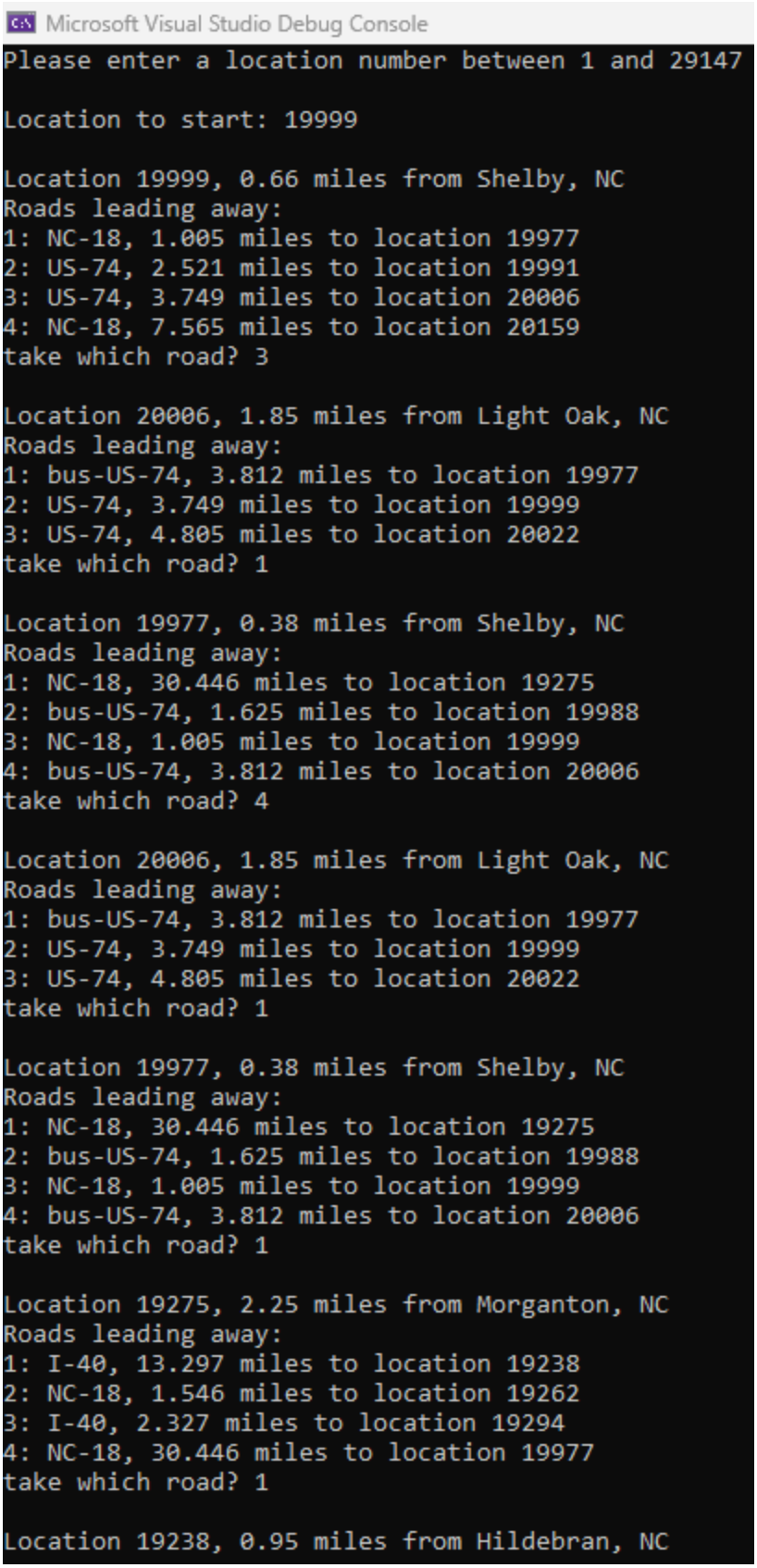
```cpp
#include <iostream>
#include <fstream>
#include <string>
#include <vector>

using namespace std;

//LOCATION:
//designing "location" such that the first intersection created is called location 1
//this is so that each location (which will be a node with different connections
branching from it) is stored in a vector with its location number corresponding to
//its position in the vector. This is so the user can specify any location to start
with and the program can access that location from memory.
//location in the program is just another term for an intersection, the user will
only see "location #" and not the intersection data itself

//NODES:
//each node will represent a single location where it will store the location number
and the information for structs "connection" and "intersection".
//each node will only contain one "intersection" and at least one "connection"

//CREATING NODES:
//a node will be created after reading a line from the connections.txt file
//each line will provide all the necessary information for the struct "connection"
as well as the location of two intersections in the intersections.txt file
//once a line is read the program will retrieve the information from the
intersections.txt file and store them in the struct "intersection"

int LOCATION_TOTAL = 0; //used and manipulated in readInterToGraph function,
                                        //if that function is used more than once,
this global variable wouldnt be reset and the
                                        //variable node.number will continue from
where LOCATION_TOTAL left off
ifstream conIN, interIN;
struct connection {
	string name, code;
	int isecA, isecB; //intersection A and B
	double length; //in miles
	connection(string n, string c, int a, int b, double l) {
		name = n;
		code = c;
		isecA = a;
		isecB = b;
		length = l;
	}
};
struct intersection {
	string state, name; //nearest named place name and state
	double lon, lat, dist; // distance from nearest named place
	intersection(string st, string na, double lo, double la, double dis) {
		state = st;
		name = na;
		lon = lo;
		lat = la;
		dist = dis;
	}
};
struct node {//equivalent to location
```

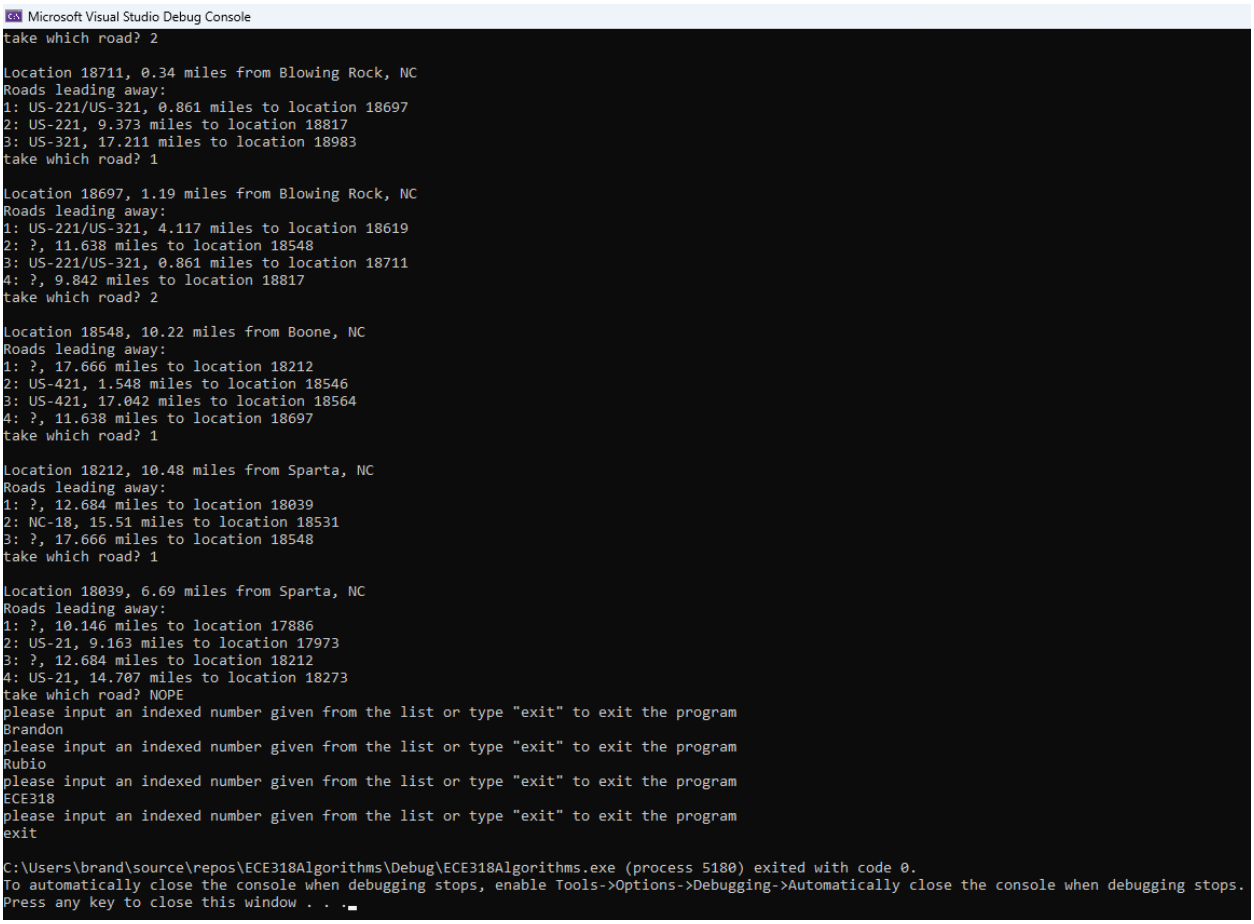
```
	vector<connection*> v_conn_data;
	vector<node*> connects_to;
	intersection* inter_data;
	int number;
	node(intersection* inter, int num) {
		inter_data = inter;
		number = num;
	}
};
struct graph {
	vector<node*> v_nodes;
};
void readInterToGraph(graph& g) {
	interIN.open("intersections.txt");
	if (interIN.fail()) {
		cout << "unable to open intersections.txt" << endl;
		exit(1);
	}

	string s, n; double lo, la, d;
	string name; node* nptr; intersection* iptr;

	while (!interIN.fail()) {
		interIN >> lo >> la >> d >> s;
		getline(interIN, name);
		name.erase(0, 1); //removes space from beginning of name

		iptr = new intersection(s, name, lo, la, d);

		nptr = new node(iptr, LOCATION_TOTAL);//location 0 is "No Such Place
Exists"
		LOCATION_TOTAL++;

		g.v_nodes.push_back(nptr);
	}

	interIN.close();
}
void connectGraph(graph &g) {

	conIN.open("connections.txt");
	if (conIN.fail()) {
		cout << "unable to open connections.txt" << endl;
		exit(1);
	}


	string N, C; int A, B; double L; connection* cptr;

	while (!conIN.fail()) {
		conIN >> N >> C >> A >> B >> L;
		cptr = new connection(N, C, A, B, L);
		g.v_nodes.at(A)->v_conn_data.push_back(cptr);
		g.v_nodes.at(A)->connects_to.push_back(g.v_nodes.at(B));

		g.v_nodes.at(B)->v_conn_data.push_back(cptr);
		g.v_nodes.at(B)->connects_to.push_back(g.v_nodes.at(A));
	}
```

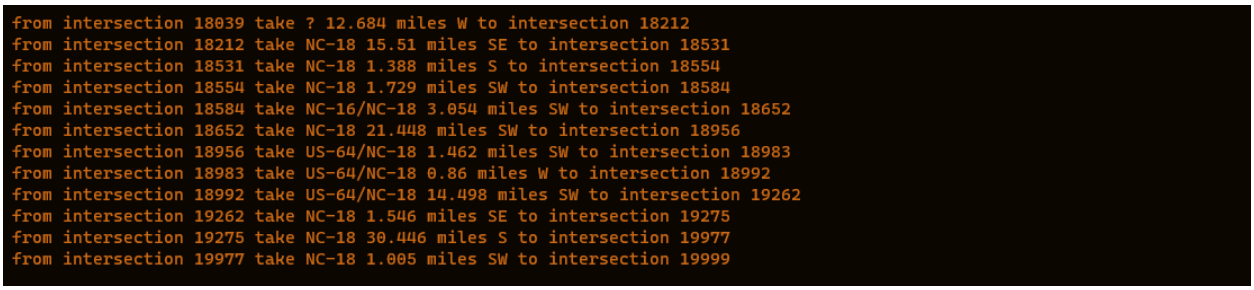
```
	conIN.close();

}
node* goToLocation(graph g, int number) {
	if (number > 0 && number < g.v_nodes.size()) {
		return g.v_nodes.at(number);
	}
	return NULL;
}
bool check_number(string str) {
	for (int i = 0; i < str.length(); i++) {
		if (isdigit(str[i]) == false) {
			return false;
		}
	}
	return true;
}
void titlePage() {
	cout << "*************************************************" << endl;
	cout << "|                                                |" << endl;
	cout << "|           A Graph of Interconnected Nodes      |" << endl;
	cout << "| By: Brandon Rubio, ECE 318, University of Miami |" << endl;
	cout << "|                                                |" << endl;
	cout << "*************************************************" << endl;
	cout << endl;
}

int main() {
	graph G;
	readInterToGraph(G);
	connectGraph(G);
	bool nextState = false;
	string input;
	cout << "Please enter a location number between 1 and " << G.v_nodes.size()
<< endl << endl;
	while (!nextState) {
		cout << "Location to start: ";
		cin >> input;
		if (input == "exit") {
			exit(0);
		}
		else if (!check_number(input)) {// if not a number
			cout << "Please enter a location number between 1 and " <<
G.v_nodes.size() << endl << endl;
		}
		else if (!(stoi(input) > 0 && stoi(input) < G.v_nodes.size())) {// if
not in range
			cout << "Please enter a location number between 1 and " <<
G.v_nodes.size() << endl;
		}
		else {
			nextState = true;
		}
	}
	cout << endl;
	node* nptr = NULL;
	string input2;
```

```
	nptr = goToLocation(G, stoi(input));

	bool next = false;
	while (1) {
		next = false;
		if (nptr->connects_to.size() <= 0) {
			cout << "connects_to.size() error" << endl;
			exit(1);
		}
		if (nptr == NULL) {
			cout << "Error, could not find location" << endl;
			exit(1);
		}
		else {
			cout << "Location " << nptr->number << ", " << nptr->inter_data-
>dist << " miles from " << nptr->inter_data->name << ", " << nptr->inter_data->state
<< endl;
			cout << "Roads leading away:" << endl;
			int i = 0;
			for (i; i < nptr->connects_to.size(); i++) {
				cout << i + 1 << ": " << nptr->v_conn_data.at(i)->name <<
", " << nptr->v_conn_data.at(i)->length << " miles to location " << nptr-
>connects_to.at(i)->number << endl;
			}
		}

		cout << "take which road? ";
		while (!next) {
			cin >> input2;
			if (input2 == "exit") {
				exit(0);
			}
			else if (!check_number(input2)) {// if not a number
				cout << "please input an indexed number given from the
list or type \"exit\" to exit the program" << endl;
			}
			else if (stoi(input2) > 0 && stoi(input2) <= nptr-
>connects_to.size()) {// if in range
				nptr = nptr->connects_to.at(stoi(input2) - 1);
				next = true;
			}
			else {
				cout << "please input an indexed number given from the
list or type \"exit\" to exit the program" << endl;
			}
		}
		cout << endl;
	}

	return 0;
}
```


Microsoft Visual Studio Debug Console
Please enter a location number between 1 and 29147
Location to start: 19999
Location 19999, 0.66 miles from Shelby, NC
Roads leading away:
1: NC-18, 1.005 miles to location 19977
2: US-74, 2.521 miles to location 19991
3: US-74, 3.749 miles to location 20006
4: NC-18, 7.565 miles to location 20159
take which road? 3
Location 20006, 1.85 miles from Light Oak, NC
Roads leading away:
1: bus-US-74, 3.812 miles to location 19977
2: US-74, 3.749 miles to location 19999
3: US-74, 4.805 miles to location 20022
take which road? 1
Location 19977, 0.38 miles from Shelby, NC
Roads leading away:
1: NC-18, 30.446 miles to location 19275
2: bus-US-74, 1.625 miles to location 19988
3: NC-18, 1.005 miles to location 19999
4: bus-US-74, 3.812 miles to location 20006
take which road? 4
Location 20006, 1.85 miles from Light Oak, NC
Roads leading away:
1: bus-US-74, 3.812 miles to location 19977
2: US-74, 3.749 miles to location 19999
3: US-74, 4.805 miles to location 20022
take which road? 1
Location 19977, 0.38 miles from Shelby, NC
Roads leading away:
1: NC-18, 30.446 miles to location 19275
2: bus-US-74, 1.625 miles to location 19988
3: NC-18, 1.005 miles to location 19999
4: bus-US-74, 3.812 miles to location 20006
take which road? 1
Location 19275, 2.25 miles from Morganton, NC
Roads leading away:
1: I-40, 13.297 miles to location 19238
2: NC-18, 1.546 miles to location 19262
3: I-40, 2.327 miles to location 19294
4: NC-18, 30.446 miles to location 19977
take which road? 1
Location 19238, 0.95 miles from Hildebran, NC

```
Select C:\Users\brand\source\repos\ECE318Algorithms\Debug\ECE31
take which road? 1

Location 19238, 0.95 miles from Hildebran, NC
Roads leading away:
1: I-40, 3.059 miles to location 19221
2: US-70, 0.928 miles to location 19222
3: I-40, 13.297 miles to location 19275
take which road? 1

Location 19221, 1.34 miles from Brookford, NC
Roads leading away:
1: I-40, 2.405 miles to location 19198
2: US-321, 1.138 miles to location 19191
3: I-40, 3.059 miles to location 19238
take which road? 2

Location 19191, 1.05 miles from Long View, NC
Roads leading away:
1: US-321, 4.663 miles to location 19109
2: US-70/US-321, 2.24 miles to location 19198
3: US-321, 1.138 miles to location 19221
4: US-70, 2.841 miles to location 19222
take which road? 1

Location 19109, 1.64 miles from Rhodhiss, NC
Roads leading away:
1: US-321, 11.382 miles to location 18983
2: alt-US-321, 11.849 miles to location 18992
3: US-321, 4.663 miles to location 19191
take which road? 1

Location 18983, 0.48 miles from Lenoir, NC
Roads leading away:
1: US-64/NC-18, 1.462 miles to location 18956
2: US-321, 17.211 miles to location 18711
3: US-64/NC-18, 0.86 miles to location 18992
4: US-321, 11.382 miles to location 19109
take which road? 2

Location 18711, 0.34 miles from Blowing Rock, NC
Roads leading away:
1: US-221/US-321, 0.861 miles to location 18697
2: US-221, 9.373 miles to location 18817
3: US-321, 17.211 miles to location 18983
take which road? 1

Location 18697, 1.19 miles from Blowing Rock, NC
Roads leading away:
1: US-221/US-321, 4.117 miles to location 18619
2: ?, 11.638 miles to location 18548
3: US-221/US-321, 0.861 miles to location 18711
```


Microsoft Visual Studio Debug Console
take which road? 2
Location 18711, 0.34 miles from Blowing Rock, NC
Roads leading away:
1: US-221/US-321, 0.861 miles to location 18697
2: US-221, 9.373 miles to location 18817
3: US-321, 17.211 miles to location 18983
take which road? 1
Location 18697, 1.19 miles from Blowing Rock, NC
Roads leading away:
1: US-221/US-321, 4.117 miles to location 18619
2: ?, 11.638 miles to location 18548
3: US-221/US-321, 0.861 miles to location 18711
4: ?, 9.842 miles to location 18817
take which road? 2
Location 18548, 10.22 miles from Boone, NC
Roads leading away:
1: ?, 17.666 miles to location 18212
2: US-421, 1.548 miles to location 18546
3: US-421, 17.042 miles to location 18564
4: ?, 11.638 miles to location 18697
take which road? 1
Location 18212, 10.48 miles from Sparta, NC
Roads leading away:
1: ?, 12.684 miles to location 18039
2: NC-18, 15.51 miles to location 18531
3: ?, 17.666 miles to location 18548
take which road? 1
Location 18039, 6.69 miles from Sparta, NC
Roads leading away:
1: ?, 10.146 miles to location 17886
2: US-21, 9.163 miles to location 17973
3: ?, 12.684 miles to location 18212
4: US-21, 14.707 miles to location 18273
take which road? NOPE
please input an indexed number given from the list or type "exit" to exit the program
Brandon
please input an indexed number given from the list or type "exit" to exit the program
Rubio
please input an indexed number given from the list or type "exit" to exit the program
ECE318
please input an indexed number given from the list or type "exit" to exit the program
exit
C:\Users\brand\source\repos\ECE318Algorithms\Debug\ECE318Algorithms.exe (process 5180) exited with code 0.
To automatically close the console when debugging stops, enable Tools->Options->Debugging->Automatically close the console when debugging stops.
Press any key to close this window . . .


from intersection 18039 take ? 12.684 miles W to intersection 18212
from intersection 18212 take NC-18 15.51 miles SE to intersection 18531
from intersection 18531 take NC-18 1.388 miles S to intersection 18554
from intersection 18554 take NC-18 1.729 miles SW to intersection 18584
from intersection 18584 take NC-16/NC-18 3.054 miles SW to intersection 18652
from intersection 18652 take NC-18 21.448 miles SW to intersection 18956
from intersection 18956 take US-64/NC-18 1.462 miles SW to intersection 18983
from intersection 18983 take US-64/NC-18 0.86 miles W to intersection 18992
from intersection 18992 take US-64/NC-18 14.498 miles SW to intersection 19262
from intersection 19262 take NC-18 1.546 miles SE to intersection 19275
from intersection 19275 take NC-18 30.446 miles S to intersection 19977
from intersection 19977 take NC-18 1.005 miles SW to intersection 19999