Calculating Decadal Growth Rate

Courtesy of D. Bruce Seymour, March 2004

Equation #1: Simplified Decadal Growth Rate

If you have data that is ten years apart use this equation to obtain the growth rate for the decade, Decadal Growth Rate (DGR):

$$DGR = \left(\frac{P_n - P_o}{P_o} \right) * 100$$

DGR = Decadal Growth Rate in %
P_n = Population now
P_o = Population originally
P_n and P_o are ten years apart

Equation #2: General Decadal Growth Rate

If you have data that is not ten years apart, this equation can be used to obtain an *adjusted* growth rate so it can be compared with other decadal growth rates (DGR_a).

$$DGR_a = \left| \left(\frac{P_n}{P_o} \right)^{\frac{10}{N}} - 1 \right| * 100$$

DGR_a = Decadal Growth Rate (*Adjusted* for comparison) in %
P_n = Population now
P_o = Population originally
N = Interval between P_n and P_o in years

Projected Growth

If you wish to calculate projected growth to some point in the future, first calculate the Annual Growth Rate (R) with Equation #3 and then calculate the Projected Growth (P_f) with Equation #4.

Equation #3: Annual Growth Rate

$$R = \left| \left(\frac{P_n}{P_o} \right)^{\frac{1}{N}} - 1 \right| * 100$$

R = Annual Growth Rate (in %)
P_n = Population now
P_o = Population originally
N = Interval between P_n and P_o in years

Equation #4: Projected Growth

$$P_f = P_n \left(1 + r\right)^N$$

P_f = Population in the future
P_n = Population now
r = Annual growth rate (as a decimal)
N = Interval between P_n and P_f in years

Example #1: Suppose your average attendance in 2003 is 400 and your average attendance in 1993 was 175. What is your decadal growth rate?

The data is ten years apart (2003 – 1993 = 10) so use Formula #1
P_n = Population now = 400
P_o = Population originally = 175

$$DGR = \left(\frac{P_n - P_o}{P_o} \right) * 100$$

$$\text{DGR} = \left(\frac{400 - 175}{175} \right) * 100$$

$$\text{DGR} = \left(\frac{225}{175} \right) * 100$$

$$\text{DGR} = (1.2857) * 100$$

DGR = 128.57% (DGR is usually reported in whole numbers so round up to the nearest whole number)

DGR = 129%

Example #2: Suppose your average attendance in 2003 is 850 and your average attendance in 1998 was 500. What is your decadal growth rate?

Data is not ten years apart so use Formula #2
P_n = Population now = 850
P_o = Population originally = 500
N = 2003 – 1998 = 5

$$DGR_a = \left[\left(\frac{P_n}{P_o} \right)^{\frac{10}{N}} - 1 \right] * 100$$

$$\text{DGR}_a = \left[\left(\frac{850}{500} \right)^{\frac{10}{5}} - 1 \right] * 100$$

$$\text{DGR}_a = \left[(1.7)^2 - 1 \right] * 100$$

$$\text{DGR}_a = \left[(2.89) - 1 \right] * 100$$

$$\text{DGR}_a = [1.89] * 100$$

$$\text{DGR}_a = 189\%$$

Example #3: Suppose your average attendance in 1998 was 500 and your average attendance in 2003 is 850. If you continue to grow at the same rate, what would your average attendance be in 2010?

Begin by calculating the annual growth rate using Equation #3.

$$R = \left[\left(\frac{P_n}{P_o} \right)^{\frac{1}{N}} - 1 \right] * 100$$

R = Annual Growth Rate (in percent)
P_n = Population now = 850
P_o = Population originally = 500
N = Interval between P_n and P_o in years = 5

$$R = \left[\left(\frac{850}{500} \right)^{\frac{1}{5}} - 1 \right] * 100$$

$$R = \left[(1.7)^{0.2} - 1 \right] * 100$$

$$R = [0.112] * 100$$

$$R = 11.2\%$$

Continue by using the decimal form of this rate (0.112) and calculate projected growth with Equation #4.

$$P_f = P_n \left(1 + r\right)^N$$

P_f = Population in the future
P_n = Population now = 850
N = Interval between P_n and P_f in years = 7
r = annual growth rate in decimal form = 0.112

$$P_f = 850 * (1 + 0.112)^7$$

$$P_f = 850 * (1.112)^7$$

$$P_f = 850 * (2.103)$$

$$P_f = 1785$$