BI 471 ; HW #1

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1) $r = 0.1/\text{day}$, $N(0) = 10$ } Given

$t = \dfrac{\ln[N(t)/N(0)]}{r}$

$\dfrac{\ln(100/10)}{0.1} = 23.02$ days to reach $N(t) = 100$.

$\dfrac{\ln(1{,}000/10)}{0.1} = 46.05$ days to reach $N(t) = 1{,}000$

$\dfrac{\ln[(1\times10^8)/10]}{0.1} = 161.18$ days to reach $N(t) = 100{,}000{,}000$.

$\dfrac{\ln[(1\times10^{11})/10]}{0.1} = 230.26$ days to reach $N(t) = 100{,}000{,}000{,}000$.

→ Yes, this is surprising to me, despite my prior knowledge regarding exponential population growth. Sometimes when looking at exponential growth in the form of a graph, I forget to remember how fast the change in the y-axis variable (in this case, population of course) is actually happening.

2) $N(2009) = N(0) = 6.9\text{ bil}$

$N(2050) = N(41) = ?$

$t_{double} = \frac{\ln(2)}{r}$

$\hookrightarrow 50 = \frac{\ln(2)}{r}$

Given

$\hookrightarrow r = \frac{\ln(2)}{50} \approx \boxed{0.01386}$

$N(t) = N(0)e^{rt}$

$\hookrightarrow N(41) = (6.9\text{ bil.})e^{41(0.01386)}$

$= \sim \boxed{12.18\text{ billion}}$ people in 2050

3)

$r = \ln(1 + 0.12)$

$\hookrightarrow r = \ln(1.12) = 0.113$

$t_{double} = \frac{\ln(2)}{r}$

$\hookrightarrow t_{double} = \frac{\ln(2)}{0.113} = \boxed{6.11\text{ years}}$

(notes)

$r = \ln(R)$

$R = 1 + r$

(# of individuals in next gen. / individ now

4) I would argue that the human death rate in Eugene is density-independent. I think this because in the 3.5 years I have lived here, the population has seemed to grow each year with no noticable increase in death rates. This is probaby because the city has done well in accommodating an increase in population, such as by providing more housing opportunities, grocery stores, etc.

- Mechanisms by which density dependence is introduced to places such as cities include:

1) disease
2) draught
   ↳ /resoone competition
3) housing availability
   ↳ /niche partitioning

All of these have the potential to affect the homan death rate in a density-dependent manner, although this is less likely in modern cities such as Eugene.

5) I think it would be most accurate to model the population dynamics of the monk parakeet using a continuous framework. Although monk parakeets mate during specific times of the year, they live to be 20-30 years old, and since they reach sexual maturity at 12-18 months of age, there is a lot of generational overlap.