Name: _____ Instructor: _____

One Billion and Counting: The Hidden Momentum of Population Growth

ACTIVITY 1: MATCHING DEMOGRAPHIC DESCRIPTIONS WITH POPULATION PYRAMIDS

A. To start your activity, log onto the *Human Geography in Action* Web site or insert your CD into your computer. > link on my website

B. Select this chapter from the drop-down list, and then click on *Computerized Chapter Activities*.

C. Click on *Activity 1: Matching Demographic Descriptions with Population Pyramids*.

1.1 Match the verbal description of a country's demographic composition (at the top of the screen) with the correct population pyramid. Click on the pyramid to check your answer. To go to the next description, click on the *Next Description* arrow in the right margin. Write the correct answer and the country name here:

Description 1: "A country with rapid population growth" matches population pyramid _____ Country name _____.

Description 2: "A country that shows the demographic effects of World War II" matches population pyramid _____ Country name _____.

Description 3: "A country at close to ZPG (zero population growth)" matches population pyramid _____ Country name _____.

Description 4: "A country that has undergone a recent shift from high to low fertility" matches population pyramid _____ Country name _____.

Description 5: "A country with many temporary immigrant workers" matches population pyramid _____ Country name _____.

Description 6: "A country with a declining population" matches population pyramid _____ Country name _____.

D. When you have finished the activity, proceed to *Activity 2*.

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ACTIVITY 2: DEMOGRAPHIC MOMENTUM

Activity 2 of this chapter will use the population pyramid for India. To demonstrate the hidden momentum of population, you will run several scenarios of population change. Underlying these scenarios are two assumptions that relate to (1) the final total fertility rate (TFR) and (2) the number of years until that rate is achieved. You will experiment with changing the final TFR and the length of time it takes to get there. Once these assumptions are set, you will scroll through the years and watch India's population pyramid and total population change. This simulation will enable you to see when, if ever, population growth stabilizes, and at what level. India begins with a TFR of 3.1 and a population of 1.1 billion in 2005 (based on U.S. Census Bureau and Census India estimates). By changing the final TFR either upward or downward, you can determine in the long run the number of children Indian women will bear. By changing the number of years to achieve that rate, you determine how long it will take for India to move to the new TFR position. Although the graphs start in 2000, your TFR assumptions will be put into effect starting in 2005.

In addition to these two assumptions, the computer incorporates (1) age specific mortality rates, (2) age-specific fertility rates, and (3) the sex ratio of newborn children. The simulation resembles a conveyor belt that moves each cohort ahead in 5-year increments. Every five years, deaths are "trimmed off" the bar graph according to the age-specific, gender-specific death rates that generally increase with age. As the conveyor belt moves women through their childbearing years, children are added to the bottom of the pyramid according to the TFR you have specified and the age-specific birth rates of women 10 through 49. These births are added at a sex ratio of 51.2 percent male and 48.8 percent female, the biological average. Fortunately, the computer will automatically perform all calculations rapidly, and you can visualize the changes over time based on your assumptions.

It is important to recognize that any population simulation or projection is hypothetical in nature. One must exercise caution in dealing with simulations. One of the dangers of projecting future population change is assuming that various demographic parameters will stay the same in the future. Fifty years ago, few demographers would have imagined European countries with fertility rates barely above 1.0 or that a disease called AIDS would kill tens of millions of people in Africa. Fifty years from now, future demographers might say that no one foresaw the dramatic increase in life expectancy that

resulted from artificial organs, a cure for cancer, or the mapping of the human genome—changes that would render most of today's population projections too low. In our case, although we allow total fertility to change, we assume that age-specific death rates, life expectancy, and the ages at which women give birth will all remain the same. Although we emphasize the hypothetical nature
of future projections by asking you to perform multiple "what-if" simulations, keep in mind that other parameters besides TFR will also change.

A. To start your activity, log onto the *Human Geography in Action* Web site or insert your CD into your computer.

B. Select this chapter from the drop-down list, and then click on *Computerized Chapter Activities*.

C. Click on *Activity 2: Demographic Momentum*.

D. On the left side of the screen you will see the 2000 population pyramid of India. Try moving the mouse over the bars of the pyramid to see the exact population in both absolute and percentage terms. This will be especially useful for certain scenarios in which there will not be room to display an entire bar because the cohort in question surpasses the maximum of 15 percent that can be displayed. On the upper right is a graph of India's population growth since 1900, and on the lower right is a demographic transition graph. These will change as you run different simulations. Try moving the mouse over the dots on the graphs. Below the pyramid, in the bottom two gray boxes, you will see the variables you can adjust in these simulations.

Final Total Fertility Rate is set to 3.1, the 2005 level; the allowable range is 0–10. *Years to Achieve Final TFR* is set to 0; it refers to years beyond 2005, the base year. For the following scenarios, you will adjust these variables
and see what effect they have.

Scenario 1: Base Case, No Change in Total Fertility Rate

E. Assume no changes in India's fertility rate. Leave the *Final Total Fertility Rate* at 3.1, the 2005 value for India. Leave *Years to Achieve Final TFR* at 0, meaning this level is reached immediately. Click *Animate* and watch as the pyramid and graph evolve. To review the animation and freeze it at any year, use the up and down arrows on the screen to change the *Currently Shown Year*.

2.1. What would India's population be in 2050? ____

2.2. The Population Reference Bureau reports the world's mid-2005 population as 6,396 million (or 6.396 billion). If India were to maintain its current fertility rate, how would its 2100 population compare to the current global population, in percentage terms?

India's population in 2100 would be roughly _____ percent of the 2005 global total.

2.3. India's 2005 population was 1,103 million. Approximately when would that population double, assuming the current fertility rate? __ _____.

2.4. Describe the shape of the population pyramid in 2100. _____ _____.

2.5. The gap between the crude birth rate (CBR) and the crude death rate (CDR) equals the rate of population change. Would this gap ever close if the TFR remains at 3.1?
_____.

2.6. What would the annual rate of change of population be in 2100, in percentage terms? Calculate it as (CBR – CDR)/10. You can find out the exact CBR and CDR by mousing over the dots in the graph.__ _____.

Scenario 2: Instant Replacement Level

F. Next, assume that *overnight*, as of 2005, Indian women average 2.4 children. Use the up and down arrows to set the *Final Total Fertility Rate* to 2.4 and the *Years to Achieve Final TFR* to 0 (since we are assuming this level is reached immediately).

2.7. When would India's total population stop growing and more or less stabilize?
_____.

2.8. What would be the approximate population when it stops growing? _____.

2.9. What would happen to the birth and death rates at the time when the population stops growing? _____.

G. Change the *Currently Shown Year* to 2020. Compare the size of the newly born 0- to 19-year-old generation (i.e., the children) with the size of the 20- to 39-year-old generation (i.e., their parents). 2.10. Would the children's generation "replace" the parents' generation in terms of approximately equal numbers of people? _____.

H. The comparison in Question 2.10 between parents and children does not, in the short term, control whether the population grows or not. For that you must compare births to deaths. Move the year shown back and forth between 2005 and 2025. Compare the size of the oldest four cohorts in 2005 (all of whom die between 2005 and 2025) to the youngest four cohorts in 2025 (all of whom were born between 2005 and 2025).

2.11. Would there be more births or elderly deaths between 2005 and 2025? _____.

2.12. By the year 2100, which of the four types of pyramids in Figure 5.6 would India's population pyramid most resemble? _____.

2.13. Assuming that achieving replacement-level fertility is desirable, is the assumption of 0 years to reach replacement fertility realistic, optimistic, or pessimistic? _____. Why? _____
_____.

Scenario 3: Forty Years until Replacement Fertility

I. Assume that a replacement-level TFR of 2.4 is India's ultimate goal, but be more realistic about when that goal can be achieved. Leave the *Final Total Fertility Rate* at 2.4. Set the *Years to Achieve Final TFR* to 40, giving India until 2045 to achieve the replacement fertility rate.

2.14. How much larger would India's peak population be than in the previous scenario with no delay in achieving replacement fertility? _____

2.15. How many people will there be when the population peaks? _____.

Scenario 4: Seventy-Five Years of Delay until Replacement Fertility

J. Now assume India will not achieve replacement fertility for 75 years. Leave the *Final Total Fertility Rate* at 2.4, but set the *Years to Achieve Final TFR* to 75.

2.16. Does India's total population completely stop growing before 2100? _____.

2.17. What is the approximate population in 2100? _____

Scenario 5: High Fertility

K. According to the Population Reference Bureau, the country in which women have the largest number of children is Niger, with a TFR of 8.0. Assume that India reaches the same TFR as Niger by 2015. Set the *Final Total Fertility Rate* to 7.5 and the *Years to Achieve Final TFR* to 10.

2.18. What would India's total population be in the year 2100? _____.

2.19. Under this high-fertility assumption, in which 5-year period would India's population surpass the world's current entire population of 6.396 billion? _____

2.20. What would happen to the base of the pyramid over the first 25 years? _____.

Scenario 6: Low Fertility

L. In order to control population growth in China—a country with more than 1.3 billion people—the government enforced strict economic and social incentives for families to have only one child. Because not everybody complied with the policy, the 2000 TFR in China was 1.7 (rather than the sought-after TFR of 1.0). Assume the Indian government applied the same measures, and this TFR was reached by 2015. Set the *Final Total Fertility Rate* to 1.7 and the *Years to Achieve Final TFR* to 10.

2.21. In what year would death rates surpass birth rates? _____.

2.22. What would happen to the total population at that time? _____.

2.23. At what total population would it peak? _____.

2.24. What would be the difference in population between the peak year and the final year, 2100? _____.

2.25. What would be the annual rate of change of population in 2080, in percentage terms? Calculate it as (CBR – CDR)/10. _____.

Scenario 7: One-Child Policy

M. Assume a one-child policy was adopted and there was perfect compliance instantly. Set the *Final Total Fertility Rate* to 1.0 and the *Years to Achieve Final TFR* to 0.

2.26. When would the population completely stop growing? _____.

2.27. At what total population would it peak? _____.

2.28. What would be the difference in population between the peak year and the final year, 2100? ___ _____.

2.29. How would you describe the shape of the age-sex distribution in 2100?

_____ _____.

2.30. Why would the crude death rate get so high near the end of the twenty-first century?

_____ _____ _____ _____.

ACTIVITY 3: INTERPRETING POPULATION CHANGE

3.1. Using the understanding you have gained by projecting India's population pyramids into this hypothetical future, give a carefully worded explanation of how it is possible for a population to continue growing for several generations after women begin averaging only two children each. It may be particularly helpful to review your answers for Scenario 2 in Activity 2.