Adventure

Credit: Eric Roberts

INTRODUCTION

Your mission in this assignment is to write a simple text-based adventure game in the tradition of Will Crowther's pioneering "Adventure" program of the early 1970s. In games of this sort, the player wanders around from one location to another, picking up objects, and solving simple puzzles. The program you will create for this assignment is considerably less elaborate than Crowther's original game and it therefore limited in terms of the type of puzzles one can construct for it. Even so, you can still write a program that captures much of the spirit and flavor of the original game.

Because this assignment is large and detailed, it takes quite a bit of writing to describe it all. This handout contains everything you need to complete the assignment, along with a considerable number of hints and strategic suggestions. To make it easier to read, the document is divided into the following sections:

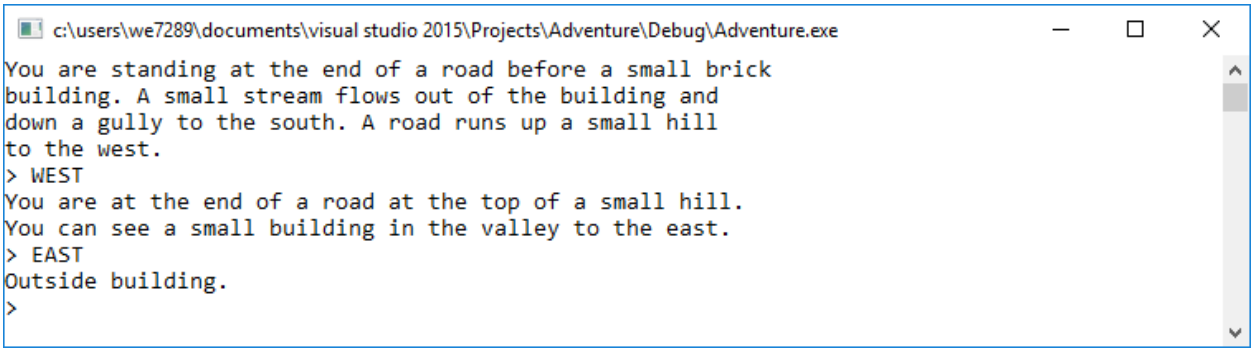
Overview of the adventure game

1. Overview of Adventure
2. The Adventure class
3. The AdvRoom and AdvMotionTableEntry classes
4. The AdvObject class
5. Implementing the adventure game
6. Strategy and tactics
7. Milestones

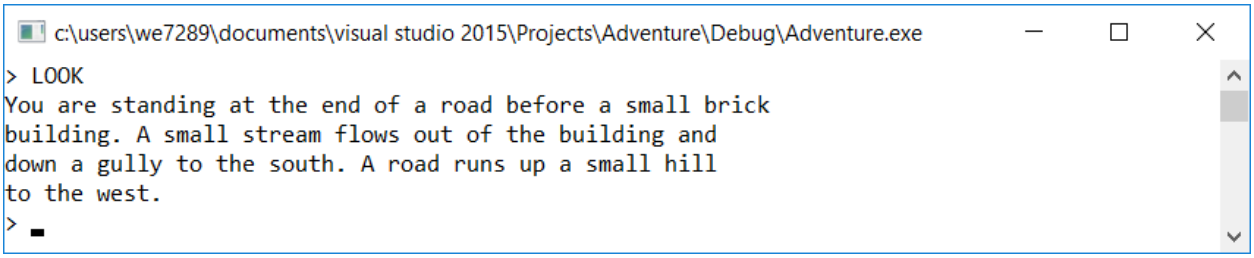
Try not to be daunted by the size of this handout. The code is not as big as you might think. If you start early and follow the suggestions in the "Strategy and tactics" section, things should work out well.

Section 1: Overview of Adventure

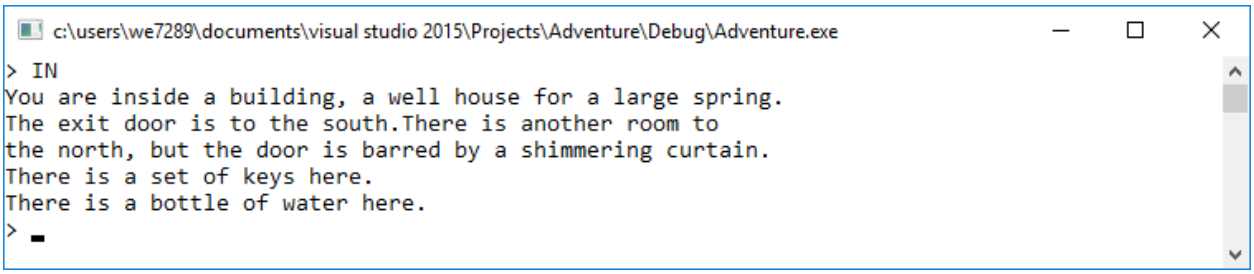
The adventure game you will implement for this assignment takes place in a virtual world in which you, as the player, move about from one location to another. The locations, which are traditionally called "rooms" even though they may be outside, are described to you through a written textual description that gives you a sense of the geography. You move about in the game by giving commands, most of which are simply an indication of the direction of motion. For example, in the classic adventure game developed by Willie Crowther, you might move about as follows:



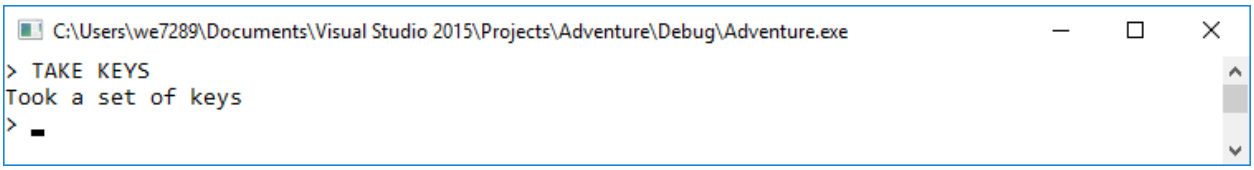
In this example, you started outside the building, followed the road up the hill by typing WEST, and arrived at a new room on the top of the hill. Having no obvious places to go once you got there, you went back toward the east and ended up outside the building again. As is typical in such games, the complete description of a location appears only the first time you enter it; the second time you come to the building, the program displays a much shorter identifying tag, although you can get the complete description by typing LOOK, as follows:



From here, you might choose to go inside the building by typing IN, which brings you to another room, as follows:



In addition to the new room description, the inside of the building reveals that the adventure game also contains objects: there is a set of keys here. You can pick up the keys by using the TAKE command, which requires that you specify what object you're taking, like this:



OVERVIEW OF THE DATA FILES

The adventure program you will create for this assignment is entirely data driven. The program itself doesn't know the details of the game geography, the objects that are distributed among the various rooms, or even the words used to move from place to place. All such information is supplied in the form of data files, which the program uses to control its own operation. If you run the program with different data files, the same program will guide its players through different adventure games.

To indicate which data files you would like to use, the adventure program begins by asking you for the name of an adventure. To get the adventure game illustrated above, you would begin by typing Crowther, which selects the collection of files associated with a relatively sizable subset of Will Crowther's original adventure game. For each adventure, there are three associated data files that contain the name of the adventure as a prefix. For the **`Crowther`** adventure, for example, these files are

- **CrowtherRooms.txt**, which defines the rooms and the connections between them. In these examples, you have visited three rooms: outside of the building, the top of the hill, and the inside of the well house.
- **CrowtherObjects.txt**, which specifies the descriptions and initial locations of the objects in the game, such as the set of keys.
- **CrowtherSynonyms.txt**, which defines several words as synonyms of other words so you can use the game more easily. For example, the compass points **N**, **E**, **S**, and **W** are defined to be equivalent to **NORTH**, **EAST**, **SOUTH**, and **WEST**. Similarly, if it makes sense to refer to an object by more than one word, this file can define the two as synonyms. As you explore the Crowther cave, for example, you will encounter a gold nugget, and it makes sense to allow players to refer to that object using either of the words **GOLD** or **NUGGET**.

These data files are not programs, but are instead text files that describe the structure of a particular adventure game in a form that is easy for game designers to write. The adventure program reads these files into an internal data structure, which it then uses to guide the player through the game.

Your program must be able to work with any set of data files that adhere to the rules outlined in this handout. In addition to the three files with the **`Crowther`** prefix, the starter folder also contains file named **`TinyRooms.txt`** that contains only three rooms with no objects and no synonyms and a set of three files with the prefix **`Small`** that define a much smaller part of the **`Crowther`** cave. Your program should work correctly with any of these files, as well as other adventure games that you design yourself.

The detailed structure of each data file is described later in this handout in conjunction with the description of the module that processes that particular type of data. For example, the rooms data file is described in conjunction with the **`AdvRoom`** class.

OVERVIEW OF THE CLASS STRUCTURE

The adventure game is divided into the following principal classes:

- **`Adventure`** - This class and is by far the largest module in the assignment. This class is yours to write, but the public methods are specified in the starter files.
- **`AdvRoom`** - This class represents a single room in the cave. This class is also yours to write. The private methods that decompose parts of the operation are yours to design, but the specification of the public methods used to communicate with other modules is specified. This class is closely linked with the **`AdvMotionTableEntry`** class, which is described in the same section. That class is provided as part of the starter project.
- **`AdvObject`** - This class represents one of the objects in the cave. As with the **`AdvRoom`** class, you have to implement this class although the public methods are specified.
- **`AdvMotionTableEntry`** - This class defines a record type that combines a direction of travel, the room one reaches by moving in that direction, and an optional object that enables the motion. The definition of this class is extremely simple and is provided in the starter project.

The structure of each of these classes is described in detail in one of the sections that follow.

Even though the code for these components is substantial, your job is made easier since most of the methods used to communicate among the classes have already been designed for you. The public methods in the **`AdvRoom`** and **`AdvObject`** classes are completely specified; all you need to do is implement them.

Section 2: The Adventure Class

The main program class is called Adventure and will contain most of the code you have to write for this assignment. This class is in charge of the following:

- opening the data files
- assembling the data structures,
- maintaining the list of words known by the game
- interacting with the user
- implementing the various commands

For the most part, you will have the opportunity to figure out how to decompose the entire operation into reasonably-sized pieces and for choosing what data structures and methods to use in the underlying implementation. The below is the header file for the Adventure class.

```
class Adventure
{

public:
	// No other public functions are needed.
	Adventure();
	Adventure(string objfile, string rmfile, string cmdfile);
	void Play();

private:
	// Loading functions
	void LoadObjects(string filename);
	void LoadRooms(string filename);
	void LoadSynonyms(string filename);

	// You should will need additional commands
	// other than the quit, help, and move commands.
	// Some of the commands should take arguments.
	// For some it may be helpful to return values.
	// You should only make functions for built-in commands.
	// For example, you should NOT make one for WAVE.
	void GetUserCmd(string &verb, string &obj);
	void QuitCmd();
	void HelpCmd();
	int MotionCmd(string motionName);


	// You will need some attributes to keep
	// track what room the player is currently in
	// and what objects are currently being held.

	// You should have some methods to help you
	// print the room and objects.

	// You will also need attributes to store
	// objects and rooms.

	struct Synonym {
		string word;
		string synonym;
	};
	vector<Synonym> synonyms;
	string GetSynonym(string str);
};
```

This class contains only one public method, which is the play method. It has the following responsibilities:

1. Read in the data files for the game into an internal data structure
2. Play the game by reading and executing commands entered by the user

Understanding how to implement these aspects of the game, however, requires you to learn more about the **`AdvRoom`** and **`AdvObject`** classes, which are described in the next two sections. Section 5 then returns to the question of how to implement the Adventure class, which represents the lion's share of the assignment.

Section 3: AdvRoom and AdvMotionTableEntry

The **AdvRoom** class represents an individual room in the cave. Each room in the cave is characterized by the following properties:

- A room number, which must be greater than zero
- Its name, which is a one-line string identifying the room
- Its description, which is a multiline array describing the room
- A list of objects contained in the room
- A flag indicating whether the room has been visited
- A motion table specifying the exits and where they lead

The **AdvRoom** stores this information in its private data structure and then makes that information available to clients through the public methods of the class. These methods are listed in the starter files. The following is the header file:

```
class AdvRoom
{
public:
	AdvRoom();
	bool readRoom(ifstream &roomFile);    // Reads room data from an open file. Returns true if successful.

	vector<string> getDescription();      // Return the room description.
	string getName();                     // Returns the room name.

	void addObject(AdvObject obj);            // Adds an object to the room.
	AdvObject removeObject(string objName);   // Removes an object with name objName and returns the object.
	AdvObject getObject(int index);           // Returns object index from the room.
	int objectCount();                        // Returns how many objects are in the room.
	bool containsObject(string objName);      // Return true if the room contains an object with objName.


	bool hasBeenVisited();             // Returns true if the room has been visited. False otherwise.
	void setVisited(bool flag);        // Sets if the room has been visited.

	vector<AdvMotionTableEntry> getMotionTable();    // Returns a motion table for the room.
	int getRoomNumber();                             // Returns the room number.

private:
	// Put the room properties here.

};
```

THE ROOMS DATA FILE

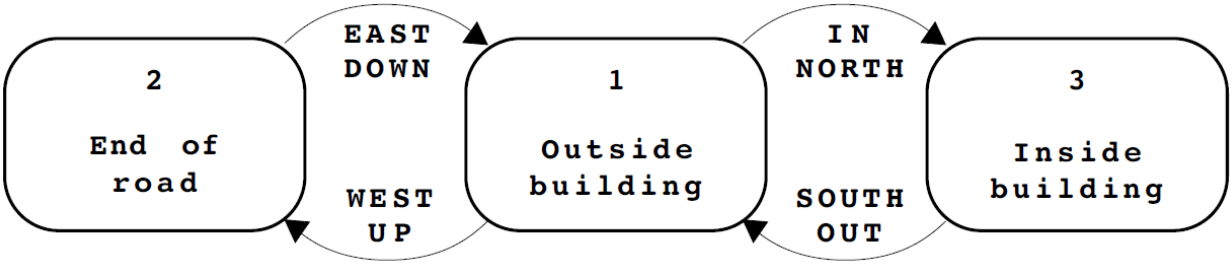
The information for the individual rooms is not part of the program but is instead stored in a data file. One of your responsibilities in completing the implementation of the **AdvRoom** class is to write the method **readRoom(roomFile)**, which creates a new **AdvRoom** object by reading that description from the rooms file for that adventure. For example, **TinyRooms.txt** looks like this:

```
1
Outside building
You are standing at the end of a road before a small brick
building. A small stream flows out of the building and
down a gully to the south. A road runs up a small hill
to the west.
-----
WEST 2
UP 2
NORTH 3
IN 3

2
End of road
You are at the end of a road at the top of a small hill.
You can see a small building in the valley to the east.
-----
EAST 1
DOWN 1

3
Inside building
You are inside a building, a well house for a large spring.
-----
SOUTH 1
OUT 1
```

In thinking about an adventure game - particularly as the player, but also as the implementer - it is important to recognize that the directions are not as well behaved as you might like. There is no guarantee that if you move from one room to another by moving north, you will be able to get back by going south. The best way to visualize the geographic structure of an adventure game is as a collection of rooms with labeled arrows that move from one room to another, as illustrated by the following diagram of the connections defined in **`TinyRooms.txt`**:



The connections in this graph are modeled using the **`AdvMotionTableEntry`** class, which is described in a subsequent section.

EXTENSIONS TO THE CONNECTION STRUCTURE

If the adventure program allowed nothing more than rooms and descriptions, the games would be extremely boring because it would be impossible to specify any interesting puzzles. For this assignment, you are required to make the following extensions to the data structure that provide a basis for designing simple puzzles that nonetheless add significant interest to the game:

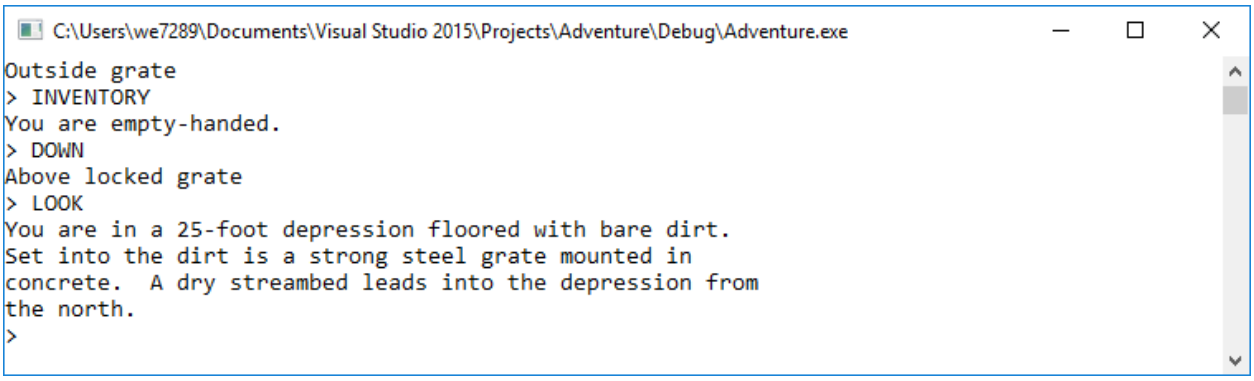
• *Locked passages.* The connection data structure must allow the game designer to indicate that a particular connection is available only if the player is carrying a particular object. That object then becomes the key to an otherwise locked passage. In the file format, such locked passages are specified by adding a slash and the name of an object after a room number.

• *Forced motion.* If the player ever enters a room in which one of the connections is associated with the motion verb **FORCED**, the program should display the long description of that room and then immediately move the player to the specified destination without waiting for the user to enter a command. This feature makes it possible to display a message to the player and is in fact identical to the design that Willie Crowther adopted in his original adventure game.

Both of these features are illustrated by the segment of the **SmallRooms.txt** data file shown in at the bottom of this page. If the player is in room 6, and tries to go down, the following two lines in the connection list come into play:

```
DOWN        8 KEYS
DOWN        7
```

The first line is active only if the player is carrying the keys. In this case, the player moves into room 8 which is the beginning of the underground portion of the cave. If not, the **DOWN** command takes the user to room 7. Because the motion entries include the verb **FORCED**, the program prints out the long description for room 7 and then moves the player back to room 6, as shown in the following sample run:




```
6
Outside grate
You are in a 25-foot depression floored with bare dirt.
Set into the dirt is a strong steel grate mounted in
concrete. A dry streambed leads into the depression from
the north.
-----
NORTH 5
UP 5
DOWN 8 KEYS
DOWN 7

7
Above locked grate
The grate is locked and you don't have any keys.
-----
FORCED 6

8
Beneath grate
You are in a small chamber beneath a 3x3 steel grate to
the surface. A low crawl over cobbles leads inward to
the west.
-----
UP 6
OUT 6
IN 9
WEST 9
```

It is possible for a single room to use both the locked passage and forced motion options. The **`CrowtherRooms.txt`** file, for example, contains the following entry for the room just north of the curtain in the building:

```
70
Curtain1
-----
FORCED 71 NUGGET
FORCED 76
```

The effect of this set of motion rules is to force the user to room 71 if that user is carrying the nugget and to room 76 otherwise. When you are testing your code for locked and forced passages, you might want to pay particular attention to the rooms in the **`CrowtherRooms.txt`** that implement the shimmering curtain that marks the end of the game.

THE ADVMOTIONTABLEENTRY CLASS

There are several possible strategies one might have chosen to represent the table of connections in each room to its neighbors. In this assignment, you should store the room connections as a vector of objects each of which is an instance of the class **`AdvMotionTableEntry`**. The complete definition of this class is included with the starter file. You could easily have designed this class yourself, but its implementation is so simple that doing so would not have helped you learn anything important. Because the class appears as the result type of a public method, it seemed easier simply to provide it to you directly.

Section 4: The AdvObject Class

The **AdvObject** class keeps track of the information about an object in the game. The amount of information you need to maintain for a given object is considerably less than you need for rooms, which makes both the internal structure and its external representation as a data file much simpler. The entries in the object file consist of three lines indicating the word used to refer to the object, the description of the object that appears when you encounter it, and the room number in which the object is initially located. For example, the data file **SmallObjects.txt** looks like this:

```
KEYS
a set of keys
3

LAMP
a brightly shining brass lamp
8

ROD
a black rod with a rusty star
12
```

This file indicates that the keys start out in room 3 (inside the building), the lamp initially resides in room 8 (beneath the grating), and the rod can be found in room 12 (the debris room). The entries in the file may be separated with blank lines for readability, as these are here; your implementation should work equally well if these blank lines are omitted.

The objects, of course, will move around in the game as the player picks them up or drops them. Your implementation must therefore provide a facility for storing objects in a room or in the user's inventory of objects. The easiest approach is to use a **vector**, which makes it easy to add and remove objects using the **push_back** and **pop_back** functions. To remove an element from somewhere in the middle of a list, you can swap the element with the back element and then pop the back element.

The header file for the **AdvObject** class appears below. The implementation of these methods should be quite straightforward, particularly in comparison to those in the **AdvRoom** class, which is significantly more complicated.

```
#include <string>
#include <iostream>
#include <sstream>
#include <vector>
#include <fstream>
using namespace std;

class AdvObject
{
public:
	AdvObject();
	AdvObject(string objName, string objDes, int loc);
	bool readObject(ifstream &objFile);

	string getName();
	string getDescription();
	int getInitialLocation();

private:
	// Add your private variables here...

};
```

Section 5: Implementing the Adventure Game

As noted in the introduction to this assignment, implementing the **Adventure** class represents the lion's share of the work. Before you start in on the code, it will simplify your life considerably if you spend some time thinking about the data structures you need and what the overall decomposition looks like.

The **play** method for the **Adventure** class must execute each of the following steps:

1. Read data files for the game into an internal data structure
2. Play the game by reading and executing commands entered by the user

READING IN THE DATA FILES

Once you have the name of the adventure, the next phase in the program is to read in the data files that contain all the information necessary to play the game. As noted in the section entitled "Overview of the data files" on page 3, every adventure game is associated with three text files whose names begin with the adventure name. For example, if the adventure name is **Crowther**, these files are named **CrowtherRooms.txt**, **CrowtherObjects.txt**, and **CrowtherSynonyms.txt**. The formats of the first two files have already been described in the discussion of the **AdvRoom** and **AdvObject** classes.

Each of those classes, moreover, includes a method that reads the data for one room or one object from an **ifstream**. All the **Adventure** class has to do, therefore, is

1. Open the appropriate file to obtain the **ifstream** object.
2. Create an empty data structure for the rooms or objects, as appropriate.
3. Call **AdvRoom.readRoom** or **AdvObject.readObject** to read in a new value.
4. Add the new room or object to their respective vectors.
5. Repeat steps 3 and 4 until **readRoom** or **readObject** returns **false**.
6. Close the file.

The rooms file must be present in every adventure, and your program should print an appropriate error message if that file is missing. If the objects file is missing—as it is for the **Tiny** adventure—your program should simply assume that there are no objects.

The only file whose format you haven't seen is the synonyms file, which is used to define abbreviations for commands and synonyms for the existing objects. The synonym file consists of a list of lines in which one word is defined to be equal to another. The **CrowtherSynonyms.txt** file shows that you can abbreviate the **INVENTORY** command to **I** or the **NORTH** command to **N**. Similarly, the user can type **GOLD** to refer to the object defined in the object file as **NUGGET**. As with the objects file, the synonyms file is optional. If it doesn't exist, your program should simply assume that there are no synonyms.

Each line of the synonyms file consists of two strings separated by a space. You can separate the string into its component pieces in any of a number of ways. A data structure is provided for you to store a word and its associated synonym.

EXECUTING COMMANDS

Once you have read in the data, you then need to play the game. The user by default will always start in room 1 and then move around from room to room by entering commands on the console. The process or reading a command consists of the following steps:

1. Get a line from the user.

2. Break the line up into a verb representing the action and an object (if specified) indicating the target of that action. In the game you have to write, the object is relevant only for the **TAKE** and **DROP** commands, but your extensions might add other verbs that take objects as well. In this phase, you should make sure to convert the words to uppercase and check the synonyms table to ensure that you're working with the canonical form of each word. For example, if the user enters the line

   ```
   > release gold
   ```

   your program should decide that the verb is **DROP** and the object is **NUGGET**. Having a dedicated method for this job is recommended.

3. Decide what kind of operation the verb represents. If the word appears in the motion table for some room, then it is a motion verb. In that case, you need to look it up in the motion table for the current room and see if it leads anywhere from the current room. If it isn't a motion verb, the only legal possibilities (outside of any extensions you write) is that it is one of the six built-in action verbs: **QUIT**, **HELP**, **LOOK**, **INVENTORY**, **TAKE**, and **DROP**. In you have an action verb, you have to call a method that implements the appropriate action, as outlined in the following section. In any other case, you need to tell the user that you don't understand that word.

An easy way to implement this is a cascading **if** statement that first checks if the verb is **"QUIT"**, then checks to see if it's **"HELP"**, and so on.

QUIT This command signals the end of the game. Your program should stop reading commands and exit from the **`run`** method.

HELP This command should print instructions for the game on the console. You need not duplicate the instructions from the stub implementation exactly, but you should certainly give users an idea of how your game is played. If you make any extensions, you should describe them in the output of your **HELP** command so that we can easily see what exciting things we should look for.

INVENTORY This command should list what objects the user is holding. If the user is holding no objects, your program should say so with a message along the lines of "You are empty-handed."

LOOK This command should type the complete description of the room and its contents, even if the user has already visited the room.

TAKE *obj* This command requires a direct object and has the effect of taking the object out of the room and adding it to the set of objects the user is carrying. You need to check to make sure that the object is actually in the room before you let the user take it.

DROP *obj* This command requires a direct object and has the effect of removing the object from the set of objects the user is carrying and adding it back to the list of objects in the room. You need to check to make sure that the user is carrying the object.

Section 6: Strategy and Tactics

Even though the adventure program is big, the good news is that you do not have to start from scratch. You instead get to start with a complete program that solves the entire assignment because each of the classes you need to write is implemented as a subclass of a library stub that performs all of the necessary functions. Your job is simply to replace all of the stubs with code of your own.

The following suggestions should enable you to complete the program with relatively little trouble:

- *Start as soon as possible!!!!*

- *The deadlines are bare minimum targets in order to finish on time.* You have the entire assignment and there is nothing preventing you from moving onto the next parts once you are done with a milestone. Ideally, you finish early and maybe complete a few extra credit extensions.

- *Get each class working before you start writing the next one.* Work on the classes one at a time, and debug each one thoroughly before moving on to the next. My suggestion is to start with **`AdvObject`** and **`AdvRoom`**, and then to move on to the more difficult implementation of **`Adventure`** itself.

- *Use the smaller data files for most of your testing.* Don't try to test your code on the **`Crowther`** data files. These files take time to read in and are complicated only because of their scale. The **`Tiny`** data files are appropriate for the basic functionality, and the **`Small`** data files have examples of every required feature. When you finish your implementation, it makes sense to try the larger data files just to make sure everything continues to work in the larger context.

Section 7: Milestones

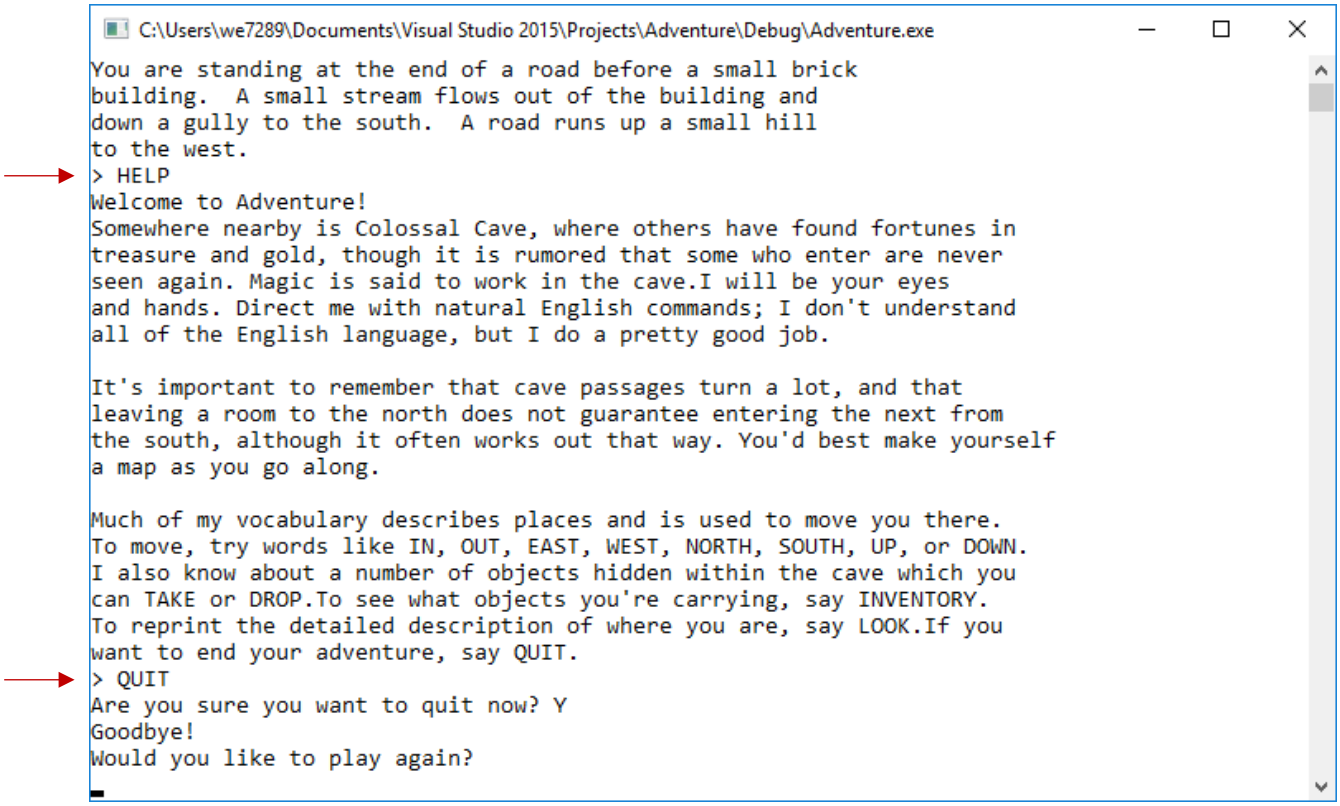
PART A

- Complete AdvObject
- Complete AdvRoom
- Complete the load functions in the Adventure class. (HINT: look at the debug functions)
- Complete the Constructors for the Adventure class.

There are some debugging methods provided for you to test these classes.

PART B

- Complete the GetUserCmd method
- Initialize the player to stand in the first room and have user input possible. You should have at a minimum the HELP, QUIT, and LOOK commands usable:



PART C

The full program should be functional for part C. I suggest completing the following order for tasks:

- Movement/Verbs in the room (i.e. EAST, SOUTH, WHISTLE, etc).
- INVENTORY command
- Picking up objects/Dropping objects
- Checking for Synonyms