Table 1.5. The development of the U.S. population in time from 1790–2050 according to the Decennial Censuses, U.S. Census Bureau, U.S. Dept. of Commerce (World Almanac 2010). The population P is measured in 10^9 and t refers to the year. The values for $t > 2000$ are projections (Population Division, U.S. Census Bureau, NP2008-T1, August 14, 2008).

t	P	t	P	t	P
1790	0.0039	1880	0.0502	1970	0.2033
1800	0.0053	1890	0.0630	1980	0.2265
1810	0.0072	1900	0.0762	1990	0.2487
1820	0.0096	1910	0.0922	2000	0.2814
1830	0.0129	1920	0.1060	2010	0.3102
1840	0.0171	1930	0.1232	2020	0.3414
1850	0.0232	1940	0.1321	2030	0.3735
1860	0.0314	1950	0.1513	2040	0.4057
1870	0.0398	1960	0.1793	2050	0.4390

Reduced Polynomial Models. The use of reduced polynomial models for the modeling of the U.S. energy consumption C, the orbital period T_P, and the total stopping distance D shows different features. After rewriting the orbital period and stopping distance data, it was shown in Sect. 1.2 that all the three problems can be successfully solved on the basis of linear functions. Further examples for the usefulness of reduced polynomial models will be discussed in Sects. 1.4 and 1.5. Thus, the application of reduced polynomial models is in general much more helpful than the use of exact polynomial models.

1.4 Model Evaluation: Population Modeling

Two approaches for creating a model were considered so far: the development of linear models (for transformed data if required) in Sect. 1.2 and the use of polynomial models in Sect. 1.3. Next, let us consider the relevant question of how a model can be evaluated. This question will be addressed by considering the development of the U.S. population in time according to the Decennial Censuses, U.S. Census Bureau, U.S. Dept. of Commerce (World Almanac 2010). The data are given in Table 1.5. First, we will address the modeling of the U.S. population in terms of linear models for redefined data. This approach is driven by concepts for the modeling of population dynamics that will be described in detail in Sect. 7.4 (here we use these concepts simply as functions that can be transformed to linear models for redefined variables). Second, we will consider the application of polynomial models. The second approach is driven by data – we try to find an appropriate model as an interpolation and extrapolation of available data. Third, we evaluate the suitability of these two modeling approaches for the development of the U.S. population.