CALCULATIONS TO ESTIMATE POPULATION AFTER 10 YEARS

population at the beginning of the time period

population at the end of the time period

cohort i	Age group	Pop t_0	Survival Rate	Survive to t_{0+10}	Birth Rate	Births	Net Migrati	Pop t_{0+10}
1	0 - 9	3,900	0.989		0	0	5	425
2	10 - 19	3,200	0.999	3857	0.011	35	0	3,857
3	20 - 29	3,300	0.998	3197	0.081	267	50	3,247
4	30 - 39	2,800	0.998	3293	0.038	106	35	3,328
5	40 - 49	1,700	0.996	2794	0.007	12	10	2,804
6	50 - 59	1,800	0.991	1693	0	0	0	1,693
7	60 - 69	1,100	0.975	1784	0	0	-20	1,764
8	70 - 79	550	0.936	1073	0	0	0	1,073
9	80+	200	0.88	691	0	0	0	691
	TOTAL	18,550		18,382		420	80	18,882

to calculate births:

births by parent age cohort group:
10-19: 3200 * .011 = 35
20-29: 3300 * .081 = 267
30 -39: 2800 * .038 = 106
40-49: 1700 * .007 = 12
the sum of these is **420**

the population at the end of the time period then becomes the population at the beginning of the next time period

CALCULATIONS TO ESTIMATE POPULATION AFTER 20 YEARS

cohort i	Age group	Pop t_{0+10}	Survival Rate	Survive to t_{0+20}	Birth Rate	Births	Net Migrati	Pop t_{0+20}
1	0 - 9	425	0.989		0	0	5	456
2	10 - 19	3,857	0.999	420	0.011	42	0	420
3	20 - 29	3,247	0.998	3853	0.081	263	50	3,903
4	30 - 39	3,328	0.998	3241	0.038	126	35	3,276
5	40 - 49	2,804	0.996	3321	0.007	20	10	3,331
6	50 - 59	1,693	0.991	2793	0	0	0	2,793
7	60 - 69	1,764	0.975	1678	0	0	-20	1,658
8	70 - 79	1,073	0.936	1720	0	0	0	1,720
9	80+	691	0.88	1612	0	0	0	1,612
	TOTAL	18,882		18,638		451	80	19,169

SUMMARY TABLE: POPULATION BY 10-YEAR AGE COHORT FOR THE YEARS 2000, 2010, and 2020

(assuming that t_0 is the year 2000)

cohort i	Age group	Pop t_0 2000	Pop t_{0+10} 2010	Pop t_{0+20} 2020
1	0 - 9	3,900	425	456
2	10 - 19	3,200	3,857	420
3	20 - 29	3,300	3,247	3,903
4	30 - 39	2,800	3,328	3,276
5	40 - 49	1,700	2,804	3,331
6	50 - 59	1,800	1,693	2,793
7	60 - 69	1,100	1,764	1,658
8	70 - 79	550	1,073	1,720
9	80+	200	691	1,612
	TOTAL	18,550	18,882	19,169
Change over previous period			+332	+287
>> due to natural change (births - deaths)			+252	+207
>> due to net migration (inmigration - outmigration)			+80	+80

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EXAMPLE OF POPULATION FORECASTING USING THE COHORT SURVIVAL METHOD

NOTES:
1. This is a simple example of cohort survival. It makes a few simplifying assumptions (which may be altered in more detailed cohort survival calculations): (a) 10-year cohorts rather than 1-year cohorts (to keep the number of cohorts small); (b) no differentiation between men and women (hence using birth rates rather than fertility rates directly tied to the number of women); (c) all people at the beginning of a cohort are "at risk" of having a baby, regardless of whether they survive through the entire 10-year period (this will lead to a slight overestimate of births); (d) migrants enter the cohort at the end of the period and are thus not "at risk" of having a baby until the next cohort (leading to a slight underestimate of births); (e) age-specific survival rates, birth rates and absolute migration levels are constant over time (in reality, these assumptions become more problematic the further in the future we go).
2. The example has unusually low birth rates -- far below replacement. This will lead, over time, to a dramatic reduction in population. It will take, however, many decades for the population to stabilize at a new, lower level.
3. Rounding techniques: there are several ways to deal with fractions (e.g., estimated fractional births and fractional deaths). In this example I simply rounded the numbers to the nearest whole number at each stage.

source of data: I used and modified data from: Norbert Offenheim, 1980. APPLIED MODELS IN URBAN AND REGIONAL ANALYSIS. Englewood Cliffs, NJ: Prentice-Hall. (Ch. 2 "Demographic Models"). I used Excel for the calculations, and then saved as an Adobe .pdf file.