

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)

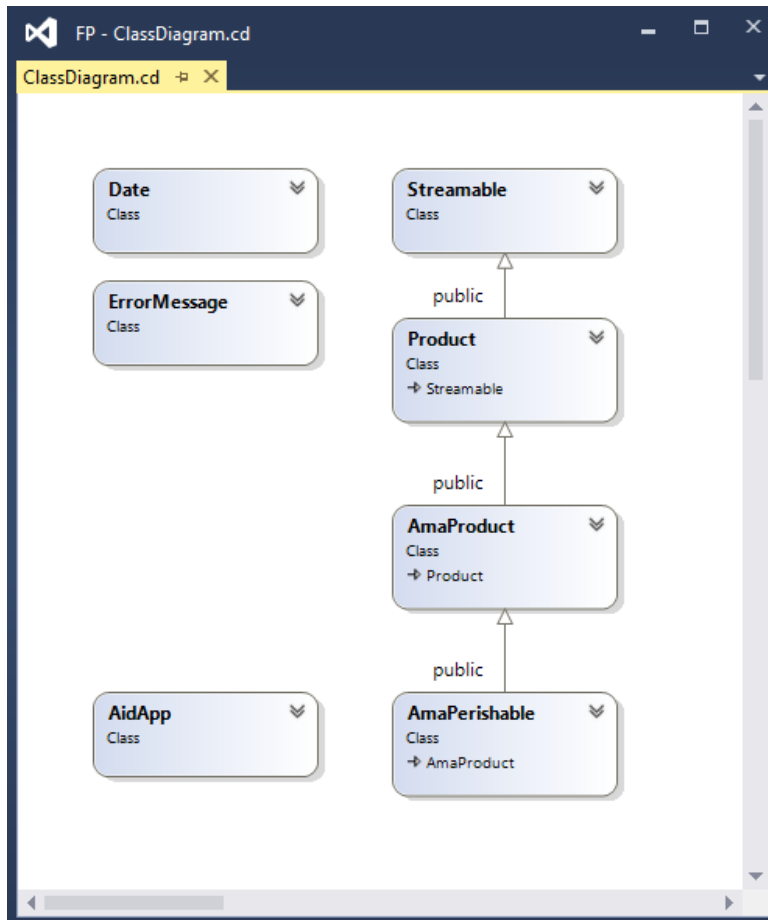
AMA_Perishable

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 8th, 5 days
 - The ErrorMessage class Due: Jul 11th, 3 days
 - The Streamable class Due: Jul 12th, 1 day
 - The Product class Due: Jul 18th, 6 days
 - The AMA product classes Due: Jul 27th, 9 days
 - The AidApp class. Due: Aug 6th, 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 retrun *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.

MILESTONE 5: THE AMAPRODUCT AND AMAPERISHABLE CLASSES

AmaProduct Class

Implement the [AmaProduct](#) class in [AmaProduct.h](#) and [AmaProduct.cpp](#) as a class derived from a [Product](#) class.

Essentially, [AmaProduct](#) is a [Streamable Product](#) class that is not abstract.

An [AmaProduct](#) is a [Product](#) designed to work with the Aid Management Application.

Private member variables

```
char fileTag_;
```

Holds a single character to tag the records as Perishable or non-Perishable product in a file.

```
char unit_[11];
```

Unit of Measurement (i.e. Kg, Liters, ...)

Protected member variables

`AmaProduct` class has only one protected member variable of type `ErrorMessage`, called `err_`.

Constructor:

`AmaProduct` has only one constructor that receives the value for the `filetag_` member variable and if this value is not provided, it will use the character 'N' as the default value for the argument.

Public member functions

```
const char* unit()const;
```

returns a constant pointer to the `unit_` member variable.

```
void unit(const char* value);
```

Copies the incoming value string into the `unit_` string.
Make sure copying does not pass the size of the `unit_` array.

`AmaProduct` implements all four pure virtual methods of the class `Streamable` (the signatures of the functions are identical to those of `Streamable`).

```
fstream& AmaProduct::store(fstream& file, bool addNewLine)const:
```

Using the operator<< of ostream first writes the `fileTag_` member variable and a comma into the `file` argument, then without any formatting or spaces writes all the member variables of `Product`, comma separated, in following order:

sku, name, price, taxed, quantity, unit, quantity needed
and if `addNewLine` is true, it will end them with a new line. Then it will return the file argument out.

Example:

```
N,1234,box,123.45,1,1,kg,5<Newline>
```

```
fstream& AmaProduct::load(fstream& file)
```

Using the operator>>, ignore and getline methods of istream, `AmaProduct` reads **all the comma separated fields form the current record in** the `file` and sets the member variables using the

setter methods. When reading the **fields**, load assumes that the record does not have the “N,” (the **filetag_**) at the beginning, so it starts the reading from the **sku**.

No error detection is done.

At the end the file argument is returned.

Hint: create temporary variables of type double, int and string and read the fields one by one, skipping the commas. After each read, set the member variables using setter methods.

ostream& AmaProduct::write(ostream& os, bool linear) const.

If the **err_** member variable is not clear (use **isClear** member function). It simply prints the **err_** using **ostr** and returns **ostr**. If the **err_** member variable is clear (No Error) then depending on the value of **linear**, **write()**, prints the Product in different formats:

Linear is true:

Prints the Product values separated by Bar “|” character in following format:

```
1234 | Box | 139.50 | 1 | kg | 5 |
```

Sku: left justified in MAX_UPC_LEN characters
Name: left justified 20 characters wide (truncated if longer than 20 chars)
Cost: (not the price) right justified, 2 digits after decimal point 7 chars wide
Qty on hand: right justified 4 characters wide
Unit: left justified 10 characters wide
Quantity needed: right justified 4 characters wide
NO NEW LINE

Linear is false:

Prints one member variable per line in following format:

```
Sku: 1234
Name: box
Price: 123.45
Price after tax: 139.50
Quantity On Hand: 1 kg
Quantity Needed: 5
NO NEW LINE
```

Or the following is the product is not taxed:

```
Sku: 1234
Name: box
Price: 123.45
Price after tax: N/A
Quantity On Hand: 1 kg
Quantity Needed: 5
NO NEW LINE
```

Afterwards, **write** returns the **ostr** argument.

`istream& AmaProduct::read(istream& istr):`

Receives the values using `istream` (the `istr` argument) exactly as the following:

```
Sku: 1234<ENTER>
Name: box<ENTER>
Unit: kg<ENTER>
Taxed? (y/n): y<ENTER>
Price: 123.45<ENTER>
Quantity On hand: 1<ENTER>
Quantity Needed: 5<ENTER>
```

if `istr` is in a **fail** state, then the function exits doing nothing other than returning `istr`.

When entering the Taxed field, check the character entered, if it is one of 'Y','y','N' or 'n' then clear (flush) the keyboard, otherwise set the message of `err_` object to **"Only (Y)es or (N)o are acceptable"** and the rest of the entry is skipped.

Also to make the error handling is consistent with `istream`'s fail flag, call the following function:

```
istr.setstate(ios::failbit);
```

This will manually put the `istream` in failure state. By doing this, the error handling will be consistent with `istream`'s error detection.

If at any stage `istr` fails (cannot read), `err_` should be set to the proper error message and the rest of the entry is skipped and nothing is set in the `Product` (also no error message is displayed).

Here are the possible error messages:

fail at Price Entry:	Invalid Price Entry
fail at Quantity Entry:	Invalid Quantity Entry
fail at Quantity Needed Entry:	Invalid Quantity Needed Entry

Since the rest of the member variables are text, `istr` cannot fail on them, therefore there are no error messages designated for them. Make sure at the end of the Entry you do not read the last new line or flush the keyboard.

At end, read will return the `istr` argument.

AmaPerishable Class

Implement the `AmaPerishable` class in `AmaPerishable.h` and `AmaPerishable.cpp` to be derived out of an `AmaProduct` class. Essentially, `AmaPerishable` is an `AmaProduct` class that with an expiry date.

Private member variables

`AmaPerishable` class has one private member variable:

- A `Date`, called `expiry_`

Constructor:

`AmaPerishable` has only one default constructor invokes the `AmaProduct` constructor passing the value 'P' for the `fileTag` argument.

Public member functions

Public Accessors (setters and getters)

```
const Date& expiry()const;
```

returns a constant reference to `expiry_` member variable.

```
void expiry(const Date &value);
```

Sets the `expiry_` attribute to the incoming value.

Virtual method implementations

`AmaPerishable` re-implements all four virtual methods of the `AmaProduct`.

```
fstream& store(fstream& file, bool addNewLine = true)const:
```

Calls the `parent's store` passing the file and "false" as arguments and then writes a comma and the `expiry date` into the file. If the `addNewLine` argument is true, it will write a newline into the file.

The outcome will be something like this being written to the file:

```
P,1234,water,1.5,0,1,liter,5,2017/10/12<NEWLINE>
```

```
fstream& load(fstream& file)
```

Calls the `parent's load` passing the file as the argument and then calls the read method of the `expiry_` object passing the file as the argument and then ignores one character (reads one character from the file and dumps it).

```
ostream& write(ostream& ostr, bool linear)const:
```

Calls the `write of the parent` passing `ostr` and `linear` as arguments. Then if `err_` is clear and product is not empty:

if `linear` is true, it will just print the `expiry` otherwise it will first go to new line and then print:

“[Expiry date](#): “ and the print the expiry date.

The outcome will be like this:

```
1234 |water | 1.50| 1|liter | 5|2017/10/12
```

OR:

```
Sku: 1234
Name: water
Price: 1.50
Price after tax: N/A
Quantity On Hand: 1 liter
Quantity Needed: 5
Expiry date: 2017/10/12
NO NEW LINE
```

Afterwards, write returns the [ostr](#) argument.

[istream&](#) read([istream&](#) istr):

It will call [parent's read](#) passing [istr](#) as argument.

Then if [err_](#) is clear it will print:

[Expiry date \(YYYY/MM/DD\):](#)

then it will read the date from the console into a [temporary Date object](#).

If Expiry (Date) Entry fails then, depending of the error code stored in the Date object, set the error message in [err_](#) to:

[CIN_FAILED](#): Invalid Date Entry

[YEAR_ERROR](#): Invalid Year in Date Entry

[MON_ERROR](#): Invalid Month in Date Entry

[DAY_ERROR](#): Invalid Day in Date Entry

Then to be consistent with [istream](#) failure, manually sets the [istr](#) to failure mode by calling this function:

[istr.setstate\(ios::failbit\);](#)

If nothing has failed, then it will set the [expiry date of the object](#) to the [temporary Date object](#) read from the console.

At end, read will return the [istr](#) argument.

MILESTONE 5 SUBMISSION

If not on matrix already, upload [general.h](#), [Date.h](#), [Date.cpp](#), [ErrorMessage.h](#), [ErrorMessage.cpp](#), [Streamable.h](#), [Product.h](#), [Product.cpp](#), [AmaProduct.h](#), [AmaProduct.cpp](#), [AmaPerishable.h](#), [AmaPerishable.cpp](#) and the tester files 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_ms5 <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 6: THE AID MANAGEMENT APPLICATION

For your final milestone for this project, create a class called "AidApp".

AidApp is a class that uses the previously created classes in this project to give the user the capability to store and retrieve Perishable and Non-Perishable product information from and to a file.

The AidApp class has several private member functions and only two public functions.

A description for each function is provided below. Those that are more complex will be complimented with suggested pseudo code to help you implement the function. You may use the pseudo code as suggested, revise it to improve on the logic, or implement your own logic.

Code the AidApp class in files **AidApp.h** and **AidApp.cpp**.

AidApp class

Private member variables:

```
char filename_[256];
```

Holds the name of the text file used to store the product information.

```
Product* product_[MAX_NO_RECS];
```

An array of Product pointers, MAX_NO_RECS long. (i.e. Each element of this array is a product pointer).

```
fstream datafile_;
```

An fstream instance used to create and access a file.

```
int noOfProducts_;
```

Number of Products (perishable or non-perishable) pointed to by the product_ array.

The Constructor

The `AidApp` constructor receives a constant char string called `filename` and then:

- 1- Copies `filename` to `filename_` member variable
- 2- Sets all the `product_` elements to `nullptr`
- 3- Sets `noOfProducts_` to zero
- 4- Loads the Records (calls the member function to do this)

Private member functions:

Copy and assignment prevention

Make sure the `AidApp` cannot get copied or assigned to another `AidApp`.

```
void pause()const;
```

Prints: "Press Enter to continue..."<NEWLINE> then waits for the user to hit enter. If the user hits any other key, the key is ignored. Only the ENTER key will terminate this function.

```
int menu();
```

Menu() displays the menu as follows and waits for the user to select an option.

```
Disaster Aid Supply Management Program
1- List products
2- Display product
3- Add non-perishable product
4- Add perishable product
5- Add to quantity of purchased products
0- Exit program
> _
```

^ The cursor should be positioned here when the menu is printed

- If the selection is valid, menu() will return the selection otherwise it will return -1
- The standard input buffer (keyboard) must be cleared before the function exits.

```
void loadRecs();
```

Opens the data file for reading. If the file does not exist, it will create an empty file, close the file and exit.

Otherwise, read the data file and store each record to the pointer array of Products accordingly (overwriting the old ones).

Note: Prevent memory leaks by deleting each Product element pointer in the array before overwriting/replacing the element with a new Product pointer.

After reading all the records, close the file.

```
Pseudo code:
Set readIndex to zero
Open the file for reading (use ios::in)
if the file is in fail state it means there is no file on the disk, then
    clear the failure
    close the file
    open the file for writing (ios::out) to create the file
    close thefile
otherwise
    until reading fails loop
        deallocate the memory pointed by product pointer at readindex
        read one char character to identify type of Product into Id character
        if Id character is P
            Dynamically create a Perishable product and hold it in product pointer at readIndex
        if Id character is N
            Dynamically create a Non-perishable product and hold it in product pointer at readIndex
        if either P or N is read
            skip the comma in the file
            load the product from the file (using its load method)
            add one to read index
        continue the loop
set number of products to readIndex
close the datafile
```

void saveRecs();

- Opens the data file for writing
- Loops through the `product_` array up to `noOfProducts_` and stores them in the `datafile_`
- Closes the file

void listProducts()const;

- Prints the following title:

Row	SKU	Product Name	Cost	QTY	Unit	Need	Expiry
----	-----	-----	-----	----	-----	----	-----

- Then loops through the `products_` array up to `noOfProducts_` and prints the row number (four spaces wide, right justified), followed by a bar/pipe character (|) surrounded by two spaces
- Then prints the current `Product` in the loop followed by a newline

- When the number of printed items reaches 10, it will pause until the user hits the Enter key.
- With each loop iteration, it will calculate the total cost of the `products` in a `double` value using the `operator+=` implemented by the `Product` class.
- When the list is done, a line of dashes will be printed:

- Finally, the total cost will be printed:

Total cost of support: \$9999.99

The total cost value is printed with a dollar sign at left and two digits after decimal point

int SearchProducts(const char* sku)const;

Loops through the `product_` up to `noOfProducts_` and checks each of them for the same SKU as the incoming argument using the `operator==` implemented by the `Product` class. If a match is found it will return the index of the found `Product` in the `product_` array, otherwise it will return -1.

void addQty(const char* sku);

Updates the quantity on hand for a `Product`.

`updateQty()` searches for the `Product` with the same `sku` as the incoming argument. If not found it will display:

"Not found!"<NEWLINE>

If found, it will display the `Product` in non-linear format and then asks for an integer for quantity purchased:

"Please enter the number of purchased items: "

If it cannot read the integer it prints:

"Invalid quantity value! "<NEWLINE>

If it can read the integer, it makes sure the amount is less than or equal to the amount required (i.e. less than `qtyNeeded()` - `quantity()`). If it is less than or equal, it will add the value to the quantity on hand of the product using `operator+=` implemented by the `Product` class. If the value is not less than or equal the amount needed, it will only accept the amount required and prints a message to return the extra:

"Too many items; only 999 is needed, please return the extra 99 items. "< NEWLINE >

Lastly, all records will be saved back to the file and a message displayed:

"Updated!" <NEWLINE>

Make sure after the entry the keyboard is flushed.

```
void addProduct(bool isPerishable);
```

Depending on the value of the argument being true or false, create a Perishable or Non-perishable **Product** and get the values from the user and add it to the end of the **product_** array and save the records (call **saveRecs()**). If there is an error, display the **Product** and exit the function (this will show the error message).

```
int run();
```

Display the menu, receive the user's selection, and do the action requested (follow with a pause using the **pause()** function), and repeat (redisplay the menu...) until the user selects zero to exit.

1- List products

List the products.

2- Display product

Ask for a sku using this prompt

"Please enter the SKU: "

(receive input from console) then search for the Product.

If found, display the Product information in non-liner format

Otherwise display:

"Not found!"

3- Add non-perishable product

Add a Non-Perishable product to the system using the

addProduct function

Load the records.

4- Add perishable product

Add a Perishable product to the to the system using the

addProduct function

Load the records.

5- Add to quantity of purchased products

Ask for a sku using this prompt

"Please enter the SKU: "

(receive input from console) and then add to the quantity using the **addQty()** function.

0- Exit program

The program will terminate printing:

"Goodbye!!"

In case of invalid menu selection the program will print:

"===Invalid Selection, try again.==="

Followed by a pause (**pause()** function) before redisplaying the menu.

The Run function will return 0 when it ends.

PROJECT SUBMISSION

comments.txt:

Create a file called comments.txt to be submitted along with your project.

Add the following information to comments.txt:

Citation:

If you have used any code or logic developed by others in your solution, you must identify the source of that code or logic in comments in your source code.

You must insert these comments at the place in your source code where the code/logic is being used.

You must also copy and list this information in comments.txt.

Failure to identify any code or logic developed by others and included in your solution will result in an assessment of plagiarism by your professor.

Enhancements:

If you have enhanced your solution with any features not in the specifications, you should identify them clearly through comments in your source code.

You should also copy and list this information in comments.txt.

SUBMISSION METHODS

You have 3 choices for submitting your project:

1- **Short**

You can select this option if you have already successfully submitted milestones 1 to 5

2- **Long**

You can select this option if you have not submitted the past 5 milestones and want to only submit the Final Assembly. Your program must work exactly as described in the past 5 milestones.

3- **Open**

This submission does not test the output of your application but captures and submits it to your professor.

You can select this option if you believe your project works properly but you could not match the exact output requested in either Short or Long submissions.

YOU are responsible to do all the tests asked in either Short or Long submission. If you miss any steps of those tests your submission may be rejected and you will have to re-submit your application incurring more deductions for having to resubmit and not being on time.

Also, you must **add a note in the comments.txt** file with an explanation why you have chosen the open submission rather than one of the other two.

SHORT SUBMISSION:

If not on matrix already, upload your project files and [comments.txt](#) to your matrix account. Compile your code as follows:

```
> g++ -Wall -std=c++0x -o fp AidApp.cpp AmaPerishable.cpp AmaProduct.cpp
Date.cpp ErrorMessage.cpp Product.cpp aidAppMai<ENTER>
```

This command will compile your code and name your executable “fp”

Execute [fp](#) and make sure everything works properly.

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

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

and run your application using the **RED underlined bold *italic*** values in the short output section below.

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.

OUTPUT (SHORT SUBMISSION)

Disaster Aid Supply Management Program

- 1- List products
- 2- Display product
- 3- Add non-perishable product
- 4- Add perishable product
- 5- Add to quantity of purchased products
- 0- Exit program

> **1**

Row	SKU	Product Name	Cost	QTY	Unit	Need	Expiry
1	132	Banana	0.99	6	Kilos	10	2015/05/13
2	122	Bucket	11.30	150		300	
3	124	Corn	4.00	0	Packs	140	2018/04/03
4	200	Sand Bags	3.38	20	packs	1000	
5	5678	Sugar	6.78	0	1kg Bags	200	
6	111	Water Container	12.79	500	packs	5000	
7	1111	Milk	3.99	10	bag	100	2017/09/20

Total cost of support: \$8204.21

Press Enter to continue...

Disaster Aid Supply Management Program

- 1- List products
 - 2- Display product
 - 3- Add non-perishable product
 - 4- Add perishable product
 - 5- Add to quantity of purchased products
 - 0- Exit program
- > 2

Please enter the SKU: 132

Sku: 132
Name: Banana
Price: 0.99
Price after tax: N/A
Quantity On Hand: 6 Kilos
Quantity Needed: 10
Expiry date: 2015/05/13

Press Enter to continue...

Disaster Aid Supply Management Program

- 1- List products
 - 2- Display product
 - 3- Add non-perishable product
 - 4- Add perishable product
 - 5- Add to quantity of purchased products
 - 0- Exit program
- > 2

Please enter the SKU: 1111

Sku: 1111
Name: Milk
Price: 3.99
Price after tax: N/A
Quantity On Hand: 10 bag
Quantity Needed: 100
Expiry date: 2017/09/20

Press Enter to continue...

Disaster Aid Supply Management Program

- 1- List products
 - 2- Display product
 - 3- Add non-perishable product
 - 4- Add perishable product
 - 5- Add to quantity of purchased products
 - 0- Exit program
- > 3

Sku: 1234
Name: Tent
Unit:
Taxed? (y/n): y
Price: 120.33
Quantity On hand: 20

Quantity Needed: **200**

Product added

Disaster Aid Supply Management Program

- 1- List products
 - 2- Display product
 - 3- Add non-perishable product
 - 4- Add perishable product
 - 5- Add to quantity of purchased products
 - 0- Exit program
- > **4**

Sku: **2345**

Name: **Flu Vaccine**

Unit: **Boxes**

Taxed? (y/n): **n**

Price: **12.34**

Quantity On hand: **0**

Quantity Needed: **5000**

Expiry date (YYYY/MM/DD): **2018/12/12**

Product added

Disaster Aid Supply Management Program

- 1- List products
 - 2- Display product
 - 3- Add non-perishable product
 - 4- Add perishable product
 - 5- Add to quantity of purchased products
 - 0- Exit program
- > **1**

Row	SKU	Product Name	Cost	QTY	Unit	Need	Expiry
1	132	Banana	0.99	6	Kilos	10	2015/05/13
2	122	Bucket	11.30	150		300	
3	124	Corn	4.00	0	Packs	140	2018/04/03
4	200	Sand Bags	3.38	20	packs	1000	
5	5678	Sugar	6.78	0	1kg Bags	200	
6	111	Water Container	12.79	500	packs	5000	
7	1111	Milk	3.99	10	bag	100	2017/09/20
8	1234	Tent	135.97	20		200	
9	2345	Flu Vaccine	12.34	0	Boxes	5000	2018/12/12

Total cost of support: \$10923.67

Press Enter to continue...

Disaster Aid Supply Management Program

- 1- List products
 - 2- Display product
 - 3- Add non-perishable product
 - 4- Add perishable product
 - 5- Add to quantity of purchased products
 - 0- Exit program
- > **5**

Please enter the SKU: **1234**

Sku: 1234
 Name: Tent
 Price: 120.33
 Price after tax: 135.97
 Quantity On Hand: 20
 Quantity Needed: 200

Please enter the number of purchased items: **100**

Updated!

Disaster Aid Supply Management Program

- 1- List products
- 2- Display product
- 3- Add non-perishable product
- 4- Add perishable product
- 5- Add to quantity of purchased products
- 0- Exit program

> **1**

Row	SKU	Product Name	Cost	QTY	Unit	Need	Expiry
1	132	Banana	0.99	6	Kilos	10	2015/05/13
2	122	Bucket	11.30	150		300	
3	124	Corn	4.00	0	Packs	140	2018/04/03
4	200	Sand Bags	3.38	20	packs	1000	
5	5678	Sugar	6.78	0	1kg Bags	200	
6	111	Water Container	12.79	500	packs	5000	
7	1111	Milk	3.99	10	bag	100	2017/09/20
8	1234	Tent	135.97	120		200	
9	2345	Flu Vaccine	12.34	0	Boxes	5000	2018/12/12

 Total cost of support: \$24520.96

Press Enter to continue...

Disaster Aid Supply Management Program

- 1- List products
- 2- Display product
- 3- Add non-perishable product
- 4- Add perishable product
- 5- Add to quantity of purchased products
- 0- Exit program

> **0**

Goodbye!!

LONG SUBMISSION:

If not on matrix already, upload your project files and [comments.txt](#) to your matrix account. Compile your code as follows:

```
> g++ -Wall -std=c++0x -o fp Date.cpp Error.cpp Item.cpp
  NonPerishable.cpp Perishable.cpp PosApp.cpp PosAppMain.cpp<ENTER>
```

This command will compile your code and name your executable "fp"

Execute `fp` and make sure everything works properly.

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

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

and run your application using the **RED underlined bold *italic*** values in the short output section below.

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.

Disaster Aid Supply Management Program

```
1- List products
2- Display product
3- Add non-perishable product
4- Add perishable product
5- Add to quantity of purchased products
0- Exit program
> 1
```

Row	SKU	Product Name	Cost	QTY	Unit	Need	Expiry
1	132	Banana	0.99	6	Kilos	10	2015/05/13
2	122	Bucket	11.30	150		300	
3	124	Corn	4.00	0	Packs	140	2018/04/03
4	200	Sand Bags	3.38	20	packs	1000	
5	5678	Sugar	6.78	0	1kg Bags	200	
6	111	Water Container	12.79	500	packs	5000	
7	1111	Milk	3.99	10	bag	100	2017/09/20

Total cost of support: \$8204.21

Press Enter to continue...

Disaster Aid Supply Management Program

```
1- List products
2- Display product
3- Add non-perishable product
4- Add perishable product
5- Add to quantity of purchased products
0- Exit program
> -1
```

===Invalid Selection, try again.===

Press Enter to continue...

Disaster Aid Supply Management Program

```
1- List products
2- Display product
3- Add non-perishable product
4- Add perishable product
5- Add to quantity of purchased products
0- Exit program
> 6
```

```
===Invalid Selection, try again.===
Press Enter to continue...
```

```
Disaster Aid Supply Management Program
1- List products
2- Display product
3- Add non-perishable product
4- Add perishable product
5- Add to quantity of purchased products
0- Exit program
> 2
```

Please enter the SKU: **abc**

```
Not found!
Disaster Aid Supply Management Program
1- List products
2- Display product
3- Add non-perishable product
4- Add perishable product
5- Add to quantity of purchased products
0- Exit program
> 2
```

Please enter the SKU: **132**

```
Sku: 132
Name: Banana
Price: 0.99
Price after tax: N/A
Quantity On Hand: 6 Kilos
Quantity Needed: 10
Expiry date: 2015/05/13
```

Press Enter to continue...

```
Disaster Aid Supply Management Program
1- List products
2- Display product
3- Add non-perishable product
4- Add perishable product
5- Add to quantity of purchased products
0- Exit program
> 2
```

Please enter the SKU: **1111**

```
Sku: 1111
Name: Milk
Price: 3.99
Price after tax: N/A
```

Quantity On Hand: 10 bag
 Quantity Needed: 100
 Expiry date: 2017/09/20

Press Enter to continue...

Disaster Aid Supply Management Program

- 1- List products
 - 2- Display product
 - 3- Add non-perishable product
 - 4- Add perishable product
 - 5- Add to quantity of purchased products
 - 0- Exit program
- > 3

Sku: 1234
 Name: Tent
 Unit:
 Taxed? (y/n): y
 Price: 120.33
 Quantity On hand: 20
 Quantity Needed: 200

Product added

Disaster Aid Supply Management Program

- 1- List products
 - 2- Display product
 - 3- Add non-perishable product
 - 4- Add perishable product
 - 5- Add to quantity of purchased products
 - 0- Exit program
- > 1

Row	SKU	Product Name	Cost	QTY	Unit	Need	Expiry
1	132	Banana	0.99	6	Kilos	10	2015/05/13
2	122	Bucket	11.30	150		300	
3	124	Corn	4.00	0	Packs	140	2018/04/03
4	200	Sand Bags	3.38	20	packs	1000	
5	5678	Sugar	6.78	0	1kg Bags	200	
6	111	Water Container	12.79	500	packs	5000	
7	1111	Milk	3.99	10	bag	100	2017/09/20
8	1234	Tent	135.97	20		200	

 Total cost of support: \$10923.67

Press Enter to continue...

Disaster Aid Supply Management Program

- 1- List products
 - 2- Display product
 - 3- Add non-perishable product
 - 4- Add perishable product
 - 5- Add to quantity of purchased products
 - 0- Exit program
- > 4

Sku: a

Name: a
 Unit: a
 Taxed? (y/n): a
 Only (Y)es or (N)o are acceptable

Disaster Aid Supply Management Program
 1- List products
 2- Display product
 3- Add non-perishable product
 4- Add perishable product
 5- Add to quantity of purchased products
 0- Exit program
 > 4

Sku: a
 Name: a
 Unit: a
 Taxed? (y/n): y
 Price: a
 Invalid Price Entry

Disaster Aid Supply Management Program
 1- List products
 2- Display product
 3- Add non-perishable product
 4- Add perishable product
 5- Add to quantity of purchased products
 0- Exit program
 > 4

Sku: a
 Name: a
 Unit: a
 Taxed? (y/n): y
 Price: 1
 Quantity On hand: a
 Invalid Quantity Entry

Disaster Aid Supply Management Program
 1- List products
 2- Display product
 3- Add non-perishable product
 4- Add perishable product
 5- Add to quantity of purchased products
 0- Exit program
 > 4

Sku: a
 Name: a
 Unit: a
 Taxed? (y/n): y
 Price: 1
 Quantity On hand: 1
 Quantity Needed: a
 Invalid Quantity Needed Entry

Disaster Aid Supply Management Program
 1- List products
 2- Display product

3- Add non-perishable product
 4- Add perishable product
 5- Add to quantity of purchased products
 0- Exit program
 > 4

Sku: a
 Name: a
 Unit: a
 Taxed? (y/n): y
 Price: 1
 Quantity On hand: 1
 Quantity Needed: 1
 Expiry date (YYYY/MM/DD): 12/12/12
 Invalid Year in Date Entry

Disaster Aid Supply Management Program
 1- List products
 2- Display product
 3- Add non-perishable product
 4- Add perishable product
 5- Add to quantity of purchased products
 0- Exit program
 > 4

Sku: a
 Name: a
 Unit: a
 Taxed? (y/n): y
 Price: 1
 Quantity On hand: 1
 Quantity Needed: 1
 Expiry date (YYYY/MM/DD): 2010/13/10
 Invalid Month in Date Entry

Disaster Aid Supply Management Program
 1- List products
 2- Display product
 3- Add non-perishable product
 4- Add perishable product
 5- Add to quantity of purchased products
 0- Exit program
 > 4

Sku: a
 Name: a
 Unit: a
 Taxed? (y/n): y
 Price: 1
 Quantity On hand: 1
 Quantity Needed: 1
 Expiry date (YYYY/MM/DD): 2010/10/100
 Invalid Day in Date Entry

Disaster Aid Supply Management Program
 1- List products
 2- Display product
 3- Add non-perishable product
 4- Add perishable product

5- Add to quantity of purchased products
 0- Exit program
 > 4

Sku: 2345
 Name: Flu Vaccine
 Unit: Boxes
 Taxed? (y/n): n
 Price: 12.34
 Quantity On hand: 0
 Quantity Needed: 5000
 Expiry date (YYYY/MM/DD): 2018/12/12

Product added

Disaster Aid Supply Management Program

1- List products
 2- Display product
 3- Add non-perishable product
 4- Add perishable product
 5- Add to quantity of purchased products
 0- Exit program
 > 1

Row	SKU	Product Name	Cost	QTY	Unit	Need	Expiry
1	132	Banana	0.99	6	Kilos	10	2015/05/13
2	122	Bucket	11.30	150		300	
3	124	Corn	4.00	0	Packs	140	2018/04/03
4	200	Sand Bags	3.38	20	packs	1000	
5	5678	Sugar	6.78	0	1kg Bags	200	
6	111	Water Container	12.79	500	packs	5000	
7	1111	Milk	3.99	10	bag	100	2017/09/20
8	1234	Tent	135.97	20		200	
9	2345	Flu Vaccine	12.34	0	Boxes	5000	2018/12/12

 Total cost of support: \$10923.67

Press Enter to continue...

Disaster Aid Supply Management Program

1- List products
 2- Display product
 3- Add non-perishable product
 4- Add perishable product
 5- Add to quantity of purchased products
 0- Exit program
 > 5

Please enter the SKU: 1234

Sku: 1234
 Name: Tent
 Price: 120.33
 Price after tax: 135.97
 Quantity On Hand: 20
 Quantity Needed: 200

Please enter the number of purchased items: 100

Updated!

Disaster Aid Supply Management Program

- 1- List products
 - 2- Display product
 - 3- Add non-perishable product
 - 4- Add perishable product
 - 5- Add to quantity of purchased products
 - 0- Exit program
- > 1

Row	SKU	Product Name	Cost	QTY	Unit	Need	Expiry
1	132	Banana	0.99	6	Kilos	10	2015/05/13
2	122	Bucket	11.30	150		300	
3	124	Corn	4.00	0	Packs	140	2018/04/03
4	200	Sand Bags	3.38	20	packs	1000	
5	5678	Sugar	6.78	0	1kg Bags	200	
6	111	Water Container	12.79	500	packs	5000	
7	1111	Milk	3.99	10	bag	100	2017/09/20
8	1234	Tent	135.97	120		200	
9	2345	Flu Vaccine	12.34	0	Boxes	5000	2018/12/12

Total cost of support: \$24520.96

Press Enter to continue...

Disaster Aid Supply Management Program

- 1- List products
 - 2- Display product
 - 3- Add non-perishable product
 - 4- Add perishable product
 - 5- Add to quantity of purchased products
 - 0- Exit program
- > 0

Goodbye!!

OPEN SUBMISSION:

In “**comments.txt**”, explain why you have chosen the open submission rather than one of the other two.

If not on matrix already, upload your project files and **comments.txt** to your matrix account. Compile your code as follows:

```
> g++ -Wall -std=c++0x -o fp Date.cpp Error.cpp Item.cpp
NonPerishable.cpp Perishable.cpp PosApp.cpp PosAppMain.cpp<ENTER>
```

This command will compile your code and name your executable “**fp**”

Execute **fp** and make sure everything works properly.

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

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

and run your application using the **RED underlined bold *italic*** values in the ***long output section*** above.

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.