

CMSC 447  
Software Test Description (STD)

I hereby accept this document as complete.

Signature:

Date:

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# 1 Scope

## 1.1 System overview

The system aims to provide information about areas to move to within the United States consistent with specified criteria. Each specified criterion will appear as a search option on a webpage and will be used by a user to narrow down results for a new location to move to. Locations fitting the criteria of the search will be displayed on a map as points.

## 1.2 Document overview

This document outlines testing procedures for all system components. Each component is associated with a unique project identifier and given a brief description along with a comprehensive procedure for evaluating that component.

## 2 Referenced documents

- Software Requirements Specification (SRS)
- Software Design Description (SDD)

## 3 Test preparations

The following are preparations taken going forward into testing. Safety precautions if they exist will be marked with CAUTION. As there is no personal information being put on or saved by the project, privacy concerns are minimal.

### 3.1 T0 - (Front End)

Front-end requirements include CSCI components I1-I19 as listed in section 4.1 of the SDD. This includes the user interface of the website and the displayed map. Preparations are the completion of the Front End, and installation of the Safari Web Browser to display the Front end.

#### 3.1.1 Software preparation

Preparation involves writing the HTML file and CSS file for the user interface as well as a JS file which will use the Google Maps API (A2) to display the search results as pins on the map. The installation of the Front End website and the Back End local server are available on GitHub in a public repository, with instructions on how to set up the project on a local machine.

### 3.2 T1 - (Back End)

Setup of the Back End is detailed on the GitHub. A local server must be established on the machine and will be populated with the database described above. To run the local server, the user must install Apache, SQL, and PHP. For a Windows machine, wampserver will be used and the necessary repository from GitHub moved onto the server. From there, a local copy of the webpage can be run. on Unix machines, using LAMP architecture, a server and database are setup for testing.

#### 3.2.1 Software preparation

The local SQL database will be built by querying the datausa.io API, compilation of data from

NOAA weather station CSV files and Recreation Information Database (RIDB) CSV files. A file named search.php will receive search criteria from the Front End and query the database for matching locations and return the relevant results to the Front End for display.

## **4 Test descriptions**

This section shall be divided into the following paragraphs. Safety precautions, marked by WARNING or CAUTION, and security and privacy considerations shall be included as applicable.

### **4.1 T2 - (Front End)**

This test shall cover all facets of the user interface and methods of sending information to the backend.

#### **4.1.1 T2.1 - (Correct Query)**

The purpose of this test is to verify that for each parameter in the search menu, the correct query is sent to the database

##### **4.1.1.1 Requirements addressed**

The system requirements addressed by this test case are referenced in section 2.1.1.1 – 2.1.1.10 of the SRS. All requirements specified in the SRS shall be present and functional in the project.

##### **4.1.1.2 Prerequisite conditions**

There are no specific hardware or software requirements beyond the ability to run on the Safari web browser. For each parameter listed in 2.1.1.1 – 2.1.1.10 of the SRS, a full test will take place in which parameters are set to every combination possible

##### **4.1.1.3 Test inputs**

This paragraph shall describe the test inputs necessary for the test case. The following shall be provided, as applicable:

- a. Name, purpose, and description (e.g., range of values, accuracy) of each test input

Parameter	# of inputs associated with parameter	Description
Public School	5	Selects a preference for the rate of graduation of high schools around two different percentiles: 33, 66. This option can also be turned on and off.
Public Transport	5	Selects a preference for the availability of public transportation by the amount of people that use public transportation around two different percentiles: 33, 66. This option can also be turned on and off.
Crime	4	Selects a preference for the number of violent crimes per thousand people around two different percentiles: 33 and 66. This option can be turned on and off.
Outdoor Recreation	9	Selects a preference for the proximity of a location to seven different types of recreational activities. This option can be turned on and off.
Climate	11	Selects a preference for a type of climate by choosing the average annual temperature, the average annual precipitation, and the average annual snowfall. Each of these is ranked around two different percentiles: 33, 66. This option can be turned on and off.
Health Care	4	Selects a preference for ratio of doctors to patients around two percentiles: 66 and 99. This option can be turned on or off.
Commute Time	62	Selects a preference for the average annual commute time between zero and 60 minutes. This option can be turned on and off.

- b. Test input will be selected by selecting all combinations of queries that the above list permits.
- c. Test input will be simulated via a python script
- d. Event sequence of test input:
  - 1) Event 1: Choose permutation
  - 2) Event 2: Select input
  - 3) Event 3: Send to data
  - 4) Event 4: Confirm that permutation sent to database matches selected input
  - 5) Event 5: Repeat for all permutations

#### **4.1.1.4 Expected test results**

The expected test result is that each of the inputs appears in the backend as the user requested. For example, if a user were to input that they wanted low annual snowfall and average crime rates the only fields sent to the backend would appear asking for counties with low annual snowfall and average crime rates.

#### **4.1.1.5 Criteria for evaluating results**

This paragraph shall identify the criteria to be used for evaluating the intermediate and results of the test case. For each test result, the following information shall be provided, as applicable:

- a. For this test the accuracy should be 100%, no alteration the user input is allowable as it would prevent the correct results from returning.
- b. Testing of all permutations an input can go through constitutes an acceptable test result
- c. Minimum allowable test duration for each input
- d. Halts may only occur between inputs
- e. Minimal severity of processing errors is acceptable; the site shall encounter no errors that would cause a failure to display data
- f. If a test halts halfway through an input, or no feedback is shown on the screen corrections will be performed and retested
- g. If the input does not match the query present in the database, then output is assumed to have irregularity
- h. If the test for the input returns without stopping in between them:

#### **4.1.1.6 Test procedure**

This paragraph shall define the test procedure for the test case. The test procedure shall be defined as a series of individually numbered steps listed sequentially in the order in which the steps are to be performed. For convenience in document maintenance, the test procedures may be included as an appendix and referenced in this paragraph. The appropriate level of detail in each test procedure depends on the type of software being tested. For some software, each keystroke may be a separate test procedure step; for most software, each step may include a logically related series of keystrokes or other actions. The appropriate level of detail is the level at which it is useful to specify expected results and compare them to actual results. The following shall be provided for each test procedure, as applicable:

- a. Test operator actions and equipment operation required for each step, including commands, as applicable, to:
  - 1) Initiate the test case and apply test inputs
  - 2) Resend back end query to front end
  - 3) Check whether query matches with front end inputs
  - 4) Record data
  - 5) Repeat for next iteration of input
  - 6) Terminate the test case once all iterations of input are tested
- b. Expected result and evaluation criteria for each step
  - 1) No expected result or evaluation criteria

- 2) No expected result or evaluation criteria
  - 3) Expected Result: Front end request remains the same as backend  
Evaluation criteria: If they are the same the test is a pass, if not then the test is a failure
  - 4) No expected result or evaluation criteria
  - 5) No expected result or evaluation criteria
  - 6) No expected result or evaluation criteria
- c. Step three addresses each parameter in sequence listed in 2.1.1.1 – 2.1.1.10 in the SRS

#### **4.1.1.7 Assumptions and constraints**

Below are identified any assumptions made and constraints or limitations imposed in the description of the test case due to system or test conditions, such as limitations on timing, interfaces, equipment, personnel, and database/data files. If waivers or exceptions to specified limits and parameters are approved, they shall be identified, and this paragraph shall address their effects and impacts upon the test case.

- Since there is a short amount of time, manually checking through each input would be impossible, therefore an assumption that all combinations are reached by the script is made.

#### **4.1.2 T2.2 - (Working GUI)**

The purpose of this test is to verify that each of the interface objects, labelled (I#) in the SDD, works as intended. The following subparagraphs will include a description of the test case.

##### **4.1.2.1 Requirements addressed**

The requirements that will be tested are each parameter in section 2.1.1.1 – 2.1.1.10 and 2.1.2 from the SRS.

##### **4.1.2.2 Prerequisite conditions**

The website user interface is in functioning condition which is testable.

##### **4.1.2.3 Test inputs**

Test inputs are listed below based on the requirements provided in the SRS section 2.1.1.1 – 2.1.1.10 and 2.1.2. SDD sections 4.1, 4.3, and 5.1 can be used for further description of the user interface.

- a. All components defined in SDD 4.1 shall be present in the project front end
- b. Interfaces as defined in SDD 4.3 will be present and functional as defined
- d. Helper text pop ups will appear next to parameters. When clicked they will define the parameters purpose to the user.
- e. All variables sent to the database will be within the acceptable range defined by the sliders and checkboxes, as defined in SDD 5.1.

##### **4.1.2.4 Expected test results**

The different components of the user interface are expected to operate in the manner describe in section 4.1 of the SDD.



#### **4.1.2.5 Criteria for evaluating results**

Below are the intermediate and final test criteria. Intermediate tests will serve as checkpoints as the project is developed to ensure that the site is displaying properly. The final test will consist of repeated runs of the project from a minimum of five users to ensure that the user interface is working correctly.

- 1) Ensure that components define in SDD 4.1 function as described
- 2) Any errors are captured and handled, and an error message displayed
- 3) The site will remain stable in the event of an error

#### **4.1.2.6 Test procedure**

Each of the user interface components will be tested manually to ensure that their functionality matches their counterparts in section 4.1 of the SDD.

#### **4.1.2.7 Assumptions and constraints**

- Assumption: All the user interface components described in section 4.1. of the SDD are implemented and ready for testing

## **4.2 T3 - (Back End)**

These test cases shall focus on the back end of the website. This section will be divided into the following test cases and paragraphs.

### **4.2.1 T3.1 - (Correct Results)**

The purpose of this test is to verify that the results (counties) returned by the back end, using information from the database, coincide with the known results of a few counties. This will allow verification of search function correctness.

#### **4.2.1.1 Requirements addressed**

Requirement addressed is 2.1.1.12 of the SRS.

#### **4.2.1.2 Prerequisite conditions**

For every test, every parameter that is not specified to be on during a test shall be off.

#### **4.2.1.3 Test inputs**

This paragraph shall describe the test inputs necessary for the test case. The following shall be provided, as applicable:

- a. Adair County, Iowa / Valencia County, New Mexico
  - 1) Crime Rate: Low Crime Rate
  - 2) Climate: No Preference, Medium Annual Precipitation, Medium Annual Snowfall
  - 3) Commute Time: 24 minutes
  - 4) Public Transportation: Low Availability
- b. Worcester County, MD / Yakima County, Washington
  - 1) Public Schools: High Ranking
  - 2) Outdoor Recreation: All options set on
  - 3) Health Care: High number of doctors to patients

#### **4.2.1.4 Expected test results**

Below are identified all expected test results for the test case. Both intermediate and final test results shall be provided, as applicable.

- a. Adair County, Iowa / Valencia County, New Mexico
  - a. Using the inputs given in the above test, Adair County, New Mexico should be returned as a result and Valencia County, New Mexico should not be returned
- b. Worcester County, MD / Yakima County, Washington
  - a. Using the inputs given in the above test, Worcester County, MD should be returned and Yakima County, Washington should not be returned

#### **4.2.1.5 Criteria for evaluating results**

Below are identified the criteria to be used for evaluating the intermediate and final results of the test case. For each test result, the following information shall be provided, as applicable:

- a. The accuracy of the output cannot vary at all, the two counties to be returned must be returned, and the counties which are not to be present should not be returned.
- b. If neither of the results appear then the tests are considered inconclusive and testing to be redone
- c. If different results are appearing on the map check input data for irregularities

#### **4.2.1.6 Test procedure**

This paragraph shall define the test procedure for the test case. The test procedure shall be defined as a series of individually numbered steps listed sequentially in the order in which the steps are to be performed. For convenience in document maintenance, the test procedures may be included as an appendix and referenced in this paragraph. The appropriate level of detail in each test procedure depends on the type of software being tested. For some software, each keystroke may be a separate test procedure step; for most software, each step may include a logically related series of keystrokes or other actions. The appropriate level of detail is the level at which it is useful to specify expected results and compare them to actual results. The following shall be provided for each test procedure, as applicable:

- a. Test operator actions and equipment operation required for each step, including commands, as applicable, to:
  - 1) Initiate test case by using inputs for Adair County, Iowa test
  - 2) Record whether Adair County Iowa was present/missing and whether Valencia County, New Mexico was present/missing
  - 3) Use inputs for Worcester County, MD
  - 4) Record whether Worcester County, MD was present/missing and whether Yakima County, Washington was present/missing
  - 5) Repeat the test case if unsuccessful
  - 6) Terminate the test case
- b. Steps 2 and 4 of the above procedure address requirement 2.1.1.12 of the SRS

#### **4.2.1.7 Assumptions and constraints**

- Assume data from pulled from APIs and stored in database is factual and representative of true conditions in area

#### **4.2.2 T3.2 - (Speed)**

The purpose of this test is to verify that the results (counties) are returned by the back end and displayed on the map at an average of 5 seconds and at a maximum of 15 seconds.

##### **4.2.2.1 Requirements addressed**

Requirements addressed by the test case are 2.1.1.2 and 2.1.1.3 of the SRS

##### **4.2.2.2 Prerequisite conditions**

The following considerations shall be discussed, as applicable:

- a. Initial conditions to be used in making timing measurements
  - 1) All parameters in search menu will be set to off
- b. Other special conditions peculiar to the test case
  - 1) Network delays will not be considered during out testing

##### **4.2.2.3 Test inputs**

This paragraph shall describe the test inputs necessary for the test case. The following shall be provided, as applicable:

- a. Name, purpose, and description (e.g., range of values, accuracy) of each test input  
Database will have all data for each county, queries will be made over the entire county if selection is of a particular state then that state alone will have results returned
  - 1) Random combination of inputs using provided parameters:
    - i. Public Schools, Public Transportation, Crime, Outdoor Recreation, Climate, Health Care, and Commute Time
- b. Source of the test input and the method to be used for selecting the test input
  - 1) The test input would be randomly chosen a random number generator
- c. Whether the test input is real or simulated
  - 1) simulated

##### **4.2.2.4 Expected test results**

This paragraph shall identify all expected test results for the test case. Both intermediate and final test results shall be provided, as applicable.

- The expected result for the average is less than or equal to five seconds.
- The expected result for the maximum is less than or equal to 15 seconds.

##### **4.2.2.5 Criteria for evaluating results**

This paragraph shall identify the criteria to be used for evaluating the intermediate and final results of the test case. For each test result, the following information shall be provided, as applicable:

- a. As long as the average is within or below 0.5 seconds from five seconds then it is an

- acceptable result
- b. The maximum test duration is 1000 random iterations, the minimum test duration is 100 random iterations
  - c. No halts, breaks, or interrupts are allowed during the test
  - d. No processing errors are accepted during the test
  - e. If the average is less than or equal to zero, then testing is inconclusive and re-testing must be preformed
  - f. If output is extremely large (beyond 15 seconds) or extremely small (approaching zero) then there may be irregularities in input test data, database, or test procedures.
  - g. Output shall be an average and maximum time based on data from all tests.

#### **4.2.2.6 Test procedure**

This paragraph shall define the test procedure for the test case. The test procedure shall be defined as a series of individually numbered steps listed sequentially in the order in which the steps are to be performed. For convenience in document maintenance, the test procedures may be included as an appendix and referenced in this paragraph. The appropriate level of detail in each test procedure depends on the type of software being tested. For some software, each keystroke may be a separate test procedure step; for most software, each step may include a logically related series of keystrokes or other actions. The appropriate level of detail is the level at which it is useful to specify expected results and compare them to actual results. The following shall be provided for each test procedure, as applicable:

- a. Test operator actions and equipment operation required for each step, including commands, as applicable, to:
  - 1) Randomly choose inputs
  - 2) Begin timer
  - 3) Send request to database
  - 4) Allow all pins to be displayed on map
  - 5) Stop timer
  - 6) Record time for current test
  - 7) Repeat steps one to six 1000 times
  - 8) Average all time values and find max time
  - 9) Return average time and max time
  - 10) Terminate the test case

#### **4.2.2.7 Assumptions and constraints**

This paragraph shall identify any assumptions made and constraints or limitations imposed in the description of the test case due to system or test conditions, such as limitations on timing, interfaces, equipment, personnel, and database/data files. If waivers or exceptions to specified limits and parameters are approved, they shall be identified and this paragraph shall address their effects and impacts upon the test case.

- Network delay is reasonable and will not significantly increase or decrease time taken for results to be displayed

## 5 Requirements traceability

The following is a record of the CSCI requirements and their associative test cases as identified above.

- T0 – Front End; SRS 2.1.1.4 – 2.1.1.10
- T1 – Back End; SRS 2.1.1.2, 2.1.1.3, 2.1.1.12
- T2.1 – Correct Query; SRS 2.1.1.12
- T2.2 – Working GUI; SRS 2.1.1.4 – 2.1.1.10
- T3.1 – Correct Results; SRS 2.1.1.12
- T3.2 – Speed; SRS 2.1.1.2, 2.1.1.3