Where in the USA is Carmen Sandiego?

A United States Geography Interactive Question and Answer Game

Abstract

Carmen Sandiego is a professionally trained criminal mastermind who is working as a double agent to help the Agency to Classify & Monitor Evildoers (ACME) stop the Villains International League of Evil (VILE) thieving streak. VILE is as red-hot on Carmen's trail as her trench coat and she needs a quick place to hide. You suggest a quick hiding spot somewhere in the United States of America. You call ACME to report Carmen Sandiego's location, but before you can speak to the extraction team, VILE is hot on your trail.

Thankfully VILE is better at stealing than at deciphering riddles and they are even worse with geography; so, you proceed to report her location via text. Don't forget to be a good spy and use a code. While running from VILE, ACME asks you easy to answer questions to try to narrow down your hiding spot for Carmen. Your cell has only enough battery for 20 questions, so answer quickly before your cell battery dies. If you cannot answer ACME's questions to help them find her before VILE, well let's not think about that. Whether you have Carmen sneaking around the Carolinas or Ohio, or even Oahu, can your geography clues help ACME determine where in the USA has Carmen Sandiego been hidden.

Questions including coast lines, populations, capital names and locations, and more await you. Answer truthfully, you are the only ACME agent to have ever Arkansas her; and without the correct location, the extraction team will not stand a chance of finding the red-headed Carmen Sandiego before VILE. The information that Carmen has can stop VILE forever and they want nothing more than to stop her themselves to keep ACME from acquiring the intel.

Every question you answer will narrow ACME's map of the United States, leaving only the states that meet all the clues so far. The goal is to only have the one location left before your battery dies so the extraction team knows exactly where to pick Carmen up. So, tell me, "Where in the USA is Carmen Sandiego?"

Keywords

United States Geography 2020 Census Educational Interactive

Data Requirements

Input data for this project comes from several sources.

The polygon data in the cartographic boundary shapefile from the US Census Bureau will provide the state boundary lines for each of the 50 states and can be used to narrow the states in play and remove the states that have been ruled out as the hiding location.

Point data from the ArcGIS Hub provides the geographical coordinates of all 3,886 major cities in the country and identifies the cities that are the capital for each state. Mapping the state capitals to the states will provide zooming and buffer centroids to ensure that the states in question remain centered and in view.

The ArcGIS Hub also has many different polygon shapefiles for topographical features like mountain ranges, lakes, oceans, and rivers. For example, the Mississippi River is almost the center of the country dividing the nation into East and West. Other examples are the many states which border the Atlantic Ocean, and although only three of the continental states intersect the Pacific Ocean, both Alaska and Hawaii do also, so 10% of the states are impacted by this fact making it a worthwhile question to add to the repertoire. Other noteworthy locations include states that neighbor our northern and/or southern countries. However, if the ArcGIS Hub does not have the desired features on a national level, additional sources may be necessary.

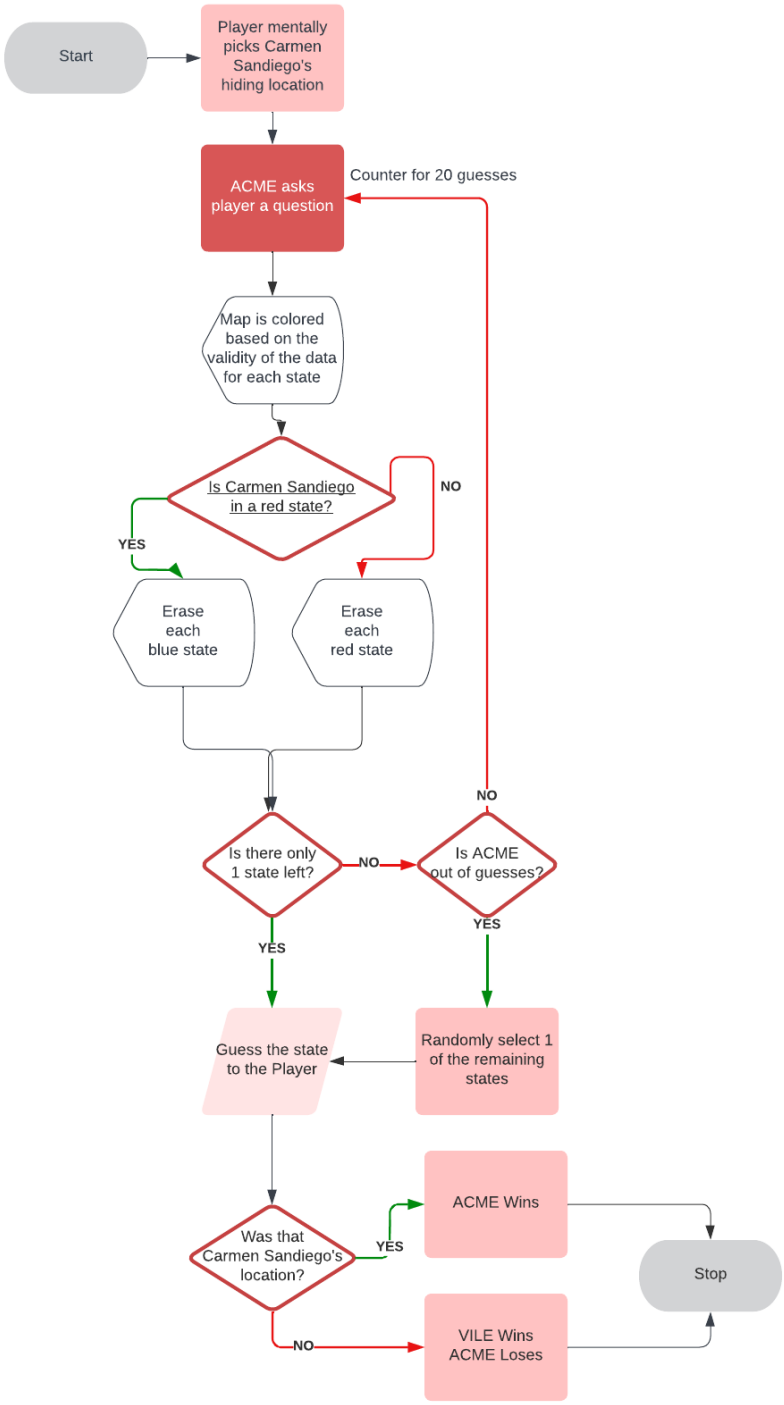
Data from the US Census Bureau including polygon statistics on state population, education, socioeconomic percentages, housing and transportation preferences, and median household income are a few fields that can be used to identify if each state is a “yes” or a “no” for filtering between the different states.

Process Description

From the time the game round starts there is a counting loop for the remaining number of turns. While moves remain ACME will continue to ask questions for the player to answer. Each question ultimately has a Boolean response (yes or no) for a state and the resulting conditional check will either remove the states or not. The question presented will be asked randomly from a bank of questions. For each state remaining as a possibly correct answer, the state will be colored red if meeting the “yes” criterion of the next question and blue for meeting the “no” criterion for the next question. Then once the answer is provided from the player the desired state(s) are kept and each of the undesired state(s) are erased from the map. Gameplay needs to be fast to keep the player’s attention. Using Python to implement the mapping calculations means an almost instantaneous response versus the long map generating time of ArcPro.

If ACME runs out of questions, then they will randomly guess from the remaining states in hopes of saving Carmen Sandiego from VILE. If ACME can guess the correct state where you hid Carmen Sandiego, the game is ultimately won. Else VILE wins the game and ACME loses if they run out of guesses and cannot guess the correct state.

Several geoprocessing tools will be used to determine if each state is a “yes” or “no” state. After each question, the response given will eliminate one or more states from the answer set. The removed states will be erased from the map leaving just the states that still meet every criterion to date as valid choices for the next question. Many questions will determine if the state intersects a particular feature (example, the Pacific Ocean or Canada). Occasionally, features are non-continuous and may require buffering to verify if each state qualifies for the feature or not. Example, the Rocky Mountains are many little mountains that intersect many states. We do not care about each state individually but want to verify if any part of the mountain intersects the state or not. Many data points in the US Census are recorded per county and not per state, so for questions relating to these topics, the information will need to be dissolved and merged for the entire state. After performing the analysis for the criteria, we need to mark the “yes” and “no” states. “Yes” states will be shaded in red, “no” states will be shaded in blue. In order to fill each state, it needs to be clipped from the country map to have individual boundaries.



As states are removed, the map will zoom in on the remaining states. ArcPro allows for features like zooming into desired map areas, but this is also possible with Python. Python, however, allows for the exact zoom percentages and definition of centroid location to ensure a perfect zoom the first time for any number and order of states being included versus ArcPro that is either a guess and check zoom or requires a preset zoom location to a particular state.