile it with `Myfile.cpp`, `MyFile.h` and `StreamableTester.cpp`. The program should compile with no error and using the tester program you will be able to read and append text to the `streamable.txt` file.

## MILESTONE 3 SUBMISSION

If not on matrix already, upload [Streamable.h](#), [MyFile.h](#), [MyFile.cpp](#) and the tester to your matrix account. Compile and run your code and make sure everything works properly.

Then run the following script from your account: (replace `profname.proflastname` with your professors Seneca userid)

```
~profname.proflastname/submit 244_ms3 <ENTER>
```

and follow the instructions.

Please note that a successful submission does not guarantee full credit for this workshop.

If the professor is not satisfied with your implementation, your professor may ask you to resubmit. Resubmissions will attract a penalty.

## MILESTONE 4: THE PRODUCT CLASS

Create a class called Product. The class Product is responsible for encapsulating a general Streamable Product.

Although the class Product is a Streamable (inherited from Streamable), it will not implement any of the pure virtual member functions, therefore it remains abstract.

The class Product is implemented under the sict namespace. Code the Product class in the Product.cpp and Product.h files.

You do not need the Date class for this milestone.

### Product Class specs:

Private Member variables:

**sku\_**: Character array, **MAX\_SKU\_LEN** + 1 characters long

This character array holds the SKU (barcode) of the items as a string.

**name\_**: Character pointer

This character pointer points to a dynamic string that holds the name of the Product

**price\_**: Double

Holds the Price of the Product

**taxed\_**: Boolean

This variable will be true if this Product is taxed

**quantity\_**: Integer

Holds the on hand (current) quantity of the Product.

**qtyNeeded\_**: Integer

Holds the needed quantity of the Product.

## Public member functions and constructors

### No argument Constructor;

This constructor sets the Product to a safe recognizable empty state. All number values are set to zero in this state.

### Five argument Constructor;

Product is constructed by passing 5 values to the constructor:

the SKU, the Name, if the Product is taxed or not, , the Price and the Needed Quantity.

The constructor:

- Copies the SKU into the corresponding member variable up to **MAX\_SKU\_LEN** characters.
- Allocates enough memory to hold the name in the name\_ pointer and then copies the name into the allocated memory pointed to by the member variable name\_.
- Sets quantity on hand to zero.
- Sets the rest of the member variables to the corresponding values received by the arguments.
- If value for Product being taxed is not provided, it will set the taxed\_ flag to the default value "true"

### Copy Constructor;

See below:

### Dynamic memory allocation necessities

Implement the copy constructor and the operator= so the Product is copied from and assigned to another Product safely and without any memory leak. Also implement a virtual destructor to make sure the memory allocated by name\_ is freed when Product is destroyed.

## Accessors

### Setters:

Create the following setter functions to set the corresponding member variables:

- **sku**
- **price**
- **name**
- **taxed**
- **quantity**
- **qtyNeeded**

All the above setters return void.

### Getters (Queries):

Create the following constant getter functions to return the values or addresses of the member variables: (these getter methods do not receive any arguments)

- **sku**, returns constant character pointer
- **price**, returns double
- **name**, returns constant character pointer
- **taxed**, returns boolean
- **quantity**, returns integer
- **qtyNeeded**, returns integer

Also:

- **cost**, returns double

Cost returns the cost of the Product after tax. If the Product is not taxed the return value of cost() will be the same as price.

- **isEmpty** returns bool

isEmpty return true if the Product is in a safe empty state.

All the above getters are constant methods, which means they CANNOT modify the owner.

### Member Operator overloads:

**Operator==** : receives a constant character pointer and returns a Boolean.

This operator will compare the received constant character pointer to the SKU of the Product, if they are the same, it will return true or else, it will return false.

**Operator+=** : receives an integer and returns an integer.

This operator will add the received integer value to the quantity of the Product, returning the sum.

**Operator-=** : receives an integer and returns an integer.

This operator will reduce the quantity of the Product by the integer value returning the quantity after reduction.

### Non-Member operator overload:

**Operator+=** : receives a double reference value as left operand and a constant Product reference as right operand and returns a double value;

This operator multiplies the cost of the Product by the quantity of the Product and then adds that value to the left operand and returns the result.

Essentially this means this operator adds the total cost of the Product on hand to the left operand, which is a double reference, and then returns it.

### Non-member IO operator overloads:

After implementing the Product class, overload the operator<< and operator>> to work with ostream (cout) to print a Product to, and istream (cin) to read a Product from, the console. Use the write() and read() methods of Streamable class to implement these operator overloads.

Make sure the prototype of the functions are in Product.h.

## MILESTONE 4 SUBMISSION

If not on matrix already, upload [general.h](#), [Streamable.h](#), [Product.h](#), [Product.cpp](#) and the tester to your matrix account. Compile and run your code and make sure everything works properly.

Then run the following script from your account: (replace profname.proflastname with your professors Seneca userid)

```
~profname.proflastname/submit 244_ms4 <ENTER>
```

and follow the instructions.

Please note that a successful submission does not guarantee full credit for this workshop.

If the professor is not satisfied with your implementation, your professor may ask you to resubmit. Resubmissions will attract a penalty.