Population Growth Model

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In lab for ENGR 115, Introduction to Environmental Resources Engineering, we created an excel spreadsheet to help in understanding how to estimate exponential growth in populations. For this lab we were asked to create a spreadsheet that shows not only how to create a spreadsheet with equations, but also how to create graphs that display the data in a more visual style. In the lab we were also given questions to answer that further enforce our understanding of the content.

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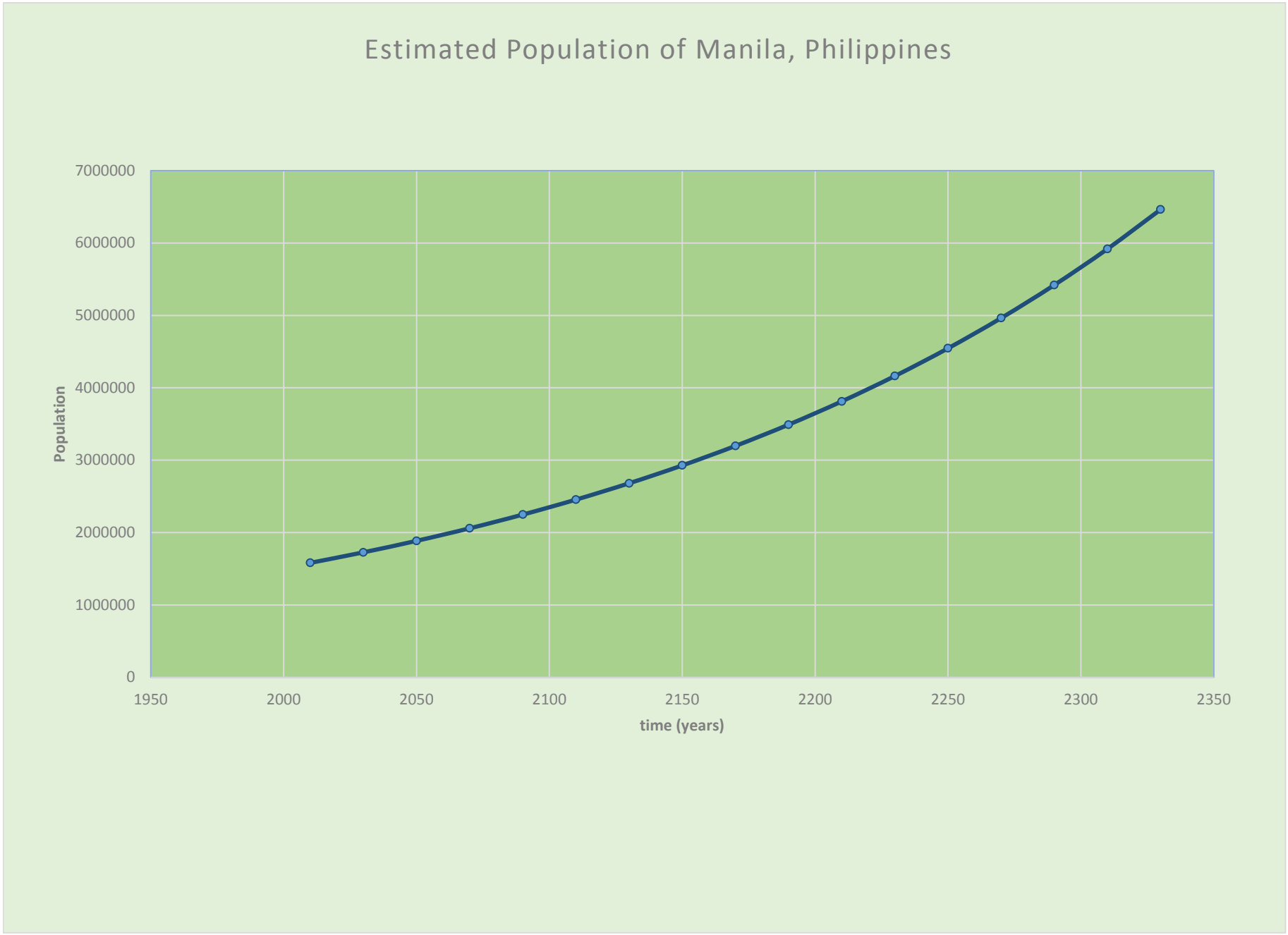
ENGR 115
16-Sep-16

Input Parameters	
Location	Manila, Philippines
Data Source	https://psa.gov.ph/content/population-city-manila-climbed-17-million-results-2010-census-population-and-housing
Model Start Year	2010
Data Start Year	2000
Data End Year	2010
Time Increment	20
Population Start	1581100
Growth Rate (1/year)	0.0044

Year	Time(yrs)	Population Estimate
2010	0	1581100
2030	20	1726542.42
2050	40	1885363.815
2070	60	2058794.891
2090	80	2248179.567
2110	100	2454985.383
2130	120	2680814.878
2150	140	2927418.004
2170	160	3196705.689
2190	180	3490764.642
2210	200	3811873.526
2230	220	4162520.613
2250	240	4545423.067
2270	260	4963547.999
2290	280	5420135.458
2310	300	5918723.54
2330	320	6463175.803
2350	340	7057711.207
2370	360	7706936.807
2390	380	8415883.45

2410	400	9190044.764
2430	420	10035419.72
2450	440	10958559.14
2470	460	11966616.41
2490	480	13067402.98
2510	500	14269448.84
2530	520	15582068.65
2550	540	17015433.88
2570	560	18580651.69
2590	580	20289850.94
2610	600	22156276.22
2630	620	24194390.47
2650	640	26419987.01
2670	660	28850312
2690	680	31504198.02
2710	700	34402210.03
2730	720	37566804.72
2750	740	41022504.54
2770	760	44796087.69


Estimated Population of Manila, Philippines
Population
7000000
6000000
5000000
4000000
3000000
2000000
1000000
0
1950
2000
2050
2100
2150
2200
2250
2300
2350
time (years)

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Input Parameters	
Location	Manila, Philippines
Data Source	https://psa.gov.ph/content/population-city-manila-climbed-17-million-results-2010-census-population-and-housing
Model Start Year	2010
Data Start Year	2000
Data End Year	2010
Time Increment	50
Population Start	1581100
Growth Rate (1/year)	0.0044

Year	Time(yrs)
=(B9)	0
=A17+$B$12	=B17+B12
=A18+$B$12	=B18+$B$12
=A19+$B$12	=B19+$B$12
=A20+$B$12	=B20+$B$12
=A21+$B$12	=B21+$B$12
=A22+$B$12	=B22+$B$12
=A23+$B$12	=B23+$B$12
=A24+$B$12	=B24+$B$12
=A25+$B$12	=B25+$B$12
=A26+$B$12	=B26+$B$12
=A27+$B$12	=B27+$B$12
=A28+$B$12	=B28+$B$12
=A29+$B$12	=B29+$B$12
=A30+$B$12	=B30+$B$12
=A31+$B$12	=B31+$B$12
=A32+$B$12	=B32+$B$12
=A33+$B$12	=B33+$B$12
=A34+$B$12	=B34+$B$12
=A35+$B$12	=B35+$B$12

=A36+$B$12	=B36+$B$12
=A37+$B$12	=B37+$B$12
=A38+$B$12	=B38+$B$12
=A39+$B$12	=B39+$B$12
=A40+$B$12	=B40+$B$12
=A41+$B$12	=B41+$B$12
=A42+$B$12	=B42+$B$12
=A43+$B$12	=B43+$B$12
=A44+$B$12	=B44+$B$12
=A45+$B$12	=B45+$B$12
=A46+$B$12	=B46+$B$12
=A47+$B$12	=B47+$B$12
=A48+$B$12	=B48+$B$12
=A49+$B$12	=B49+$B$12
=A50+$B$12	=B50+$B$12
=A51+$B$12	=B51+$B$12
=A52+$B$12	=B52+$B$12
=A53+$B$12	=B53+$B$12
=A54+$B$12	=B54+$B$12

Population Estimate
=$B$13*EXP($B$14*B17)
=$B$13*EXP($B$14*B18)
=$B$13*EXP($B$14*B19)
=$B$13*EXP($B$14*B20)
=$B$13*EXP($B$14*B21)
=$B$13*EXP($B$14*B22)
=$B$13*EXP($B$14*B23)
=$B$13*EXP($B$14*B24)
=$B$13*EXP($B$14*B25)
=$B$13*EXP($B$14*B26)
=$B$13*EXP($B$14*B27)
=$B$13*EXP($B$14*B28)
=$B$13*EXP($B$14*B29)
=$B$13*EXP($B$14*B30)
=$B$13*EXP($B$14*B31)
=$B$13*EXP($B$14*B32)
=$B$13*EXP($B$14*B33)
=$B$13*EXP($B$14*B34)
=$B$13*EXP($B$14*B35)
=$B$13*EXP($B$14*B36)

=$B$13*EXP($B$14*B37)
=$B$13*EXP($B$14*B38)
=$B$13*EXP($B$14*B39)
=$B$13*EXP($B$14*B40)
=$B$13*EXP($B$14*B41)
=$B$13*EXP($B$14*B42)
=$B$13*EXP($B$14*B43)
=$B$13*EXP($B$14*B44)
=$B$13*EXP($B$14*B45)
=$B$13*EXP($B$14*B46)
=$B$13*EXP($B$14*B47)
=$B$13*EXP($B$14*B48)
=$B$13*EXP($B$14*B49)
=$B$13*EXP($B$14*B50)
=$B$13*EXP($B$14*B51)
=$B$13*EXP($B$14*B52)
=$B$13*EXP($B$14*B53)
=$B$13*EXP($B$14*B54)
=$B$13*EXP($B$14*B55)

1. Use your model to determine the doubling time (rounded to the nearest year) at the growth rate you calculated above. You may need to increase the number of years Excel calculates to determine this on your model page. Check your model prediction with the hand calculation you did at the beginning of lab. State the doubling time from your hand calculation and the double time provided by your model. Does the doubling time from your model match the doubling time from your hand calculation?

2. What growth rate would you recommend for your chosen place? Justify your recommendation as much as possible using the information you have on your chosen area and simulations you run using your spreadsheet model. One way to start could be by suggesting a carrying capacity for your place and adjusting the growth rate so that the capacity is not exceeded over a 50-year period. Be sure to include this carrying capacity value in your justification.

3. Does an exponential growth model seem like a reasonable model for human population growth? Why or why not?

1. From my hand calculation I found that the doubling time to be about 157.6 years which is very close to the Excell model. The Excell model puts the doubling time between the decades 2150 and 2160, which is about 155 years from my start date. My hand calculation is very close to my Excell model, with a difference of only 2.6 years.

2. A growth rate of 0.0044 seems very reasonable for Manila due to it being a metropolitan area, dispite the Philippines being a third world country. Especially with only 1.7 million people compared to large cities like Los Angeles, which over double it with a population of 3.8 million people.

3. The Exponential growth model seems very reasonable in modeling human population growth, as it takes in to account the starting population, the rate of growth, and the time from the starting population. Although it seems to not take into account sudden catastrophies such as famine or disease which could decrease the population by a significant amount.