

Teaching Notes
Lesson 15
“What if ...?” Scenarios

Implementation Ideas:

This lesson targets a student’s work at Level 4 of the Modeling Continuum. The task presented in this lesson is open-ended and does not include a set of guided problems. It is presented and explained in the student’s lesson as a task. Students are expected to rework the recursive model to match their interpretation of a scenario described in the lesson. The “What if...?” scenarios are designed to simulate events similar to the events discussed in **Unit 2: Looking Back** that altered the counts of age groups for several years. Students also analyze how the collective changes of several age groups alter the shape of a country as defined in this module.

Begin this lesson by providing time for students to read the opening section and the steps needed to complete the task. This section also provides an overview of why these scenarios are important. Discuss with students that the recursive model is **not static** and that selected factors can be altered to change the shape of a country’s population. The task expects students to select a scenario, determine what factors of the recursive model need to be changed, justify why these factors should be changed, and finally interpret the altered counts of the age groups and the altered shape of the country.

This lesson expects students have access to the Excel files that implement the recursive model. The files are part of the resources available for this module. Download the 3 versions of the recursive file as identified in the section **Resources needed**. Provide access for students to the files as each student will need at least one of the files. The steps outlined in the student lesson indicate that students should load the file for the country they selected. As they enter their revised values for the factors, they should then save the revised file by a different name. In this way, students will maintain access to the original file in case they decide to restart the process with the original factors in place.

It is important to provide feedback as students complete this task. A rubric is included with these teaching notes to assist you in evaluating students’ work and providing feedback. Given the more challenging nature of this lesson, revisions and additions to the rubric or a similar assessment tool are encouraged. It is also your decision on whether or not to share a rubric of this type with students before they select and plan out their scenario.

(Note that a few scenarios are highlighted with an *. Be aware of the sensitive nature of the scenarios identified with an *. Monitor the students who may select these scenarios and whether or not you might want to encourage them to select another option.)

Resources needed for this lesson:

Provide a copy of a complete Lesson 15 for each student. This lesson also directs students to have access to the following handouts they used in previous lessons:

Handout 6: The United States 2010 – 2050

Handout 7: Kenya 2010 – 2050

Handout 8: Japan 2010 – 2050

Students need to have access to the following Excel files:

USA Recursive Model.xlsx

Kenya Recursive Model.xlsx

Japan Recursive Model.xlsx

If Excel is not available, it is possible that a different spreadsheet program will also work with these files. It may be necessary, however, for you or the students to alter some of the entries in order for the files to work correctly.

Directions for the Lesson 15 task:

Provide students access to the Excel files ***USA Recursive Model***, ***Kenya Recursive Model***, or ***Japan Recursive Model***. Direct students to save any revised files on their computer or school network by a different file name as they will need access to the original spreadsheets in case they rethink their changes to the recursive model. Before they begin the task, allow them to play around with the spreadsheet files. What happens if they decrease the values of several population factors? What happens if they increase or decrease the foundation factor?

The spreadsheet files start off with the same values as **Handouts 6, 7, or 8** that were used in Unit 3. Direct students to use the handout of the country they selected as a way to plan what factors they will alter. If necessary, assist students in connecting the summaries provided in the handouts to the spreadsheets. After an appropriate time of simply experimenting with the spreadsheets, direct students to the **Scenario Planning Template** and the **Final Summary Report** for the country they selected. Discuss with students the directions provided in the student lesson and listed below.

Step 1: Read through the scenarios. Select one scenario to complete for this lesson. If time promotes, you may be asked to select another scenario and repeat the process.

Step 2: Review your country's current population distribution using **Handout 6** for the United States, **Handout 7** for Kenya, or **Handout 8** for Japan. Carefully examine the **Scenario Planning Template** for the country you selected that is included at the end of this lesson. Indicate on this template the population factors (if any) you would change, the new values you would assign to these factors, and a brief statement why you would change these factors based on the scenario you selected..

Step 3: In addition to possibly changing the population factors, decide if you would also change the foundation factors for your country and why. Identify your changes and your explanations on the **Scenario Planning Template**. Unlike the proposed changes to the population factors, you may recommend changing the foundation factor for certain periods. For example, you may decide to increase the foundation factor from its current value for the years 2020 to 2040, and then may decide to decrease it for the years 2045 to 2050.

Step 4: Load the Excel file that matches your country (**USA Recursive Model**, **Kenya Recursive Model**, and **Japan Recursive Model**). Make sure you save the revised file to your account or computer by a new name. Directions to save files will be provided by your teachers as computer networks have different procedures regarding saving files. This process will allow you to return to the original values of the recursive model in case of errors or revisions while completing this lesson.

Step 5: Enter the proposed revisions from the **Scenario Planning Template** on the Excel file. Note the outcomes for the age group and for the population totals as a result of your changes to the model. Also note the revised shape of the final histogram.

Step 6: Continue to either revise or alter population and foundation factors on the Excel file if you think your plan needs revisions. Make sure you also record the changes on the **Scenario Planning Template**.

As students complete the task and write their final report, provide feedback of the revised model. The following rubric indicates some of the important points to evaluate and include in your feedback to students.

Possible Rubric for assessing the task:

Name: _____

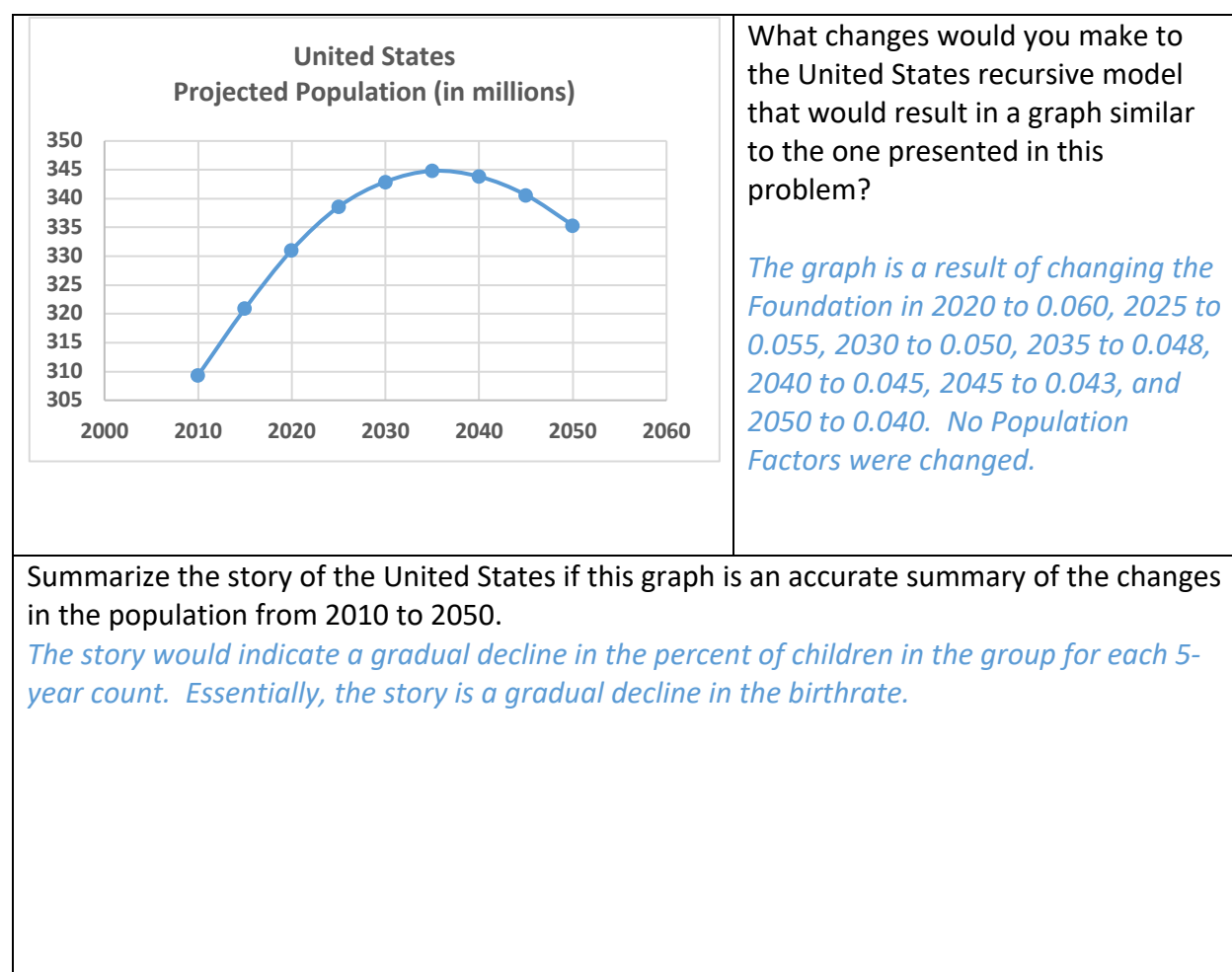
Date: _____

Criteria	0 Student did not address the criteria in the Scenario Planning Template or the Summary Final Report.	1 Student addressed the criteria in the Scenario Planning Template or Summary Final Report; however, no explanation was provided, or the explanation provided was unclear and not accurate in addressing the scenario.	2 Criteria were summarized in the Scenario Planning Template or the Summary Final Report. Student's explanations of revising the model were connected to the scenario.
1. Identifies if the scenario requires an increase or decrease or no change in the total population.			
2. Modifies selected population factors that result in increasing or decreasing the population and specific age groups affected by the change.			
3. Explains if changes are needed or not needed in the Foundation Level based on scenario.			
4. Describes if the population will increase or decrease or stay the same based on the foundation factor used.			
5. Provides an explanation and a sketch of the 2050 histogram based on the simulation in the Summary Final Report.			

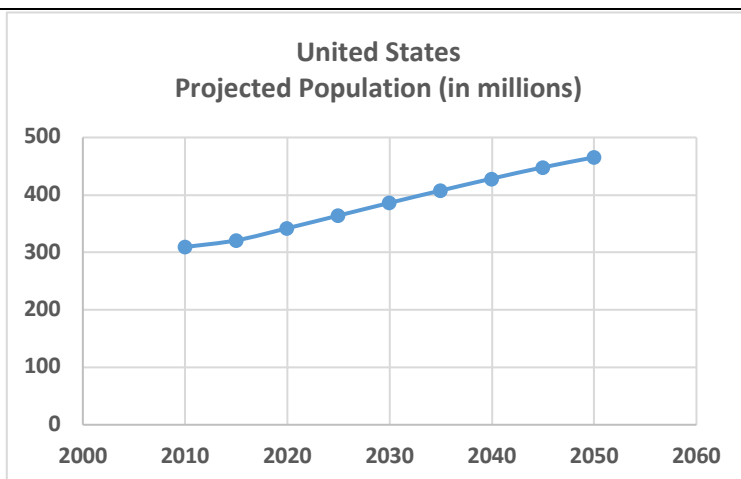
Extension Problems

Each of the following problems contain graphs of the USA population from 2010 to 2050 as a result of changing the Population Factors for certain age groups, or changing the Foundation Factor for various years, or changing both. What if the following graphs summarize stories of the United States population from 2010 to 2050? What would you change in the recursive model and why you would make those changes to the recursive model to obtain each graph? If you have access to the recursive model for the United States (**USA Recursive Model**), make the changes you identified. Did your changes result in a graph similar to the graph in the problem? If your graph is not the same, what other changes might be considered?

Extension Problem A:



Extension Problem B:



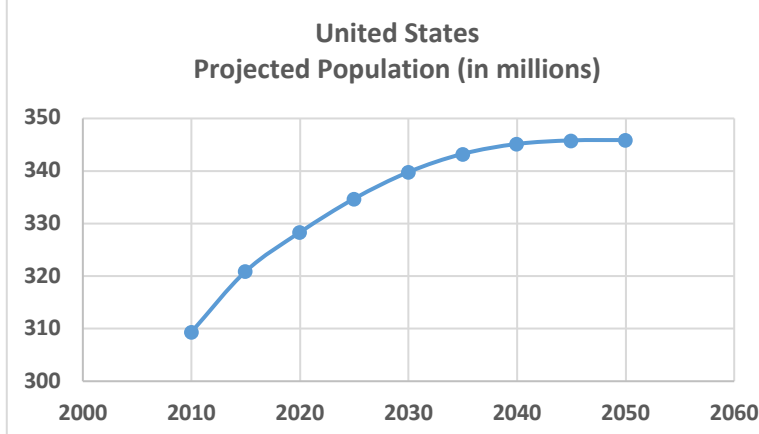
What changes would you make to the United States recursive model that would result in a graph similar to the one presented in this problem?

This is a difficult problem for students. It is a result of changing all of the Population Factors to 1.00. The growth is major. Remind students that this change would indicate that essentially no one dies, therefore, the percent of children over time increases, and the domino effect (even with relatively low birthrates) is a major increase in the population for each 5-year count.

Summarize the story of the United States if this graph is an accurate summary of the changes in the population from 2010 to 2050.

The story is about a major increase in the population of the United States. Students may investigate this change through increased Population Factors indicating immigration, or through Population Factors that are close to or equal to 1.00.

Extension Problem C:



What changes would you make to the United States recursive model that would result in a graph similar to the one presented in this problem?

This graph is a result of changing all of the Population Factors greater than 1.00 to 1.00. These changes indicate reduction in immigration, but not elimination of immigration.

Summarize the story of the United States if this graph is an accurate summary of the changes in the population from 2010 to 2050.

The story tells what happened if immigration were reduced over time.

Extension Problem D:

For this extension problem, you are in control. Make changes to the recursive model that tells a story of the population changes of the United States from 2010 to 2050. What if your changes were an accurate summary of what might happen in the United States? (If you do not have access the recursive mode spreadsheet file, sketch your graph and tell your story.)

What changes would you make to the United States recursive model that would result in a graph similar to the one you produced?

Summarize the story of the United States if this graph you produced is an accurate summary of the changes in the population from 2010 to 2050.

Consider the following variation for **Extension D**:

Direct students to write a short data-story in which the characters in their story (either fictitious or real) are described in the present. Students are expected, however, to describe in their story various scenarios for the characters regarding their future plans (possibly having a family, possibly moving to another country, possibly adopting a child from another country, possibly retiring, etc.). Based on the present age of the characters and the scenarios, students create revisions to the recursive model that they think their characters represent in the larger view of the country's population in 2050.