NAME ANSWER KEY APES-Smith

POPULATION CALCULATIONS PRACTICE

In 2003, the city of Hoodlumville conducted an extensive census and population study, and learned that the city contained 9500 Hoodlums. The following demographic information was also gathered:

- Out of 500 Hoodlums that were sampled, 50 were newborns (born in 2003)
- For every 500 people in the population, 100 died during 2003

After some sophisticated computer projecting, it is expected that the two above bits of birth & death information will remain constant for the next five years.

Ironically, consistent with its name, Hoodlumville is a high crime area (hence the rather large number of deaths every year). This does not bode well for the future of the city. The city has experienced very little economic development as companies have not moved into the city, and many companies and their employees have fled from the city seeking a more secure environment. In 2003, the city saw no new individuals move into the city, while at the same time, 500 long time residents moved out of the city to the safer suburbs (ALSO expected to remain constant for five years).

Show all calculations used in answering these questions!

1. Based upon the above scenario, what would be the predicted population size in 2005?
   "r"
2. Calculate the intrinsic rate of increase for the Hoodlum population.
3. Calculate the projected rate of change for the Hoodlum population. for 2003-2004.
4. What is the projected net growth rate of the Hoodlums for 2003-2004?
5. In how many years should the Hoodlum population double in size considering their net growth rate?
6. Calculate the rate of population change (as an annual %). (Annual Growth Rate)

ANSWERS:

① Calc N_{04} first, then N_{05}

B = #births/1000 ($\frac{50}{500} = 100/1000$)
D = #deaths/1000 ($\frac{100}{500} = 200/1000$)
I = immigrants (0)
E = emigrants (500)

$N_{04} = N_{03} + B - D + I - E$

$= 9500 + (9.5 \times 100) - (200 \times 9.5) + 0 - 500$

x9.5 b/c B/D are per 1000, but there's 9500 in population

$= 8050$

$N_{05} = N_{04} + B - D + I - E$

$= 8050 + (8.05 \times 100) - (8.05 \times 200) + 0 - 500$

$= 6745$

$N_{05} = 6,745$

② $r = B - D$

$$= \frac{100 - 200}{1000}$$

$$= \frac{-100}{1000}$$

$$= -.10$$

"r" does not take into account immigration & emigration. "Intrinsic growth" is based solely on birth rate and death rate.

③ $\frac{dN}{dt} = rN \Rightarrow \frac{\Delta N}{\Delta t} = \frac{N_1 - N_0}{1 \text{ year}} = \frac{8050 - 9500}{1 \text{ yr.}} = -1450$ per year

④ Net Growth Rate (R_0)

$$R_0 = \frac{N_1}{N_0} = \frac{8050}{9500} = .85$$

Since $R_0 < 1$, population is declining

⑤ Doubling Time

$$D_t = 70/R_0$$

$$= 70/.85$$

$$= 82.4 \text{ years}$$

Not valid. Why? Population is declining therefore it will never double.

Cannot calculate D_t when $R_0 < 1$

⑥ Annual Growth Rate

$$\% = \frac{(B - D)}{1000} \times 100\%$$

$$= \frac{B - D}{10}$$

$$= \frac{100 - 200}{10}$$

$$= \frac{-100}{10} = -10\% \text{ per year}$$

Same as "r" but expressed as a percentage