Teaching Notes

Lesson 16

(Optional Lesson)

The United States Census Models and the Recursive Model

Implementation Ideas:

Provide time for students to read the introduction of this lesson. Conduct group discussions throughout the lesson as several questions ask students to identify subtle differences of the histograms of the United States, Japan, and Kenya. Students are directed to consider another type of "What if …?" scenario in this lesson, or ***what if*** revisions are needed to the recursive model to more closely match the US Census Bureau's projections? A country's possible future will unfold as we work with the models. The problems in this lesson require a little more precision than simply playing around with the recursive model. The model and the spreadsheet files designed to implement the model are used as tools to build specific outcomes that attempt to match the outcomes of the International Data Base (IDB).

This lesson begins by comparing the recursive models' outcomes to the outcomes from the Census Bureau. If the results reported by the Census Bureau are considered the most accurate projections of the United States, Kenya, and Japan's future, then what changes to the recursive models of each country are needed to match these projections? What changes should be considered to the population factors and the foundation factors that address assumptions about the future? Are more people likely to leave the country in the next several decades or are more people likely to move into the country? Are people more likely to live longer over the next several decades or are more people likely to die at an earlier age? Are more people indicating they plan to have children or are they indicating they are not planning to have children? And if yes, how many children are then planning to have? What might be the conditions of these countries that result in changes to the projections of the recursive model?

This lesson also addresses several serious questions for students to consider as they either revise the Foundation Factor or the Population Factors or both factors of the recursive model. They should make their suggestions for the revisions based on the comparison of the recursive model's predictions to the Census Bureau's predictions. Closely monitor the discussion.

The teaching notes for this lesson are designed to provide opportunities for discussion. As a wrap-up to this module, let the distinct differences, and the common concerns faced by the people in each country (United States, Kenya, or Japan), provide an opportunity for students to express their understanding of the key features of this module.

This lesson is designed for students to apply their own ideas and use the tools of the recursive model to build a specific outcome. The summaries provided in the teaching notes are intended to guide periodic discussions of the questions or problems. (In addition, this lesson evaluates a student's perseverance!)

Resources needed for this lesson:

Provide an online or printed copy of Lesson 16 for each student. This lesson also directs students to have access to the following handouts:

Handout 9: The United States Project Worksheet
Handout 10: Kenya Project Worksheet
Handout 11: Japan Project Worksheet

Handouts 9, 10, and 11 are essentially blank versions of the recursive model. The anchor years are included for each country. Population factors and foundation factors are blank. Students will complete their work on these handouts as directed in the lesson.

Students also need to have access to the following Excel files:

USA Recursive Model.xlsx

Kenya Recursive Model.xlsx

Japan Recursive Model.xlsx

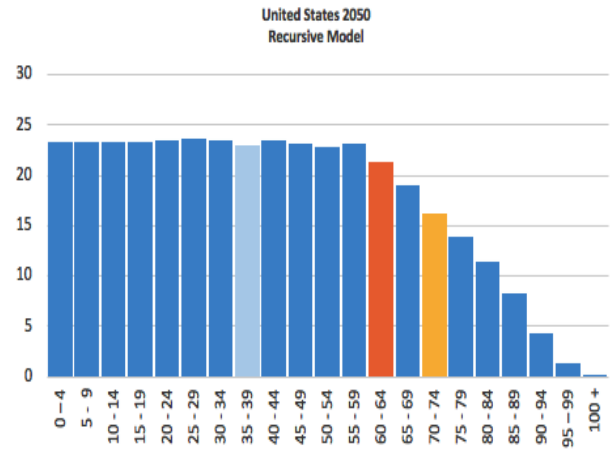
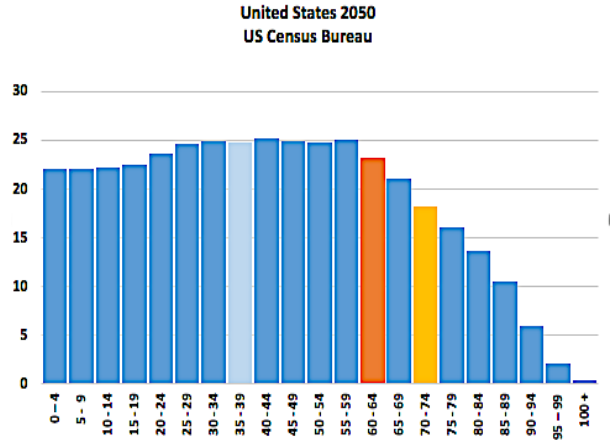
Student responses or descriptions

Lesson 16 - Problems

The first lesson of this module included the 2015 population pyramid graph of the United States compiled by the International Data Base (IDB) of the United States Census Bureau. This lesson was followed with problems that also analyzed the 2015 pyramid graphs of Kenya and Japan. The pyramid graphs for these countries are also included in this lesson.

The models students studied forecast future counts of these countries. The population pyramid graphs for 2015 and 2050 were obtained from the Census Bureau. The first pyramid graph is the familiar one used in several previous lessons that indicated the best estimates of the actual counts of people in 2015. The second pyramid graph is the estimate of the 2050 counts based on a population projection model used by the International Data Base (IDB) of the United States Census Bureau.

Discuss with students the following histograms. Are the estimates of the recursive and the Census Bureau models similar? If not, what are the differences in the models' predictions and the implications for the countries? These questions are investigated in this lesson.

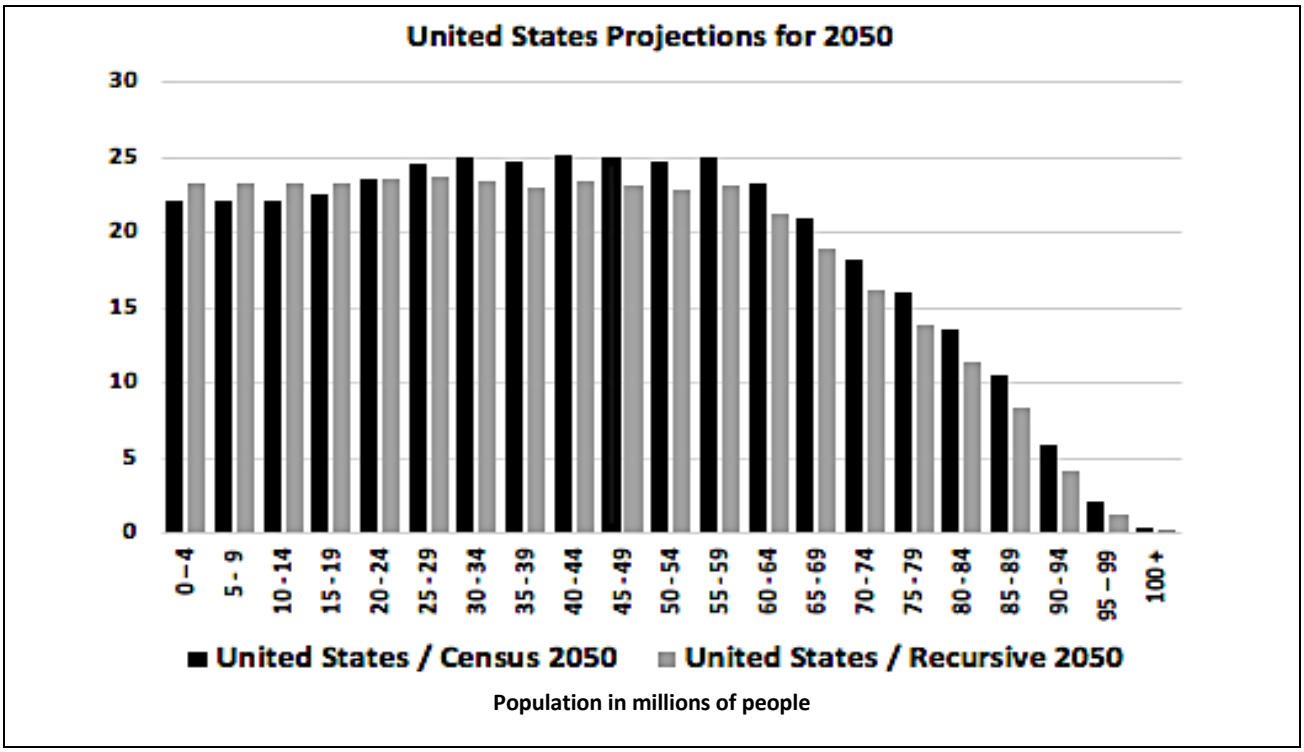
Recursive Model Projections for 2050	Census Projections for 2050
	
Total population projected to be 375.67 million people	**Total population projected to be 398.33 million people**

1. Do you think the recursive projections and the Census projections are similar? Explain your answer.
   Overall, the two histograms have a similar pattern. The Census Bureau histogram is slightly more ragged and has a more obvious increase in counts of age groups from 15 – 19 years old to the 30 – 34 years old age group. Both histograms have a similar pattern for the older age groups when the counts decrease, although the Census Bureau counts of those age groups are greater. Based on the students' work in Lesson 15, there are events that the Census Bureau factored into their predictions, resulting in greater counts in the middle age groups. Consider using this lesson to discuss with students what might be some of these events. (For example, a decrease in the birth rate in the future, or people living longer, or an increase in the number of people immigrating to the United States.)

2. Of the two models, which model projects the largest estimated population for the United States in 2050? What is the population projected by that model?
   The US Census Bureau predicts the larger 2050 population at 398.44 million people compared to 375.67 million people predicted by the recursive model.

3. What is the percent increase of the Census model's prediction compared to the recursive model's prediction?
   The difference of the total populations of the two models is approximately 22.77 million people. The Census Bureau's prediction is approximately 6% greater than the recursive model. The proportion 22.77/375.67 is approximately equal to 6%.

The following graph is designed to compare the estimates of each model by age groups:



4. Study the age group estimates of the two models. Identify at least 3 age groups in which the recursive model's projections (color coded in light gray) are greater than the Census Bureau's projections (color coded in black).
   Answers will vary. Several of the younger age groups are greater in count (by about a million people or more) than the counts of the Census Bureau. Included in the age groups greater than the Census estimates are:
   0 – 4 years old, 5 – 9 years old, and
   10 – 14 years old are greater than the Census model.

5. Identify at least 3 age groups in which the recursive model's projections (color coded in light gray) are less than the Census predictions (color coded in black).
   Bars that shorter for particular age groups of the recursive model identify age groups that are projected to be less in count from the Census model. Several age groups in the middle of the age groups of the recursive model are less than the counts of the Census model, or:
   30 – 34 years, 35 – 39 years old, 40 – 44 years old, 45 – 49 years old,
   50 – 54 years old, 55 – 59 years old.

Several of the older age groups in the recursive model estimate a smaller count than the Census Bureau estimates:

75 – 79 years old, 80 – 84 years old, 85 – 89 years old, 90 – 94 years old, 95 – 99 years old, and 100+ years old are less than the Census model predictions.

6. What if we increase the population factor for the 35 – 39 years old age group to the 40 – 44 years old age group? Place a "+" in the location of this population factor on **Handout 9** as illustrated below. How does this change affect the counts in 2020? Answer the following questions related to this change of one population factor:
   a. Why will the estimated count for the 40 – 44 years old increase in 2020? Place a "+" in the 40 – 44 years old age group indicating that the count in this age group will be increased as a result of increasing the population factor.

35 - 39	+	20.08	20.31	
40 - 44		20.91	20.16	+

The estimated count for the 40 – 44 years old age group increases as the population factor multiplied by the count of 35 – 39 years old to estimate the count of the 40 – 44 years old is greater.

   b. Why will the total count of the population also increase if we increase the population factor for people 35 – 39 years old? Place a "+" in the 2020 column representing the count of the total population.
   The estimate of the total population for 2020 will increase. A "+" should be added to the location recording the sum of the counts in the age groups. The total population increases as there is an increase in one age group.

7. Why will the estimated count for the 0 – 4 years old also increase in 2020? On **Handout 9**, place a "+" in the age groups representing the 0 – 4 years old. The "+" indicates that the count in this age group will also increase as a result of increasing the population factor of people who are 35 – 39 years old to 40 – 44 years old.

Age Groups	Population Factors	2010	2015	2020
0 – 4		20.19	19.91	+

The estimated count in the 0 – 4 years old age group increases as the total population increases. The estimated count of the 0 – 4 years old is 0.062 or 6.2% of the total population. If the total increases, then the estimated count in this age group increases.

It is very likely students will not recall the equation used to derive the count of the 0 – 4 years old age group (Lesson 12, problem 15). In that lesson, the count of the 0 – 4 years old age group was set-up as a proportion of the 0 – 4 years old age group to the total count of the population. This proportion was equal to the foundation factor. Therefore, if an increase in an age group also increases the total population, then the count in the 0 – 4 years age group would also have to increase so that the overall proportion (or the foundation factor) remains the same. It is appropriate to simply indicate to students that the model was designed with the assumption that if the counts in the 5 – 9 to 100+ age groups are increased, there will likely be more births resulting in an increased count in the 0 – 4 years old age group. A "+" in that cell indicates the count for that age group will increase. The handout students are completing should look like the following:

Handout 9: The United States Project Worksheet (Planning Worksheet)

		Foundation Factors:		
		0.065	0.062	
		Actual Counts:		Projections:
Age Groups	Population Factors	2010	2015	2020
0 – 4		20.19	19.91	+
5 - 9		20.33	20.48	
10 - 14		20.68	20.61	
15 - 19		21.98	21.09	
20 - 24		21.70	22.69	
25 - 29		21.15	22.40	
30 - 34		20.07	21.62	
35 - 39	+	20.08	20.31	
40 - 44		20.91	20.16	+
45 - 49		22.64	20.80	
50 - 54		22.35	22.29	
55 - 59		19.80	21.77	
60 - 64		16.99	19.04	
65 - 69		12.52	16.05	
70 - 74		9.34	11.48	
75 - 79		7.32	8.12	
80 - 84		5.76	5.80	
85 - 89		3.64	3.86	
90 - 94		1.47	1.85	
95 – 99		0.38	0.50	
100 +		0.05	0.08	
	Totals	309.35	320.91	+

Discussion with students:

Consider providing students a chance to verify the 3 anticipated changes to the 2020 population using the spreadsheet file ***USA Recursive Model.xlsx***. Direct students to load the spreadsheet file and change the population factor of the 35 – 39 years old age group to the 40 – 44 years old age group to 2.00. This altered factor indicates a 100% growth for the connecting age groups or a doubling of the count of people in the 40 – 44 years old age group in the next 5 years (very unrealistic). However, using a large value helps students identify the changes in the population based on changing one population

factor. If students enter this value for the population factor, they should observe the following outcomes for the 2020 population:

- 40 – 44 years old has a count of 40.62 millions of people
- 0 – 4 years old has a count of 21.91 millions of people, and
- total population has a count of 353.35 millions of people. This total population count is approximately a 6.5% increase from the original estimate with no revisions.

The remaining age groups **for 2020** did not change.

You may discuss with students the effect of lowering a population factor. Direct students to change the population factor of the 35 – 39 years old to the 40 – 44 years old to 0.50. This factor indicates a 50% decrease, or a reduction by 1/2 for the connecting age groups (also unrealistic for a 5-year period). If students enter this value for the population factor, they should observe the following outcomes for the 2020 population:

- 40 – 44 years old has a count of 10.16 millions of people
- 0 – 4 years old has a count of 19.89 millions of people, and
- total population has a count of 320.87 millions of people. This total population count is approximately a 3.3% decrease from the original estimate with no revisions.

The remaining age groups for 2020 remained the same.

The observed changes should be used to help students verify their work with the handout. Changes in age groups from 2020 to 2050 using this one change in a population factor can be observed from the spreadsheet.

8. More age groups are affected than just the three identified in 2020. The increases represented by the "+" in 2020 also result in increases in the 2025 counts. Place a "+" in the age groups for 2025 that will increase as a result of the increases predicted in 2020.

   See the student handout that summarizes the increases if this one population factor is increased. Students could also observe the changes on the spreadsheet.

9. Continue this process. Place a "+" in the age groups of the table for 2030 to 2050 that will increase in the recursive model as a result of increasing the population factor for the 35 – 39 years old age group.
   A summary of Handout 9 is summarized below.

Handout 9: The United States Project Worksheet
(Planning Worksheet)

		Foundation Factors:								
		0.065	0.062							
		Actual Counts:		Projections:						
Age Groups	Population Factors	2010	2015	2020	2025	2030	2035	2040	2045	2050
0 – 4		20.19	19.91	+	+	+	+	+	+	+
5 - 9		20.33	20.48		+	+	+	+	+	+
10 - 14		20.68	20.61			+	+	+	+	+
15 - 19		21.98	21.09				+	+	+	+
20 - 24		21.70	22.69					+	+	+
25 - 29		21.15	22.40						+	+
30 - 34		20.07	21.62							+
35 - 39	+	20.08	20.31							
40 - 44		20.91	20.16	+	+	+	+	+	+	+
45 - 49		22.64	20.80		+	+	+	+	+	+
50 - 54		22.35	22.29			+	+	+	+	+
55 - 59		19.80	21.77				+	+	+	+
60 - 64		16.99	19.04					+	+	+
65 - 69		12.52	16.05						+	+
70 - 74		9.34	11.48							+
75 - 79		7.32	8.12							
80 - 84		5.76	5.80							
85 - 89		3.64	3.86							
90 - 94		1.47	1.85							
95 – 99		0.38	0.50							
100 +		0.05	0.08							
	Totals	309.35	320.91	+	+	+	+	+	+	+
	Key:	Adeline		Abbey		Kristin		Parent		

10. Summarize what age groups are projected to increase in 2050 as a result of the increase in the population factor of the 35 – 39 years old age group to the 40 – 44 years old age group.

The age groups from 0 – 4 years old to 30 – 34 years old will increase. An increase in those age groups would not provide a better match to the Census estimates as the recursive model estimated greater counts in those age groups before these changes. The actual increases will depend on the new value of the 35 – 39 years old population factor. Several of the middle age groups (40 – 44 years old to 70 – 74 years old will also increase. An increase in these age groups will more closely match the Census counts. The Census counts were greater than the recursive counts for those age groups, therefore an increase in the recursive model estimates would more closely match the Census estimates.

11. Will an increase in the age groups identified by the "+" suggest a closer match to the projections reported by the Census Bureau? Identify the age groups in 2050 that will increase in count and as a result more closely match the Census Bureau's projections.

Most of the age groups that were less than the Census model will increase in counts. As a result, several age groups are expected to more closely match the Census model. The challenge is to increase the counts in the older age groups and decrease the counts in the youngest age groups that the recursive model had estimated greater than the Census estimates.

What if an increase in the population factor of the 70 - 74 years old age group is considered?

12 In the same way that a "+" was used to indicate an increase for the 35 – 39 years old age group population factor, place a "+" in the population factor cell for the 70 – 74 years old age group population factor.
Monitor progress of student's handout.

13. Why was an increase in the population factor for 70 – 74 considered?
Increasing the counts in several of the older age groups is needed to match the Census model. By increasing the population factor, counts in the age groups that follow will also increase, and by 2050, several of the older age groups will be projected to increase in counts.

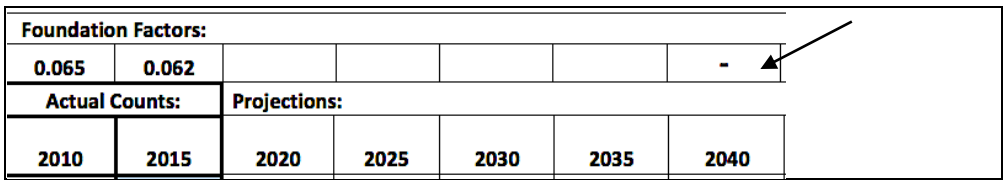
14. What additional age groups are increased as a result of increasing the population factor for the 70 – 74 years old population factor? Place a "+" in the age groups of the handout if the count of the age group will increase. If an age group already has a "+", place a second "+" next to it, or a "++" indicating two changes will increase the count in this cell. Will the increase in the 70 – 74 years old population factor result in a closer match to the Census model? Explain your answer.

The following table summarizes the changes if the two population factors identified in the above problems are increased. Several of the older age groups will increase in count which will more closely match the estimates of the Census Bureau.

Handout 9: The United States 2010 – 2050
(Planning Worksheet)

		Foundation Factors:								
		0.065	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062
		Actual Counts:		Projections:						
Age Groups	Population Factors	2010	2015	2020	2025	2030	2035	2040	2045	2050
0 – 4		20.19	19.91	++	++	++	++	++	++	++
5 - 9		20.33	20.48		++	++	++	++	++	++
10 - 14		20.68	20.61			++	++	++	++	++
15 - 19		21.98	21.09				++	++	++	++
20 - 24		21.70	22.69					++	++	++
25 - 29		21.15	22.40						++	++
30 - 34		20.07	21.62							++
35 - 39	+	20.08	20.31							
40 - 44		20.91	20.16	+		+	+	+	+	+
45 - 49		22.64	20.80			+	+	+	+	+
50 - 54		22.35	22.29			+	+	+	+	+
55 - 59		19.80	21.77				+	+	+	+
60 - 64		16.99	19.04					+	+	+
65 - 69		12.52	16.05						+	+
70 - 74	+	9.34	11.48							+
75 - 79		7.32	8.12	+	+	+	+	+	+	+
80 - 84		5.76	5.80		+	+	+	+	+	+
85 - 89		3.64	3.86			+	+	+	+	+
90 - 94		1.47	1.85				+	+	+	+
95 – 99		0.38	0.50					+	+	+
100 +		0.05	0.08						+	+
	Totals	309.35	320.91	++	++	++	++	++	++	++
	Key:	Adeline		Abbey		Kristin		Parent		

15. Several of the younger age groups had a greater count in the recursive model than in the Census model. Let's consider decreasing the Foundation Factor in 2040 from the estimate used in the recursive model.
    a. Place a "-" in the location of the Foundation Factor for 2040. This indicates that a new foundation factor will be considered and that this factor will be less than the 6.2% used in the recursive model to derive the count of 0 - 4 years old.



Foundation Factors:						
0.065	0.062					-
Actual Counts:		Projections:				
2010	2015	2020	2025	2030	2035	2040

    b. By decreasing the Foundation Factor, what age group is affected in 2040?
    The first age group to be affected will be the 0 – 4 years age group. The count in that age group will be decreased depending on the value of the lower percent of the population in the 0 – 4 years old age group. Place a "-" in the cell of the 0 – 4 years old age group.

    c. Although not an age group, what other count decreases as result of decreasing the 2040 foundation factor? Place a "-" in that location.
    The other location that will be decreased will be the cell representing the total population of the country in 2040. A "-" should also be placed in that cell.

    d. What additional age groups in 2045 will be impacted by a reduced count of 0 – 4 years old in 2040? Place a "-" in each age group in **Handout 9** that will decrease if the foundation factor for 2040 is decreased. For age groups that were previously identified as "+" or "++", add a "-" next to the list, or "+ -" or "+ + - ".

    Counts that will decrease in 2045 are the 0 – 4 years old as the total population value will be less. The 5 – 9 years old age group is derived by multiplying the population factor for the 0 – 4 years old by the 0 – 4 counts in 2040. As the 0 – 4 counts are estimated to decrease for 2040, so will the estimate for the connected age group of 5 – 9 years old in 2045. Also, the total population will decrease, therefore a "-" should be placed in that location.

16. Consider also reducing the Foundation Factors for 2045 and 2050.
    a. Place a "-" in the two locations of the Foundation Factors for 2045 and 2050. Also place a "-" in the age groups of 2045 and 2050 that will decrease as a result of decreasing the foundation factors in 2045 and 2050.
    See the completed table.
    b. Although not an age group, what else will decrease in count when the foundation factor for 2045 and 2050 is decreased? Place a "-" in each of these locations.
    See the completed table.

Handout 9: The United States 2010 – 2050
Planning Worksheet

		Foundation Factors:								
		0.065	0.062	0.062	0.062	0.062	0.062	-	-	-
		Actual Counts:		Projections:						
Age Groups	Population Factors	2010	2015	2020	2025	2030	2035	2040	2045	2050
0 – 4		20.19	19.91	++	++	++	++	++ -	++ -	++ -
5 - 9		20.33	20.48		++	++	++	++	++ -	++ -
10 - 14		20.68	20.61			++	++	++	++	++ -
15 - 19		21.98	21.09				++	++	++	++
20 - 24		21.70	22.69					++	++	++
25 - 29		21.15	22.40						++	++
30 - 34		20.07	21.62							++
35 - 39	+	20.08	20.31							
40 - 44		20.91	20.16	+	+	+	+	+	+	+
45 - 49		22.64	20.80		+	+	+	+	+	+
50 - 54		22.35	22.29			+	+	+	+	+
55 - 59		19.80	21.77				+	+	+	+
60 - 64		16.99	19.04					+	+	+
65 - 69		12.52	16.05						+	+
70 - 74	+	9.34	11.48							+
75 - 79		7.32	8.12	+	+	+	+	+	+	+
80 - 84		5.76	5.80		+	+	+	+	+	+
85 - 89		3.64	3.86			+	+	+	+	+
90 - 94		1.47	1.85				+	+	+	+
95 – 99		0.38	0.50					+	+	+
100 +		0.05	0.08						+	+
	Totals	309.35	320.91	++	++	++	++	++ -	++ -	++ -
	Key:	Adeline		Abbey		Kristin		Parent		

Cells that are identified in **Handout 9** for 2050 with a "+" or "++" are estimated to have an increase in counts. Cells that are identified as "-" are estimated to have a decrease in the counts. Cells that have a combination, or "+ -" or "+ + -" could increase or decrease depending on the value of the factors entered.

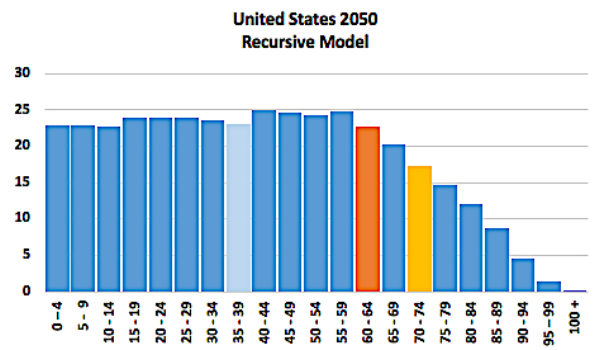
17. Use **Handout 9** to answer the following questions regarding the revised estimates for the 2050 age groups.
    a. What age groups will increase?
    Age groups 15 – 19 to 30 – 34 have a "++" designation. This designation indicates Increased counts from the original recursive model estimates. Also "+" for age groups 44 – 44 years old to 100+ increases are estimated. Age groups 0 – 4 years old to 10 – 14 years old are not clear. Depending on the actual revisions to the population factors or the foundation factors, we cannot determine whether or not the age groups increase or decrease.
    b. What age groups will decrease?
    No cells have strictly "-". Decreases could result for the age groups with a "+ - " or a "++-" in the cells.
    c. What age groups are unclear whether or not they will increase or decrease?
    Age groups that are "+ -" are unclear as to whether or not they will increase or decrease. This includes age groups 0 – 4 years old to 10 – 14 years old.
    d. If an age group remains blank, what does that indicate about the estimated count in 2050?
    Blank cells remain at the counts of the original recursive estimates.

If you access to the file ***USA Recursive Model.xlsx,*** enter the following revisions to the recursive model:

Change the Population Factor for the 35 -39 years old to 1.055
Change the Population Factor for the 70 – 74 years old to 0.900
Change the Foundation Factors for 2040, 2045, and 2050 to 0.059.

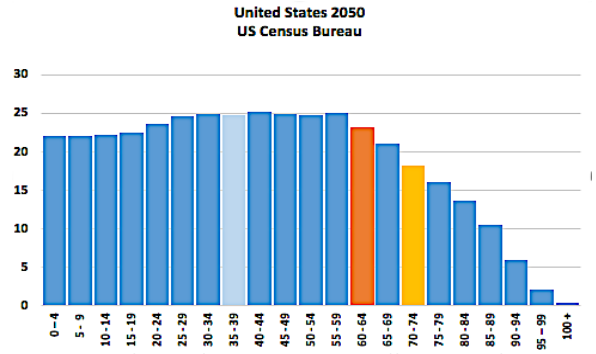
The 2050 projections resulting from these revisions and the 2050 Census projections are summarized below:

Recursive model projections for 2050 with revisions:



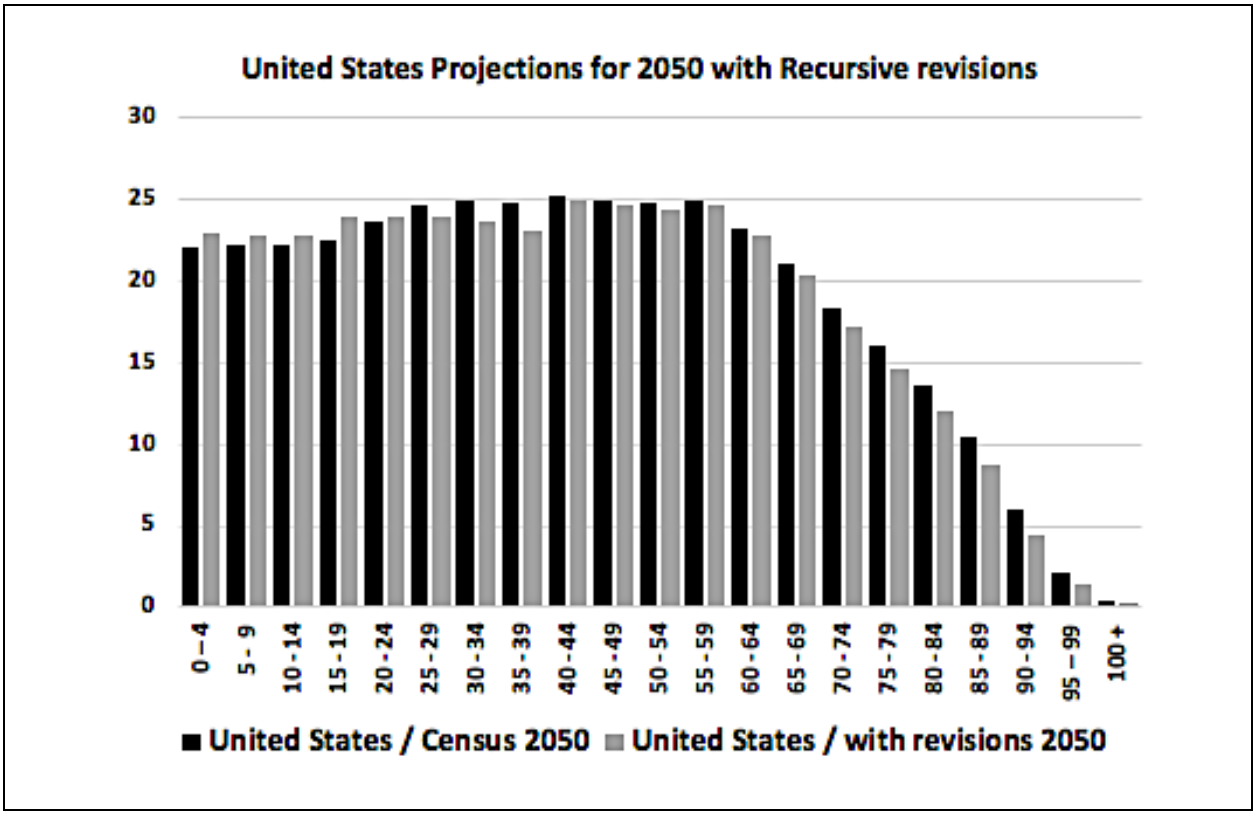
Total population: 387.5 million people

Census model projections for 2050:



Total population: 398.33 million people

The following graph combines the above histograms to help us compare the two models. This graph compares the two models **after** the revisions were made to the recursive model.



18. Answer the following:
    a. Identify the age groups that have nearly equal projections.
       Age group 20 -24 is nearly equal for the two models.

    b. Identify the age groups where the recursive projections (color coded light gray) are noticeable greater than the Census projections (color coded black).
       Age groups 0 – 4 to 15 – 19 have greater counts in the recursive model. (Also, age group 20 – 24 has a slightly greater count for the recursive model.)

    c. Identify the age groups where the recursive projections are noticeable less than the Census projections.

       Age groups 25 – 29 to 100+ have noticeably less counts in the recursive model than the Census estimates.

    d. Did the changes in the population and foundation factors result in a better match of the recursive model to the Census model? Explain your answer.
       The recursive model and the Census model are a closer match, but still some adjustments should be considered.

19. Provide an explanation of events in the United States that would result in the changes entered to the recursive model.

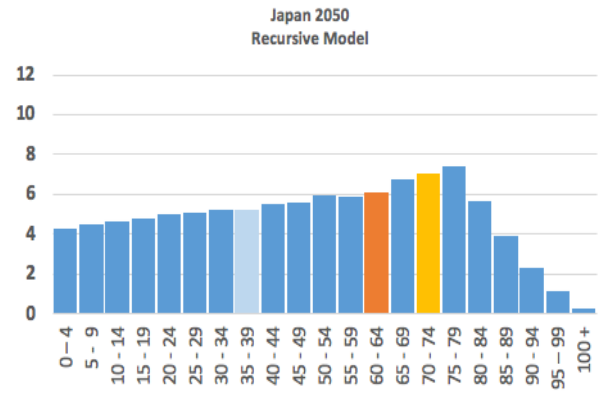
    The greater counts for the older age groups observed in the Census model indicate that more immigration and people living longer are built into their model. Fewer young people in the Census model indicates that birth rates or decreased foundation factors were also built into their model.

Consider other changes to the recursive model that you think will result in a closer match to the Census projections. If you have access to the spreadsheet file, revise either the population factors or the foundation factors that you think will result in a closer match of the two models. Keep track of your changes.

Japan

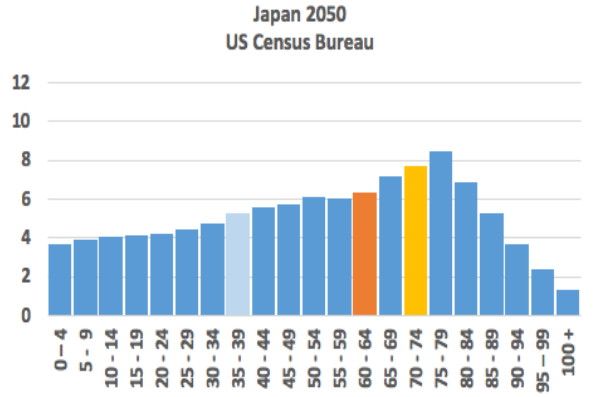
In a similar way, compare the projections from the recursive model to the projections of the United States Census Bureau's model for Japan's population:

Recursive model projections for Japan in 2050:

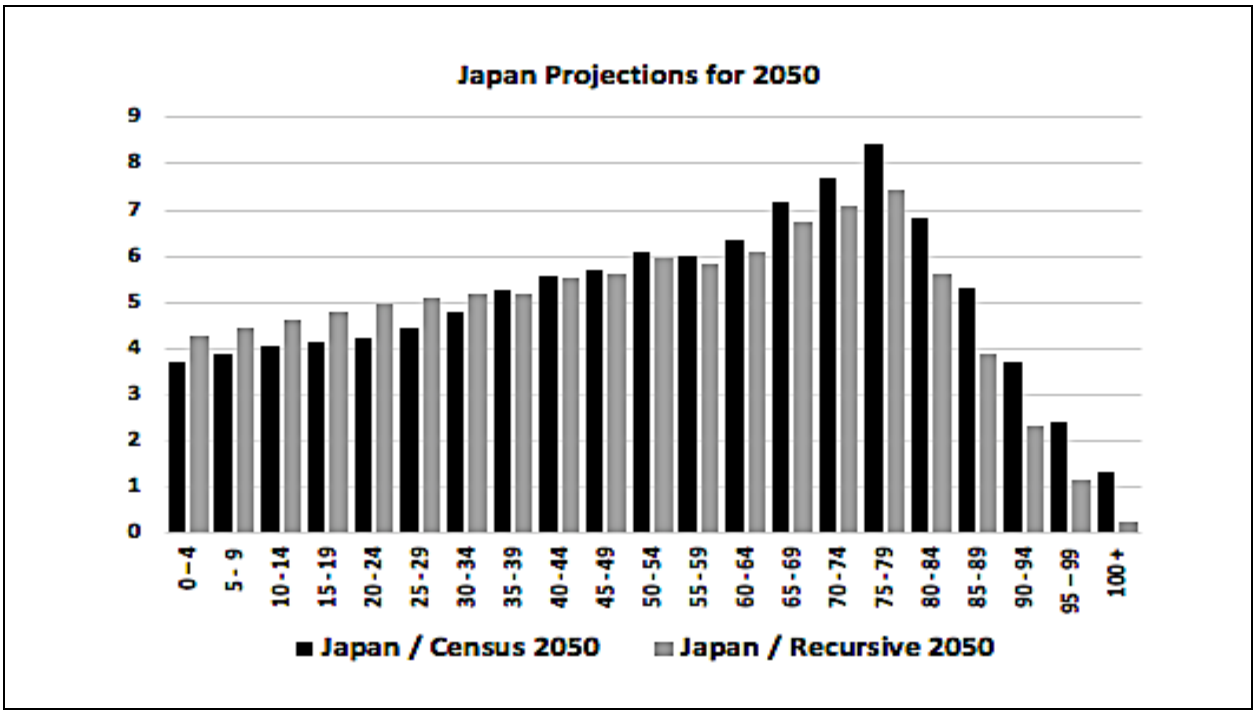


Total population: 102.14 million people

Census model projections for Japan in 2050:



Total population: 107.21 million people



20. Compare the two projection models of Japan's population in 2050 represented in the above histograms. Do you think the recursive projections and the Census projects are similar? Explain your answer.

    The two histograms are very similar. The overall shape (building up to the older age groups and then moving down) is similar. The total population for Japan is greater for the Census model. The counts in the older age groups are greater for the Census model

(75 – 59 years old to 100+ years old). The counts in the younger age groups are less (0 – 4 years old to 30 – 34 years old) in the Census model.

21. Derive the percent increase of the total population of Japan projected by the Census model to the total population projected by the recursive model.
The difference in the total population is 5.07 million people. The Census model predicts the greater count. The percent difference is 5.07/ 102.14 or approximately 5%. The Census model's projection is 5% greater than the recursive model's projection.

22. Identify at least 3 age groups in which the recursive model projections (color coded in light gray) are greater than the Census Bureau's projections (color coded in black).
Answers vary. Most of the age intervals in which the recursive model's projections were greater than the Census model's projections were the younger age groups (0 – 4 years old, 5 – 9 years old, 10 – 14 years old, 15 – 19 years old, and a few others).

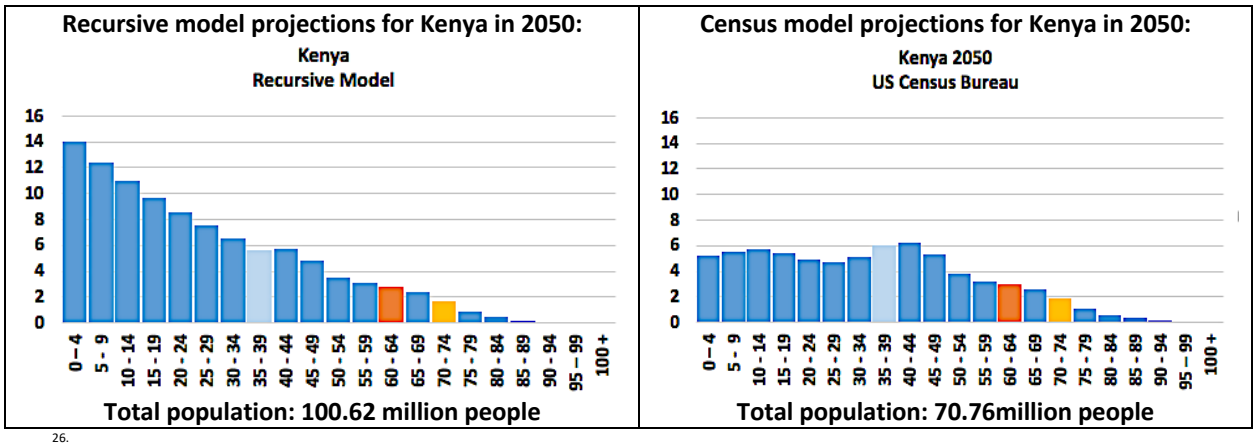
23. Identify at least 3 age groups in which the recursive model projections (color coded in light gray) are less than the Census projections (color coded in black).
Answers will also vary in this problem. Most of the age intervals in which the recursive model's projections were less than the Census model's projections were the older age groups. Any of the age groups from 65 – 69 years old to 100+ years old are age groups in which the differences between the recursive model and the Census model are the most noticeable.

24. Given the option to change the population factors or the foundation factors in the spreadsheet **Japan Recursive Model**, identify and enter revisions to the recursive model that you think will result in similar projections to the Census projections.
Discuss possibilities with students, especially if they are still unable to see the ripple effect of changing the factors. Consider discussing the following : Change the Foundation Factors to a slightly lower value at 2035 to 2050. This change will decrease the younger age groups. Increase the population factors for the older age groups to increase the counts in these age groups.

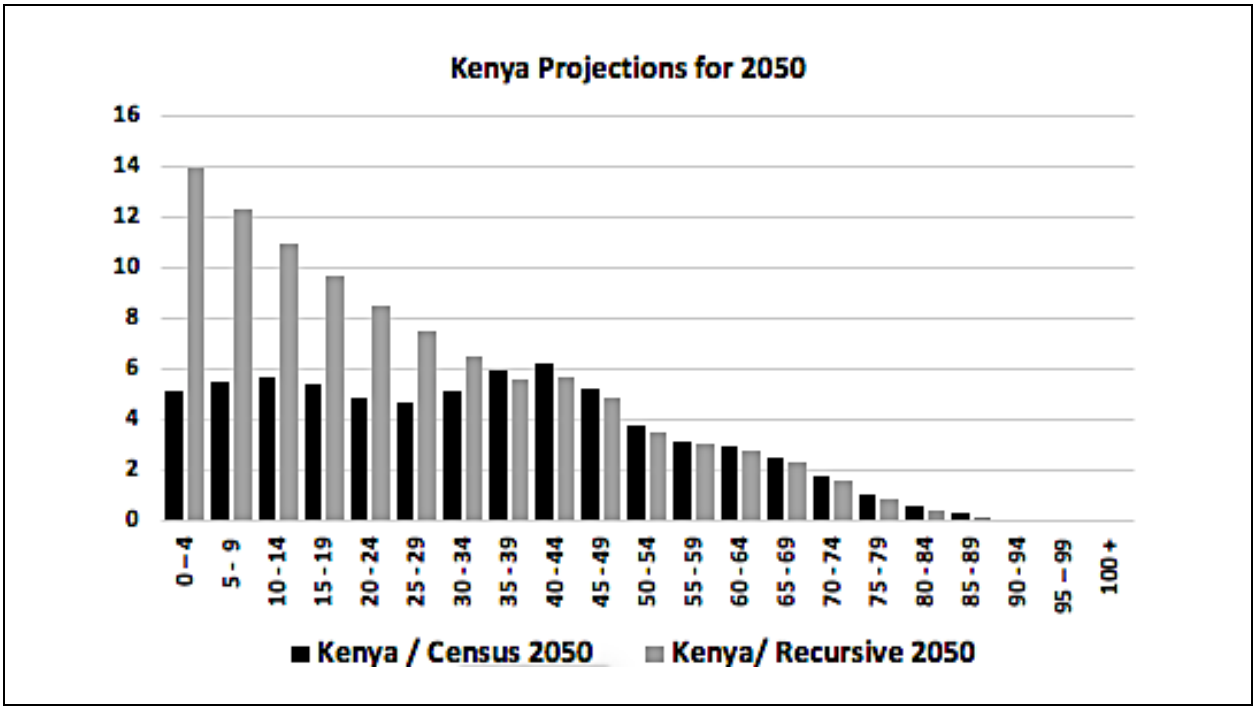
25. Based on the changes you proposed to the recursive model, what assumptions are you altering that you think will result in a better match to the Census Bureau's projections from 2020 to 2050 for Japan?
Changes should be considered that decrease the younger age groups (or decrease selected Foundation factors) and increase the older age groups (or increase selected Population factors) in the recursive model.

Kenya

Finally, compare the projections from the recursive model to the projections of the United States Census Bureau's model for Kenya's population:



26.



26. Compare the two histograms of Kenya. The first histogram was prepared from the estimates of the recursive model. The second histogram was prepared from the projections of the Census Bureau. Are they similar? Explain your answer.
The Kenya predictions from the recursive model and the Census model are not similar. The graphs have little in common. The recursive model predicts a much larger population in 2050, and a more pronounced bottom-layered country. This is an excellent example in which major events are predicted for a country by the Census model.

27. Given the option to change the population factors and the foundation factors in the spreadsheet **Kenya Recursive Model**, what changes do you think will result in a better match of the recursive model and the Census model in 2050?

    The goal is to decrease the Foundation Factor and to increase the Population Factors. There are many options that could be explored. If students have access to the recursive model, changing several of these factors provide changes in the histogram that result in a lower total population and a greater count of the older population. If students do not have access to this model, then simply summarizing a decrease in the Foundation Factor and increases in the Population Factors is sufficient.

28. Based on the changes you proposed to the recursive model, what assumptions are you making that are different from the original assumptions in the recursive model from 2020 to 2050?

    The predicted changes in Kenya are linked to a decrease in the Foundation Factors, or the birth rate over time. The increase in the count of older people assumes that the people in the older age groups are anticipated to live longer.

29. Clearly the recursive model and the Census Bureau model differ the most for the Kenya predictions. Why do you think that the predictions by the Census Bureau for Kenya are different from the recursive model for Kenya?

    The Census model incorporates other factors that are assumed will happen in Kenya in the future. Namely, it is assumed Kenya will decrease its birth rate. In addition, people are anticipated to live longer.

Population projection models consider several other factors than just the population and foundation factors designed in the recursive model. Data obtained from surveys, death and birth records, health records, and several other data resources are also considered when building a population model. Each year in which the United States Census is conducted, a short survey is also distributed to a sample of households. This additional set of questions is referred to as the long-form. The questions people are asked varied from census to census. In addition, the questions are often met with political controversy.

30. Think of at least two questions you would include on a survey that might impact the assumptions included in a projection model. Indicate why you think the questions are related to projecting the future population counts.

    Answers will vary. Important questions in past census' included:

    Do you plan to have children or more children?

    Do you plan to continue your education?

    Where would you most like to live? (In the country? In the city?)

Final problem for this project:

Identify and describe 3 reasons why an accurate population projection is important.

Students' answers to this question should link to the insights a projection model provides about the future of a country. Will a country grow? Is the country ready for this growth? What is the dominate age group in a country? Are the goods and services of a country reaching all age groups? Is there evidence of concerns in health care? As stated in this module from the beginning, people count.